



THE EFFECT OF HEALTH EDUCATION ON GLYCEMIC CONTROL OF PATIENTS DM TYPE 2 IN FAMILIES WITH A FAMILY APPROACH SELF CARE

Bahtiar Yusuf^{1*}, Yehud Maryen¹, Yuliati²

¹Ministry of Health Polytechnic Sorong, Jl. Basuki Rahmat, Klawalu, Distrik Sorong Timur, Kota Sorong, Papua Barat 98416, Indonesia

²Makassar Midwifery Study Program, Sekolah Tinggi Ilmu Kesehatan Makassar, Jl. Maccini Raya No.197, Sinrijala, Makassar, Sulawesi Selatan 90232, Indonesia

*bahtiar Yusuf270989@gmail.com

ABSTRACT

Diabetes mellitus is a chronic metabolic disorder with a global prevalence of 537 million with an age range of 20-79 years, a mortality prevalence of 6.7 million. Diabetes education improves self-management, glycemic control and quality of life. This study aims to determine the effect of diabetes health education on glycemic control. Quasi-experimental research with a one group pre-test and post-test design, the sample was carried out by accidental sampling at the Fakfak Health Center and the Sekban Health Center in June - August 2024 as many 52 respondents. The instrument used, the Diabetes Self-Management Questionnaire (DSMQ), has undergone robust validity and reliability testing, showing a Cronbach's alpha coefficient of 0.908. The Diabetes Knowledge Questionnaire (DKQ) achieved a Cronbach's alpha of 0.937, indicating high internal consistency. This confirms that both questionnaires are valid and reliable and can be used in this study. Analysis with statistical paired sample test with significance $\alpha \leq 0.05$. Results: Female gender 44 people, average age 53 years, housewife occupation 69.2%, average duration of diabetes >5 years, regular exercise 19%, irregular 81%, diabetes diet 96%, regular medication consumption 71.2%, history of wounds 17.3%, walking barefoot 34.6%, getting DM information 92.3%, average BMI 26.2, hypertension 65.4%. GDS value <200mg/dl before education was 19 people (36.5%) after education 27 people (51.9%). While GDS>200mg/dl before education was 33 people (63.5%), after education 25 people (48%). The average score before and after education was 222mg/dl and 193mg/dl. The p value is 0.001. Conclusion: diabetes health education increases knowledge and controls glucose with a self-care approach.

Keywords: diabetes education; glycemic control; self care

How to cite (in APA style)

Yusuf, B., Maryen, Y., & Yuliati, Y. (2024). The Effect of Health Education on Glycemic Control of Patients DM Type 2 in Families with A Family Approach Self Care. *Indonesian Journal of Global Health Research*, 6(S5), 549-560. <https://doi.org/10.37287/ijghr.v6iS5.4558>.

INTRODUCTION

Diabetes mellitus is a significant and evolving medical issue, affecting patients of all ages worldwide, characterized by chronic metabolic disorders with rising incidence rates both globally and nationally. The prevalence of diabetes mellitus (DM) worldwide is 537 million adults aged 20-79 years, projected to increase to 643 million by 2030 and 783 million by 2045, with a mortality rate of 6.7 million. Three out of four adults with DM live in low- and middle-income countries. Additionally, there are 240 million people with undiagnosed diabetes (IDF 2021). According to the 2018 Riskesdas results, the prevalence of DM in Indonesia based on doctor diagnosis for those aged ≥ 15 years is 2%, equating to 10.7 million people with DM in 2019. However, the prevalence of DM based on blood glucose tests was 8.5% in 2018. Almost all provinces showed an increase in prevalence from 2013 to 2018, with the highest increase of 0.9 observed in several provinces, including Riau, DKI Jakarta, Banten, Gorontalo, and West Papua (Kementerian Kesehatan RI. 2020). In West Papua, there were 13,656 cases of DM in 2018, with 1,129 cases in Fakfak Regency ((LPB) 2018). Therefore, specialized education for those with diabetes is necessary.

Lifestyle education is essential for changing individual behavior. Diabetes patients must participate in diabetes self-management education to improve their knowledge (American Diabetes Association 2018), along with the latest recommendations regarding sleep health and physical activity, which are crucial for individuals with diabetes (American Diabetes Association 2023). Research reports that diabetes health training positively influences glycemic control and quality of life (Sherifali et al. 2021). Another study found that implementing a health education program for type 2 DM patients significantly improved lifestyle changes and clinical characteristics compared to routine diabetes care (Sanaeinasab et al. 2021). However, this research contrasts with findings that traditional lecture-style health education about DM did not show significant results compared to patient education programs in reducing diabetes-related distress (Wong et al. 2020). The increasing prevalence of DM is attributed to unhealthy lifestyles, particularly poor dietary intake and lack of physical activity. Therefore, patients diagnosed with DM require special attention in their management. Standard DM services provided by the government include 1) blood glucose measurement, 2) education, and 3) therapy, with the highest healthcare service coverage in Kaimana Regency (100%) and the lowest in Fakfak Regency (6.48%) (Barat 2019). Thus, individuals diagnosed with diabetes must prioritize self-care behaviors. Self-care encompasses physical activity (exercise), dietary management, blood glucose monitoring, medication adherence, and complication prevention (Beck et al. 2017).

Based on this information, the research team will further investigate the impact of diabetes health education on glycemic control within families using a self-care approach in the Fakfak Health Center area in Fakfak Regency. Adhering to a routine series of self-care actions that will last a lifetime is a significant challenge and not easy to accomplish. Therefore, appropriate education and family involvement are essential for supporting diabetes management for patients. Self-management in type 2 diabetes patients refers to how patients can manage their condition and health effectively. The better the self-management, the better the glycemic control in type 2 diabetes patients. Seven essential self-care skills for type 2 diabetes patients include: healthy eating, physical activity, blood glucose monitoring, medication adherence, good problem-solving skills, healthy coping skills, and risk-reduction behaviors (Hayati, Malini, and Rahman 2021). These skills and management strategies can be enhanced by patients and their families if they receive adequate health education.

Health education is one approach nurses can take to improve knowledge and self-management skills for diabetes to avoid long-term complications (M. Dwi Setiawan 2022). Diabetes education encompasses health information about diabetes, including preventive, promotional, curative, and rehabilitative aspects. Therefore, it is vital for patients with diabetes mellitus to receive diabetes education at least after diagnosis. Nurses, as educators, can provide education to diabetes patients so that individuals can enhance their knowledge about managing their condition. The objectives of diabetes education go beyond providing knowledge and skills; they also aim to change patient behavior, increase motivation to adhere to therapy recommendations, improve their quality of life, build partnerships in the treatment process, prepare patients for self-care, raise awareness of cardiovascular risk factors, and enhance psychological resilience. The education process is influenced by several factors, particularly the psychological and socioeconomic characteristics of patients, as well as variables related to educators (Swiatoniowska et al. 2019). Research has demonstrated the effectiveness of diabetes management through education programs for individuals with diabetes. Diabetes self-management education programs enhance knowledge, self-care, quality of life, and dietary adherence (M. Dwi Setiawan 2022). Adequate health literacy is crucial for patients to make optimal choices for managing their health and diabetes treatment. The aim of this study

is to analyze the effect of health education on glycemic control in patients with type 2 diabetes mellitus through a family-based self-care approach.

METHOD

This research design is a quasi-experimental study utilizing a one-group pre-test and post-test design. The sampling was conducted using accidental sampling at the Fakfak Tengah Health Center and Sekban Health Center in Fakfak Regency from June to August 2024, with a total sample size of 52 respondents. Inclusion criteria: Type 2 diabetes mellitus patients, aged ≥ 18 years, who have undergone treatment at the health center, can communicate effectively, and are willing to remain respondents until the end of the study. Exclusion criteria: Incomplete clinical outcome data or presence of severe complications. The instruments used were the Diabetes Self-Management Questionnaire (DSMQ) to assess patients' knowledge in self-care management, the Diabetes Knowledge Questionnaire (DKQ) to evaluate patients' knowledge about diabetes, and the GDS test tool. Data was collected twice: first when respondents visited the health center, followed by education on diabetes knowledge, and then evaluated with the same questionnaire, DKQ. The instrument used, the Diabetes Self-Management Questionnaire (DSMQ), has undergone robust validity and reliability testing, showing a Cronbach's alpha coefficient of 0.908. The Diabetes Knowledge Questionnaire (DKQ) achieved a Cronbach's alpha of 0.937, indicating high internal consistency. This confirms that both questionnaires are valid and reliable and can be used in this study. Data were analyzed using paired sample t-test with significance set at $\alpha \leq 0.05$. The study was approved by the Ethics Research Committee of the Fakfak Regency Government, with Number 009/68/BKBP/FF/2024, dated May 21, 2024."

RESULT

Tabel 1.
Sosiodemografi responden

Characteristic	f	%
Sex		
Male	8	15.4
female	44	84.6
Age		
18-59 Year	38	73.1
60 Year	14	26.9
Status perkawinan		
Kawin	48	84.6
Janda	4	15.4
Education Level		
Elementary School	2	3.8
Junior High School	9	17.3
Senior High School	16	30.8
Diploma	14	26.9
Bachelor	11	21.2
Job		
Honorary	2	3.8
Housewife	36	69.2
Pastor	1	1.9
Farmer	3	5.8
Civil Servant	5	9.6
Enterpreneur	5	9.6

Research results showed that the majority of respondents were women, with 44 individuals (84.6%), compared to only 8 men (15.4%). The average age of all respondents was 53 years, consisting of 38 adults (73.1%) and 14 elderly individuals (26.9%). The oldest respondent

was over 70 years old (3 people), while the youngest was 30 years old. In terms of education levels, 16 respondents (30.8%) had completed high school, 14 (26.9%) had a diploma, and 11 (21.2%) had a bachelor's degree. The most commonly reported occupation in this study was housewives, with 36 individuals (69.2%).

Table 2.
Respondents' Health Status

Characteristic	f	%
Duration of DM Disease		
<5 Year	33	63.5
5-10 Year	13	25
>10 Year	6	11.5
Other Disease		
Anemia	1	1.9
Gingival Disorders	1	1.9
Gastritis	3	5.8
Hypercholesterolemia Hypertension	1	1.9
Myalgia	27	51.9
Stroke	1	1.9
Tidak ada	1	1.9
Smoking	17	32.7
No		
Yes	50	96.2
Alcohol Consumption	2	3.8
No		
Yes	52	100
Exercise	0	0
Regular		
Iregular	10	19.2
Dietary Restrictions	42	80.8
Controler		
Uncontroler	50	96.2
Diabetes Medication Therapy	2	3.8
Regular		
Irregular	37	71.2
History of DM Wounds	15	28.8
No		
Yes	43	82.7
History of DM Wounds	9	17.3
Tidak		
Ya	2	3.8
Habit of Walking Barefoot	50	96.2
No		
Yes	34	65.4
Body Mass Index	18	34.6
Underwight (<17)		
Normal (18,5 – 25)	2	3.8
Overweight(25 – 27)	27	51.9
Obesity (>27)	6	11.5
Siastolic Blood Pressure	17	32.7
Hypertension (>139 mmHg)		
Normal (100-139 mmHg)	34	65.4
Diastolic Blood Pressure	18	34.6
80-90 mmHg		
>90 mmHg	41	78.8
	11	21.2

An interesting finding is that among the respondents, 33 individuals (63.5%) had a duration of diabetes of less than 5 years, 13 individuals (25%) had diabetes for 5-10 years, and 6 patients

(11.5%) had diabetes for more than 10 years. The majority of respondents also had hypertension, with 27 individuals (52%). Additionally, it was reported that 2 individuals (3.8%) smoked, and no patients were found to consume alcohol. Regarding exercise, 10 respondents (19%) reported exercising regularly, while 42 respondents (81%) did not engage in regular physical activity. Of the respondents, 50 individuals (96%) followed a diet or food and beverage restrictions, while 2 individuals (3.8%) did not adhere to a diabetes diet. A total of 37 individuals (71.2%) regularly took diabetes medication, whereas 15 individuals (29%) did not take it regularly. Furthermore, 9 individuals (17.3%) reported a history of wounds, and 2 individuals (3.8%) had a history of amputations. Another finding was that 18 patients (34.6%) had the habit of walking barefoot.

Additionally, the results indicated that respondents received information about diabetes from doctors and health workers at the health center, with 28 individuals (92.3%) reporting this. The Body Mass Index (BMI) of the respondents showed that 2 individuals (3.8%) were underweight, while 17 individuals (32.7%) were obese, with an average BMI of 26.2. Moreover, blood pressure readings indicated that the majority of patients had hypertension, with 34 individuals (65.4%) reporting this condition.

Table 3.
Distribution of Percentage Scores for DMSQ

Score	f	%
Good	20	38.5
Enough	25	48.1
Poor	7	13.5
Total	52	100

Table 3 describes that the majority of respondents, 25 individuals (48.1%), have adequate self-care management, while 20 individuals (38.5%) have good self-care management, and 7 individuals (13.5%) have poor self-care management.

Table 4.
Distribution of Random Blood Glucose Percentages

GDS (mg/dl)	Education				Correlation	p value
	Pretest		Posttest			
	f	%	f	%		
< 200	19	36,5	27	51.9	0.835	0.001
200	33	63,5	25	48		
Mean	222		193			

Table 4 above shows the Random Blood Glucose (RBG) values. The RBG of respondents who had levels of <200 mg/dl before education was 19 individuals (36.5%), which increased to 27 individuals (51.9%) after education. Conversely, the number of respondents with RBG levels >200 mg/dl decreased from 33 individuals (63.5%) before education to 25 individuals (48%) after education. The average scores before and after education were 222 mg/dl and 193 mg/dl, respectively. The highest RBG value found among respondents before education was 521 mg/dl, while the lowest value after education was 110 mg/dl. The statistical test used was the Paired Samples Test. The obtained p-value was 0.001.

Table 5.
Analysis of DKQ Scores Before and After Education

Skor DKQ	Education				Correlation	p value
	Pretest		Posttest			
	f	%	F	%		
Tinggi	8	15,4	48	92,3	0,205	0,001
Sedang	42	80,8	4	7,7		
Rendah	2	3,9	-	-		

From Table 5, the scores of the Diabetes Knowledge Questionnaire (DKQ) can be reported. Before education, the largest score was in the medium category, with 42 individuals (80.8%) scoring medium, 8 individuals (15.4%) scoring high, and 2 individuals (3.9%) scoring low. After education, the dominant category was high, with 48 individuals (92.3%) scoring high and 4 individuals (7.7%) scoring medium. The average score before education was 14.2, while after education, it increased to 21.6. The statistical test used was the Paired Samples Test, conducted using SPSS version 26. The obtained p-value was 0.001

DISCUSSION

The sociodemographic data of the respondents indicate that the majority are women. This is because women are at a higher risk of developing type 2 diabetes, as they physically have a greater likelihood of increased Body Mass Index (BMI). According to existing theories, the high incidence of type 2 diabetes in women is attributed to differences in body composition and sexual hormone levels between adult men and women. Women have a higher amount of adipose tissue compared to men. The difference in fat levels is around 15-20% for men and 20-25% for women relative to their body weight. This statement is consistent with the average BMI of respondents in this study, which is 26.2, and some individuals are classified as obese. Additionally, the decreased concentration of estrogen in menopausal women leads to an increase in fat reserves, especially in the abdominal area, resulting in increased free fatty acid release, which can cause insulin resistance (Bhatt, H., Saklani, S., & Upadhayay 2018). Based on the research findings, it can be concluded that women are more at risk of developing diabetes mellitus (DM) because they physically have a greater chance of increased body mass index. Premenstrual syndrome and postmenopausal changes contribute to the accumulation of body fat due to hormonal processes, thus putting women at risk of diabetes mellitus. The researchers assume that, because women have higher fat levels compared to men, there are differences in daily activities and lifestyles that significantly influence the occurrence of type II DM. Therefore, the increase in fat levels in women is higher than in men, making the factors leading to type 2 DM significantly more prevalent in women.

The average age of respondents is 53 years, predominantly adults aged between 19 and 59 years, with a unique finding of a respondent aged 30 years. This indicates that diabetes is not limited to individuals aged 40 and older. The results of this study align with previous research, which reported that type 2 DM predominantly occurs in individuals aged 45 and older (72.4%) (Diah Pradnya Paramita, 2019). At this age, there are changes in the body, both anatomically, physiologically, and biochemically, due to degenerative factors, including changes in pancreatic beta cells' ability to produce insulin, thereby increasing the risk of DM and glucose intolerance. Type 2 DM can also arise due to lifestyle factors that increase the risk of developing type 2 DM (Mildawati, Diani, and Wahid, 2019). However, this finding contrasts with research that reported type 2 DM occurs predominantly in the elderly aged ≥ 60 years (Milita, Handayani, and Setiaji, 2021). Additionally, the elderly have three times the risk of developing type 2 DM compared to individuals under 45 years (Rohanah and Fadilah, 2019). The majority of respondents have relatively high educational levels. In theory,

education is an effort to develop personality and skills both inside and outside of school. Individuals with higher educational levels tend to seek help from health teams more quickly compared to those with lower social status. People with higher education levels generally have more knowledge about health. Individuals with higher education have better opportunities for good behavior. Higher educational levels facilitate individuals or communities in absorbing information and implementing it into daily behavior and lifestyle, particularly in adhering to DM dietary management (Yulisetyaningruma, Sri Siska Mardianab, 2019).

The study found that the most reported occupation among respondents was housewife, as the majority of participants in the study were married women. Theoretically, work factors also contribute to the occurrence of diseases, with housework being considered a light activity. One study indicated that individuals with light physical activity have a 4.36 times greater risk of developing type 2 DM compared to those with moderate or heavy activity (Isnaini and Ratnasari, 2018). Another finding is the diverse number of ethnic groups involved in this study, with 11 ethnic groups represented. This is generally the case in Papua, particularly in Fakfak Regency, which is inhabited by people from various ethnic groups across Indonesia. Furthermore, the average duration of diabetes among respondents is over 5 years, with 6 patients having diabetes for more than 10 years. This finding supports previous research that reported 78 respondents (98.7%) having diabetes for 1–10 years. The longer an individual suffers from diabetes, the higher the risk of complications related to the disease. Some studies indicate that prolonged duration of diabetes leads to a deterioration in bodily conditions due to complications (Duri Kartika, 2018). Similar studies have stated that the increase in complication occurrences is directly proportional to the duration of diabetes; in other words, the longer someone suffers from diabetes, the higher the risk of complications. One such complication includes cognitive function decline (Ramadhan and Marissa, 2018). Another complication of diabetes is heart disease, which aligns with our findings regarding other conditions experienced by respondents during the study, namely hypertension. This finding corresponds with previous explanations stating that patients with a duration of DM exceeding 5 years are likely to experience various complications.

No respondents were found to consume alcohol, and only a small percentage smoked (4.8%). This indicates that diabetes is caused by various factors, including diet and irregular exercise. This may also be due to another finding in this study, where only a small proportion of respondents engaged in regular physical activity (19.2%). A related study reported that among 34 respondents, the majority were inactive, with 18 respondents (52.9%) categorized as such (Opelya et al., 2020). Furthermore, another study reported a correlation between physical activity and blood glucose levels in patients with type 2 diabetes (Sundayana, Rismayanti, and Candra Devi, 2021). These findings align with previous research indicating that many individuals with type II diabetes are less physically active, which is attributed to a lack of knowledge regarding the benefits of physical activity, how much activity is necessary, and what types of exercise should be performed. Patients with type II diabetes often do not manage their time effectively for exercise (Kuniano, 2018). Physical activity is defined as bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2024). According to existing theories, individuals with type 2 diabetes tend to rest more and engage in less physical activity to prevent hypoglycemia, which can occur suddenly. Infrequent physical activity is not advisable for patients with type 2 diabetes, as it can adversely affect the body's physiology, leading to increased glucose production by the liver and decreased glucose utilization by muscles, resulting in an increased risk of uncontrolled blood sugar levels.

Dietary restrictions in the study were generally well managed (90%). This suggests that diabetes diet education provided by healthcare professionals at the health center has been effective. This is also supported by our findings, which showed that the majority of respondents received information about diabetes from doctors and other healthcare providers at the health center (92.3%). The head of the health center reported during an interview that health education has been ongoing for a long time and that it is the responsibility of every healthcare worker to educate all patients visiting the center. Regarding the regular consumption of diabetes medication, 71.2% of respondents reported doing so, while 15 individuals (28.8%) did not adhere to their medication schedule. This finding contrasts with previous research stating that adherence to dietary guidelines among type 2 diabetes patients is 65%, with only 19% complying with their dietary restrictions (Nursihhah et al., 2021). This suggests that respondents who seldom adhere to their diets have a higher risk of uncontrolled blood sugar compared to those who frequently manage their diets. Therefore, education and management of diabetes must be continuously enhanced and promoted throughout the community in the operational area of the Fakfak health center. In theory, patient adherence refers to behaviors aimed at treatment actions, such as diet, healthy lifestyle, and medication compliance. Regular medication consumption and monthly blood sugar monitoring are efforts to control blood sugar levels and prevent complications (Julaiha, 2019).

Another report from respondents indicated a history of previous wounds, with some patients having undergone amputations. This is consistent with several studies indicating that patients with diabetes for more than five years may experience various macro and microvascular complications, including neuropathy, which can lead to diabetic foot ulcers. Additionally, other research reported that many patients walk barefoot, which significantly increases the risk of foot injuries. The study results revealed high random blood glucose levels, with an average of 222 mg/dl; some respondents even had blood glucose levels exceeding 500 mg/dl. This can lead to various complications, including heart disease and stroke. It was also reported that the majority of respondents experienced high blood pressure or hypertension. This finding aligns with reports indicating that cardiovascular complications were prevalent among the respondents, affecting 56 individuals (39.2%), along with complications such as neuropathy, nephropathy, and retinopathy (Rif'at, N. and Indriati, 2023). Once diagnosed with diabetes mellitus, the most critical action is to adapt self-care behaviors. According to Orem, self-care refers to activities undertaken to meet needs that sustain life, health, and well-being, whether in a state of health or illness, performed by the individual themselves. Self-care management in diabetes involves actions taken by individuals to control their diabetes mellitus, including treatment and complication prevention. Aspects of self-care management include dietary regulation, physical activity/exercise, blood glucose monitoring, and medication adherence (Ayunda, Wayunah, and Hidayatin, 2023).

Self-care in patients with diabetes is an essential activity. This aligns with the statement that self-care in diabetic patients can prevent morbidity and mortality (La Greca AM, 2004). Self-care behaviors for diabetic patients include dietary management, blood glucose monitoring, medication therapy, and physical exercise (Saragih, Simanullang, and Br Karo, 2022). Our study found that the management of self-care among respondents was rated as adequate (48.1%), followed by good (38.5%) and poor (13.5%). This indicates that patients' self-management does not focus on improving their knowledge about personal care or enhancing the quality of life for individuals with diabetes, as well as improving diabetes management and continuity regarding diet, physical activity, stress control, medication adherence, and regular health check-ups. Knowledge is the result of awareness that occurs after individuals perceive a particular object through their senses, which include sight, hearing, smell, taste,

and touch. Most human perception is gained through the eyes and ears. Cognitive knowledge is a crucial domain in shaping a person's actions (Notoatmodjo, S., 2010). Several factors influencing the level of knowledge are divided into two categories: internal and external factors. Internal factors include age, health, interest, and attention. Therefore, the patient's knowledge about diabetes mellitus becomes vital, considering that many diabetes patients lack understanding of the disease they suffer from. Knowledge also aims to shape compliance behavior in undergoing therapeutic management, facilitating successful therapy (Saifunurmazah, D., 2018).

Knowledge also aims to foster compliance in therapeutic management, thus achieving successful treatment outcomes (Saifunurmazah, D., 2018). A study reported that respondents obtained health information about diabetes with a percentage of 78.5% (Qusyairi, Andi Sani, and Chaeruddin Hasan, 2022). This health information is crucial for diabetic patients as it provides accurate insights from healthcare providers. The primary findings from the random blood glucose (RBG) levels and Diabetes Knowledge Questionnaire (DKQ) scores of respondents before and after education indicated that the number of respondents with RBG levels below 200 mg/dl increased from 19 (36.5%) before education to 27 (51.9%) after education. Conversely, the number of respondents with RBG levels above 200 mg/dl decreased from 33 (63.5%) before education to 25 (48%) after education. The average scores before and after education were 222 mg/dl and 193 mg/dl, respectively. The highest RBG level recorded before education was 521 mg/dl, while the lowest after education was 110 mg/dl. The statistical test employed was the Paired Samples Test using SPSS version 26. The resulting p-value was 0.001, indicating a significant effect of diabetes education on the improvement of knowledge and glycemic control among respondents. This is likely because the education provided to patients was effective, allowing respondents to manage their diabetes through a self-care approach within their families, resulting in lower RBG levels and better blood glucose control. A study indicated that the duration of diabetes significantly impacts knowledge levels, demonstrating a notable relationship between the length of diabetes and knowledge (Carrillo-Alarcon et al., 2018). Thus, the self-care approach to enhancing patients' knowledge about diabetes management, which includes dietary regulation, physical activity/exercise, blood glucose monitoring, medication adherence, and stress management, is crucial for improving their quality of life and comfort.

CONCLUSION

The research results indicate that diabetes health education improves patient knowledge and effectively maintains glucose control through a self-care approach, which includes dietary management, physical activity, glucose monitoring, and adherence to diabetes medication. This study can serve as an evaluation tool for healthcare providers, particularly nurses, in delivering educational materials related to diabetes mellitus. Adequate knowledge education is expected to continuously improve clinical outcomes, enhance the quality of life, and prevent complications arising from diabetes. It is hoped that individuals with diabetes mellitus will be able to independently manage and control their condition and become a source of knowledge for the community, further increasing public awareness.

REFERENCES

- (LPB), Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan. 2018. Laporan Provinsi Papua Barat Riskesdas 2018.
- American Diabetes Association. 2018. "Standards of Medical Care in Diabetes-2018." Diabetic Retinopathy 1–36. doi: 10.1142/9789814304443_0001.

- American Diabetes Association. 2023. "American Diabetes Association Releases 2023 Standards of Care in Diabetes to Guide Prevention, Diagnosis, and Treatment for People Living with Diabetes." *Clinical Electroencephalography* 13(3):136–136. doi: 10.1177/155005948201300303.
- Ayunda, Wayunah, and Titin Hidayatin. 2023. "Hubungan Self-Care Management Dengan Kadar Glukosa Darah Pada Penderita Diabetes Mellitus." *MEJORA : Medical Journal Awatara* 1(1):8–16.
- Barat, Provinsi Papua. 2019. "Dinas Kesehatan."
- Beck, Joni, Deborah A. Greenwood, Lori Blanton, Sandra T. Bollinger, Marcene K. Butcher, Jo Ellen Condon, Marjorie Cypress, Priscilla Faulkner, Amy Hess Fischl, Theresa Francis, Leslie E. Kolb, Jodi M. Lavin-Tompkins, Janice MacLeod, Melinda Maryniuk, Carole Mensing, Eric A. Orzeck, David D. Pope, Jodi L. Pulizzi, Ardis A. Reed, Andrew S. Rhinehart, Linda Siminerio, and Jing Wang. 2017. "2017 National Standards for Diabetes Self-Management Education and Support." *Diabetes Care* 40(10):1409–19. doi: 10.2337/dci17-0025.
- Bhatt, H., Saklani, S., & Upadhayay, K. 2018. "Anti-Oxidant and Anti-Diabetic Activities of Ethanolic Extract of *Primula Denticulata* Flowers." *Indonesian Journal of Pharmacy* 27(2):74–79.
- Carrillo-Alarcon, Lourdes, Erika Lopez-Lopez, Mario Lopez-Carbajal, and Ocampo Moises. 2018. "Level of Knowledge in Patients with Type 2 Diabetes Mellitus and Its Relationship with Glycemic Levels and Stages of Grief According to Kübler-Ross." *Diabetes & Metabolism* 6:1–5. doi: 10.4172/2155-6156.1000495.
- Diah Pradnya Paramita, A. .. Wiradewi Lestari. 2019. "Terhadap Kadar Glukosa Darah Pada Dewasa Muda Keturunan Pertama Dari Penderita Diabetes Mellitus Tipe 2 Di Denpasar Selatan." *E-JURNAL MEDIKA* 8(1).
- Duri Kartika, Chlarasinta. 2018. "Hubungan Lamanya Menderita Diabetes Melitus Tipe 2 Dengan Penurunan Fungsi Kognitif Naskah." *Hubungan Lamanya Menderita Diabetes Melitus Tipe 2 Dengan Penurunan Fungsi Kognitif Naskah* 16(1994):1–37.
- La Greca AM. 2004. "Manual For The Self Care Inventory."
- Hayati, Delvi Sri, Hema Malini, and Dally Rahman. 2021. "Implikasi Edukasi Kesehatan Di Rawat Inap Meningkatkan Pengetahuan Dan Kontrol Glikemik Pasien Diabetes Mellitus Tipe 2: Systematic Review." *Jurnal Penelitian Kesehatan Suara Forikes* 12(4):1–8.
- IDF. 2021. "Diabetes Facts & Figures." IDF. Retrieved April 2, 2023 (<https://idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html>).
- Isnaini, Nur, and Ratnasari Ratnasari. 2018. "Faktor Risiko Mempengaruhi Kejadian Diabetes Mellitus Tipe Dua." *Jurnal Kebidanan Dan Keperawatan Aisyiyah* 14:59–68. doi: 10.31101/jkk.550.
- Julaiha, Siti. 2019. "Analisis Faktor Kepatuhan Berobat Berdasarkan Skor MMAS-8 Pada Pasien Diabetes Mellitus Tipe 2." *Jurnal Kesehatan* 10:203. doi: 10.26630/jk.v10i2.1267.

- Kementerian Kesehatan RI. 2020. "Infodatin Tetap Produktif, Cegah, Dan Atasi Diabetes Melitus 2020." Pusat Data Dan Informasi Kementerian Kesehatan RI 1–10.
- Kuniano, Duwi. 2018. "Menjaga Kesehatan Di Usia Lanjut." *Jurnal Olahraga Prestasi* 11(2):19–30.
- M. Dwi Setiawan, Susilawati. 2022. "Pengaruh Program Diabetes Self Manajemen Education pada Pasien Diabetes Melitus Tipe 2 Di Indonesia (a: Systematic Review)." *Pengaruh Program Diabetes Self Manajemen Education Pada Pasien Diabetes Melitus Tipe 2 Di Indonesia (a: Systematic Review)* 1(3):1–7.
- Mildawati, Noor Diani, and Abdurrahman Wahid. 2019. "Hubungan Usia, Jenis Kelamin Dan Lama Menderita Diabetes Dengan Kejadian Neuropati Perifer Diabateik." *Caring Nursing Journal* 3(2):31–37.
- Milita, Fibra, Sarah Handayani, and Bambang Setiaji. 2021. "Kejadian Diabetes Mellitus Tipe II Pada Lanjut Usia Di Indonesia (Analisis Risesdas 2018)." *Jurnal Kedokteran Dan Kesehatan* 17(1):9. doi: 10.24853/jkk.17.1.9-20.
- Notoatmodjo S. 2010. *Metodes Penelitian Kesehatan*. edited by Ed. Rev. Jakarta: Penerbit Rineka Cipta.
- Nursihhah, Meliana, Dwi Septian Wijaya, Program Studi Gizi, Sekolah Tinggi Ilmu Kesehatan Khas Kempek, and Corresponding Author. 2021. "Hubungan Kepatuhan Diet Terhadap Pengendalian Kadar Gula Darah Pada Pasien Diabetes Melitus Tipe 2." (Dm):1002–10.
- Opelya, Ni Made Winda, Adi Sucipto, Santi Damayanti, and Siti Fadlilah. 2020. "Hubungan Aktivitas Fisik Dengan Tingkat Stres Pada Pasien Diabetes Melitus Di Puskesmas Gondokusuman 1 Kota Yogyakarta." *Jurnal Ilmiah Keperawatan Imelda* 6(2):178–87. doi: 10.52943/jikeperawatan.v6i2.422.
- Qusyairi, Rahmat, Andi Sani, and Chaeruddin Hasan. 2022. "Hubungan Tingkat Pengetahuan Dengan Aktivitas Self Care Pada Penderita Diabetes Melitus Di Wilayah Kerja Puskesmas Batua Kota Makassar." *Window of Public Health Journal* 3(4):595–606. doi: 10.33096/woph.v3i4.61.
- Ramadhan, Nur, and Nelly Marissa. 2018. "Karakteristik Penderita Diabetes Mellitus Tipe 2 Berdasarkan Kadar Hba1C Di Puskesmas Jayabaru Kota Banda Aceh." *Sel* 2(2):49–56. doi: 10.22435/sel.v2i2.4637.49-56.
- Rif'at, Ivan Dzaki, Yesi Hasneli N, and Ganis Indriati. 2023. "Gambaran Komplikasi Diabetes Melitus Pada Penderita Diabetes Melitus." *Jurnal Keperawatan Profesional (JKP)* 11(1):1–18.
- Rohanah, Rohanah, and Lailatul Fadilah. 2019. "Pengaruh Edukasi Terhadap Pengelolaan Diabetes Lansia Di Posbindu Kelurahan Karang Sari Kota Tangerang Tahun 2018." *Jurnal Medikes (Media Informasi Kesehatan)* 6(1):19–26. doi: 10.36743/medikes.v6i1.91.
- Saifunurmazah D. 2018. "Kepatuhan Penderita Diabetes Mellitus Dalam Menjalani Terapi Olahraga Dan Diet." Universitas Negeri Semarang.

- Sanaeinasab, Hormoz, Mohsen Saffari, Davoud Yazdanparast, Aliakbar Karimi Zarchi, Faten Al-Zaben, Harold G. Koenig, and Amir H. Pakpour. 2021. "Effects of a Health Education Program to Promote Healthy Lifestyle and Glycemic Control in Patients with Type 2 Diabetes: A Randomized Controlled Trial." *Primary Care Diabetes* 15(2):275–82. doi: 10.1016/j.pcd.2020.09.007.
- Saragih, Helinida, Murni Sari Dewi Simanullang, and Lea Florentina Br Karo. 2022. "Hubungan Self Care Dengan Kualitas Hidup Pasien Dm Tipe 2." *Jurnal Ilmiah Keperawatan IMELDA* 8(2):147–54. doi: 10.52943/jikeperawatan.v8i2.1001.
- Sherifali, Diana, Anka Brozic, Pieter Agema, Zubin Punthakee, Natalia McInnes, Daria O'Reilly, R. Muhammad Usman Ali, Sarah Ibrahim, and Hertzal C. Gerstein. 2021. "Effect of Diabetes Health Coaching on Glycemic Control and Quality of Life in Adults Living With Type 2 Diabetes: A Community-Based, Randomized, Controlled Trial." *Canadian Journal of Diabetes* 45(7):594–600. doi: 10.1016/j.cjcd.2020.11.012.
- Sundayana, I. Made, I. Dewa Ayu Rismayanti, and Ida Ayu Putu Desta Candra Devi. 2021. "Penurunan Kadar Gula Darah Pasien DM Tipe 2 Dengan Aktivitas Fisik." *Jurnal Keperawatan Silampari* 5(1):27–34. doi: 10.31539/jks.v5i1.2367.
- Swiatoniowska, Natalia, Kathie Sarzynska, Anna Szymanska-Chabowska, and Beata Jankowska-Polańska. 2019. "The Role of Education in Type 2 Diabetes Treatment." *Diabetes Research and Clinical Practice* 151:237–46. doi: 10.1016/j.diabres.2019.04.004.
- WHO. 2024. "Physical Activity."
- Wong, Man Kin, Sai Yip Ronald Cheng, Tsun Kit Chu, Fung Yee Lam, Shiu Kee Lai, Kai Chung Wong, and Jun Liang. 2020. "Impact of Motivational Interviewing on Self-Management in Patients with Type 2 Diabetes: Protocol for a Pilot Randomized Controlled Trial." *JMIR Research Protocols* 9(3):1–9. doi: 10.2196/15709.
- Yulisetyaningruma, Sri Siska Mardianab, Dewi Susantic. 2019. "Hubungan Tingkat Pendidikan Dan Pengetahuan Tentang Diet DM Dengan Kepatuhan Diet Pasien Diabetes Mellitus." 3(1):44–50.