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Analysis Psychosocial Factors Affecting Behaviour of Self-Monitoring Blood Glucose in People with Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: Compliance with monitoring blood glucose levels is crucial to diabetes management. Self-monitoring behaviour of blood glucose levels can be influenced by psychosocial factors in people with T2DM, such as knowledge, coping, diabetes distress, family support, and nurse support. **Objective:** The study aimed to analyze psychosocial factors that influence the behaviour of self-monitoring of blood glucose levels in people with T2DM. **Methods:** The study was a descriptive-analytic study with a cross-sectional design. The sample was T2DM patients in the Jember Regency with a sample size of 138 respondents, taken using multistage random sampling. Data were collected using a questionnaire (SKILLDS, Coping Scale, DDS, HDFSS, Nurse's role perception, and the SMBG questionnaire) and analyzed using a multiple linear regression test. **Results** The modelling results show that psychosocial factors (knowledge, coping, diabetes distress, family support, and nurse support) have a simultaneous and significant influence on the behaviour of monitoring blood glucose levels ($F = 9.292$; $p = 0.001 < \alpha = 0.05$) with adjusted $R^2 = 0.232$. It showed that psychosocial factors could explain the variance of behaviour monitoring blood glucose levels by 23.2%. Partially, there are three influential variables, namely coping, perception of family support, and perception of nurse support ($p = 0.039$; $p = 0.016$; and $p = 0.020 < \alpha = 0.05$). Better coping, family support, and nurse support could improve blood glucose monitoring. **Conclusion:** Psychosocial factors can affect monitoring blood glucose levels in people with T2DM. The nurse can make efforts to improve the behaviour by monitoring blood glucose levels by considering the psychosocial aspects of people with T2DM through preventive promotion efforts to improve coping, family support, and nurse support to improve self-management and quality of life of people with T2DM.

Keyword: Type 2 Diabetes Mellitus, Psychosocial Factors, Blood Glucose Level Monitoring Behavior

ABSTRAK

Latar belakang: Kepatuhan terhadap pemantauan kadar glukosa darah merupakan aspek kunci dalam tatalaksana diabetes. Perilaku pemantauan kadar glukosa darah mandiri dapat dipengaruhi oleh faktor psikososial penderita DMT2, seperti pengetahuan, coping, distress diabetes, dukungan keluarga, dan dukungan perawat. **Tujuan:** Menganalisis faktor-faktor psikososial yang mempengaruhi perilaku pemantauan kadar glukosa darah mandiri pada penderita DMT2. **Metode:** Penelitian ini merupakan penelitian observasional analitik dengan desain cross-sectional. Sampel penelitian adalah penderita DMT2 di Kabupaten Jember dengan besar sampel adalah 138 responden yang diambil secara acak menggunakan multistage random sampling. Instrumen yang digunakan berupa kuesioner, yaitu SKILLDS, The Coping Scale, DDS, HDFSS, kuisioner persepsi peran perawat dan kuesioner SMBG. Analisa data menggunakan uji regresi linier berganda. **Hasil:** Hasil pemodelan menunjukkan bahwa faktor psikososial (pengetahuan, coping, distress diabetes, dukungan keluarga, dan dukungan perawat) mempunyai pengaruh secara simultan dan signifikan terhadap perilaku pemantauan kadar glukosa darah ($F=9,292$; $p= 0,001 < \alpha=0,05$) dengan adjusted $R^2 =0,232$. Hal ini menunjukkan bahwa faktor psikososial dapat menjelaskan variansi perilaku pemantauan kadar glukosa darah sebesar 23,2%. Secara parsial, terdapat tiga variabel yang berpengaruh yaitu coping, persepsi dukungan keluarga, dan persepsi dukungan perawat ($p= 0,039$; $p= 0,016$; dan $p= 0,020 < \alpha=0,05$). Semakin baik coping, dukungan keluarga, dan dukungan dari perawat dapat meningkatkan perilaku pemantauan kadar glukosa darah. **Kesimpulan:** Faktor psikososial dapat mempengaruhi perilaku pemantauan kadar glukosa darah pada penderita DMT2. Upaya peningkatan perilaku pemantauan kadar glukosa darah dapat dilakukan dengan mempertimbangkan aspek psikososial penderita DMT2 melalui upaya promosi preventif untuk meningkatkan coping, dukungan keluarga, dan dukungan perawat sehingga dapat meningkatkan pengelolaan mandiri dan kualitas hidup penderita DMT2.

Kata Kunci: Diabetes Melitus Tipe 2, Faktor Psikososial, Perilaku Pemantauan Kadar Glukosa Darah

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Introduction:

Type 2 diabetes mellitus (T2DM) is a complex chronic disease that requires ongoing medical care with multifactorial risk reduction strategies (American Diabetes Association, 2020). Continuous self-management education and support can reduce the risk of complications. Several treatments are needed to achieve reasonable blood glucose control, one of which is monitoring blood glucose levels (Perkumpulan Endokrinologi Indonesia, 2021). In the East Java Regional Health Research in 2018, the prevalence of diabetes mellitus was 2% of the total diabetes mellitus sufferers in East Java (Kementerian Kesehatan RI, 2018).

A preliminary study showed that the number of people with T2DM in Jember Regency in 2020 was 11,117; in 2021, it had increased to 25,931 people. The results of interviews with the person in charge of the non-communicable disease program showed that the behaviour of monitoring blood glucose levels was still poor. Most people with T2DM do not monitor their blood glucose routinely due to a lack of knowledge about the disease, economic barriers, and wrong perceptions about treatment (Dinas Kesehatan Jember, 2021). A previous study showed that many people with T2DM do not monitor their blood glucose levels or access health services on an ongoing basis (Raoufi et al., 2018). Although health workers such as doctors and other health workers have advised people with T2DM to monitor blood glucose levels regularly, there are still many T2DM patients who do not follow the advice (Al-Keilani et al., 2017). It is likely due to the complex practice of monitoring blood glucose levels, cost, time, and fear of procedures, such as pain (Raoufi et al., 2018).

Several factors, including psychosocial factors, can influence the behaviour of monitoring glucose levels in people with T2DM. Psychosocial factors that influence the behaviour of monitoring blood glucose levels include knowledge, coping, distress, family support, and nurse support. Blood glucose monitoring contributes to increasing the self-regulation of diabetic individuals by monitoring blood glucose levels so that they remain normal

and avoid the dangers of complications (Anene-Okeke et al., 2021; Jutterstrom, 2013; Rayanti et al., 2018; Tanaka et al., 2018). Therefore, further analysis is needed to determine what psychosocial factors can affect the behaviour of monitoring blood glucose levels in patients with type 2 diabetes mellitus.

Methods:

The research design used was analytic observational with cross-sectional. This study was conducted in Jember Regency from April to July 2022. The sample of this study was patients with Type 2 DM with inclusion criteria: (1) age 40-65 years, (2) duration of diabetes more than or equal to 1 year, and (3) is willing to be a respondent. While the exclusion criteria are (1) undergoing hospitalization in health facilities and respondents, (2) there are communication barriers such as deaf, speech impaired, and blind. The sample size of this study was 138 respondents calculated using the G Power ($f^2 = 0.15$; $\alpha = 0.05$; $\beta = 0.95$). Samples were taken randomly using multistage random sampling. The researcher divides the Jember Regency into five areas based on the map (north, south, central, west, and east). In each area, two public health centres were chosen randomly, with ten public health centres selected. Then from each public health, five villages were randomly selected, so a total of 50 villages were selected. The researcher randomly selected 2 - 3 respondents from each village, so we obtained 138 respondents.

Data collection in this study is door-to-door using the self-report technique where respondents can fill out questionnaires by asking directly or filling in independently. Before taking data, the researcher explained the purpose, benefits, and procedures of the study, and then the researcher gave an informed consent form to read and sign. After the respondent signed the informed consent, the researcher explained how to fill out the questionnaire.

There are two variables in the study: the independent variable and the dependent variable. The independent variable is psychosocial factors: knowledge, coping,

diabetes distress, family support, and nurse support. At the same time, the dependent variable is the behaviour of monitoring blood glucose levels.

The measurement of variables in this study used six questionnaires which were tested for validity and reliability by researchers:

- (1) SKILLDS (Spoken Knowledge in Low Literacy patients with Diabetes Scale) was used to measure the diabetes knowledge of people with T2DM and categorized as low (<5.33), medium (5.33 - 10.67), and high category (>10.68). The questionnaire is valid and reliable ($r = 0.354 - 0.836$; and Cronbach alpha = 0.904);
- (2) Coping Scale was used to measure coping skills and categorized as low (<22), medium (22 - 32.99), and high category (>33). The questionnaire is valid and reliable ($r = 0.436 - 0.748$); and Cronbach alpha = 0.904);
- (3) DDS (Diabetes Distress Scale) was used to measure the distress experienced by people with T2DM in disease management and was categorized as low (<2.44), medium (2.44 - 3.86), and high category (>3.86). The questionnaire is valid and reliable ($r = 0.529 - 0.784$; and Cronbach alpha = 0.895);
- (4) HDFSS (The Hensarling Diabetes Family Support Scale) was used to measure the perception of people with T2DM about family support in managing the disease and categorized as low (<48), medium (48 - 71.99), and high category (>72). The questionnaire is valid and reliable ($r = 0.451 - 0.818$; and Cronbach alpha = 0.946);
- (5) Perception of the nurse's role questionnaire was used to measure the perception of people with T2DM about nurse support in managing the disease and categorized as low (<48), medium (48 - 71.99), and high category (>72). The questionnaire is valid and reliable ($r = 0.630 - 0.838$; and Cronbach alpha = 0.965);
- (6) The SMBG (Self-Monitoring Blood Glucose) questionnaire was used to measure people's self-monitoring blood glucose behaviour with T2DM and

categorized as low (<60.66), medium (60.66 - 95.34), and high category (>95.3). The questionnaire is valid and reliable ($r = 0.329 - 0.938$; and Cronbach alpha = 0.795);

Data analysis used descriptive and inferential statistical tests. Researchers used descriptive statistics to explain the characteristics of respondents and study variables. At the same time, the inferential statistical test used a multiple linear regression test. Researchers also perform classical assumption tests (normality, multicollinearity, heteroscedasticity, and linearity). It is a prerequisite for multiple linear regression tests. The results of the normality test for all data were normal ($p > = 0.05$), there was no multicollinearity (VIF value < 10 and tolerance value > 0.10), and linear and there were no symptoms of heteroscedasticity ($p > = 0.05$). This research had approved by the Health Research Ethics Committee of the Faculty of Nursing, Universitas Jember, with an ethical certificate Number:131/UN25.1.14/KEPK/2022.

Results:

The study results showed that most respondents were 56-65 years or the late elderly (56.5%), female (71%), had a basic education level (42%), and income level less than minimum wage (69.6%).

Table 1. Demographic Characteristics of People with T2DM in Jember Regency April – July 2022 (n=138)

Demographic Characteristics	n	%
Age		
40- 45 (late adulthood)	10	7.2
46- 55 (early elderly)	50	36.2
56- 65 (late elderly)	78	56.5
Gender		
Male	40	29.0
Female	98	71.0
Level of Education		
No Formal School	20	14.5
Elementary School	58	42.0
High School	51	37.0

Demographic Characteristics	n	%
College	9	6.5
Level of Income		
< Minimum Income	96	69.6
> Minimum Income	42	30.4

Table 2. Monitoring Blood Glucose Levels Behavior of People with T2DM in Jember Regency for April – July 2022 (n=138)

Variable	Mean ± SD	Category	n	%
Monitoring Blood Glucose Levels Behavior	82.72 ± 19.64	Low	20	14,5
		Medium	80	58.0
		High	38	27.5

Table 2 shows that most respondents had a medium category in blood glucose monitoring (58%), with an average score of 82.72 ± 19.64.

Table 3. Psychosocial Factors of People with T2DM in Jember Regency April – July 2022 (n=138)

Variable	Mean ± SD	Category	n	%
Education	9.60 ± 3.24	Low	18	13.0
		Medium	58	42.0
		High	62	44.9
Coping	28.37 ± 5.52	Low	16	11.6
		Medium	90	65.2
		High	32	23.2
Distress	2.99 ± 0.98	Low	41	29.7
		Medium	72	52.2
		High	25	18.1
Perceived family support	63.31 ± 16.99	Low	26	18.8
		Medium	67	48.6
		High	45	32.6
Perceived nurse support	60.30 ± 17.70	Low	32	23.2
		Medium	74	53.6
		High	32	23.2

Table 3 shows that most respondents had knowledge in the high category (44.9%), with an average score of 9.60 ± 3.24 and the coping skills were in the medium category (65.2%), with an average score of 28.37 ± 5.52. Most respondents had diabetes distress in the medium category (52.2%), with an average score was 2.99 ± 0.98. Perceived family support, mainly in the medium category (48.6%), with an average score of 63.31 ± 16.99, and perceived nurse support in the medium category (53.6%), with an average score of 60.30 ± 17.70.

Table 4. Model 1: The Effect of Psychosocial Factors on the Behavior of Monitoring Blood Glucose Levels in People with T2DM in Jember Regency for the Period April – July 2022 (n=138)

Fisher's test			t-test			Adjusted R Square
F	Sig	Desc.	B	t	Sig	
9.292	0.001	Fit (Constant)	50.542	3.595	0.001	0.232
		Education	-0.507	-1.007	0.319	
		Coping	0.607	2.089	0.039	
		Distress	-3.436	-1.877	0.063	
		Perception of family support	0.269	2.443	0.016	
		Perception of nurse support	0.216	2.352	0.020	

Table 4 shows the results of the model's feasibility test (F= 9.292; p= 0.001 < 0.05). It means independent variables simultaneously influenced the behaviour of monitoring blood glucose levels in people with T2DM. The individual parameter significance test (t-test) showed that the variables influencing the behaviour of monitoring blood glucose levels

were coping, perceived family support, and perceived nurse support (p -value < 0.05). The adjusted R-value in this test was 0.232, which means that knowledge, coping, distress, perceived family support, and perceived nurse support could explain the behaviour of monitoring blood glucose levels by 23.2%. Meanwhile, other variables outside the model explained 76.8% of the variance of the behaviour of monitoring blood glucose levels. Based on **Table 4**, it can form a multiple linear regression model with the following equation: $Y = 50.524 - 0.507$ (knowledge) + 0.607 (coping) - 3.436 (distress) + 0.269 (perception of family support) + 0.216 (perception of nurse support).

In this equation, three independent variables (coping, perceived family support, and perceived nurse support) positively contribute to monitoring blood glucose levels. The interpretation of this statement is that the higher the level of coping, family support, and nurse support, the higher the behaviour of monitoring blood glucose levels in people with T2DM. While the other two variables, namely the knowledge and the distress variable, have a negative contribution with the interpretation that the higher the level of knowledge and the level of eating distress, the lower the level of behaviour in monitoring blood glucose levels.

Table 5. Model 2: The Influence of Psychosocial Factors on the Behavior of Monitoring Blood Glucose Levels in People with T2DM in Jember Regency, April – July 2022 (n=138)

Fisher's test			t-test			Adjusted R square	
F	Sig	Des c.	B	t	Sig		
13.949	0.001	Fit	(Constant)	29.417	3.201	0.001	0.221
			Coping	0.725	2.566	0.011	
			Perception of family support	0.331	3.341	0.001	

Fisher's test			t-test			Adjusted R square	
F	Sig	Des c.	B	t	Sig		
			Perception of nurse support	0.915	2.148	0.034	0.221
			Coping	0.725	2.566	0.011	
			Perception of family support	0.331	3.341	0.001	

In **Table 5**, it can be seen that the results of the Fishers Test were significant ($F = 13.949$; $p = 0.001 < 0.05$). It means coping, perceived family support, and perceived nurse support influenced the behaviour of blood glucose level monitoring. An adjusted R Square value of 0.221 means coping, perceived family support, and perceived nurse support could explain the behaviour of blood glucose monitoring levels by 22.1%. At the same time, other variables outside the model explained 77.9%. Without eliminating the first model that already fit, the researcher wanted to see how much the behaviour of monitoring blood glucose levels was in the coping variables, perceptions of family support, and perceptions of nurse support. Based on **Table 5**, the following multiple linear regression model equation can be formed: $Y = 29.417 + 0.725$ (coping) + 0.331 (perceived family support) + 0.195 (perceived nurse support)

Discussion :

The results showed that most people with type 2 diabetes mellitus were in the late elderly age or 56-65 years (56.5%). This study's results align with previous studies that state that most people with type 2 diabetes mellitus are in the late elderly age range (Asimwe et al., 2020; Jangra et al., 2019). The increased risk of developing diabetes and increasing age is due to an ageing process in which insulin production decreases due to decreased pancreatic beta cell function. A previous study also stated that muscle cells experience a decrease in activity in older individuals, so the muscle fat levels increase, which can trigger insulin resistance (Komariah & Rahayu, 2020). The results also show that most respondents are women (71%). This study's results align with the previous study that most people with T2DM are women (Milita

et al., 2021). Differences in sex hormone levels and body composition in women and men are also a factor in the high incidence of diabetes in women. The ratio of adipose tissue and fat content is also higher in women. The lack of concentration of the hormone estrogen in the body of women who have entered menopause can cause an increase in fat reserves so that the released fatty acids also increase. This condition can also be related to the occurrence of insulin resistance.

Most respondents in this study were at the basic education level or only graduated from elementary school (42%). This study is in line with a previous study that stated that most people with T2DM had a low level of education (Chavan et al., 2015). The level of education affected the incidence of diabetes mellitus. The higher the level of education, the more knowledge they have about the disease. It also affects the awareness of individuals in maintaining their health. Individuals with a high level of knowledge tend to be aware of a healthy lifestyle and pay attention to their daily lifestyle. Individuals with low levels of education tend to be at risk of developing diabetes mellitus due to a lack of awareness of maintaining a lifestyle and preventing the risk of diabetes mellitus.

Most research respondents had income below the minimum wage (69.6%). This study's results align with a previous study that stated that most people with T2DM were low-income (Bird et al., 2015). People with T2DM from lower-income families have difficulty accessing health care services. The psychosocial factors significantly affected the behaviour of monitoring blood glucose levels. This study is in line with a previous study that stated psychosocial influences on the quality of life of diabetics as well as self-management to conduct self-checks or blood sugar checks if access to health services is still inadequate (Wijaya & Widiastuti, 2018).

The knowledge had no significant effect on the behaviour of blood glucose monitoring. The results of this study contradict previous research, which states that the level of knowledge is one of the factors that can determine patients' healthy behaviour (Nugraha

& Dewi, 2020). Lower knowledge affects the management of diseases such as taking diabetes medication regularly, lack of physical activity, and unhealthy eating patterns. It can cause an increase in blood glucose levels (Bukhsh et al., 2019). In this study, the most important thing is the provision of health education to increase willingness to carry out self-care, such as monitoring blood glucose levels. Because if the individual does not have the will to change their lifestyle and follow the management of disease treatment, the individual's knowledge is meaningless. In addition, an individual's perception of blood sugar control only if unwell feeling, so knowledge does not affect the behaviour of monitoring blood glucose levels.

The coping variable significantly affected the behaviour of blood glucose monitoring. This study is in line with a previous study that stated that after the individual knows the disease, the individual will unconsciously apply different coping mechanisms, focusing on emotional adjustment after knowing the condition or solving problems (Rayanti et al., 2018). Individuals will generally experience resistance to lifestyle changes and feel angry, anxious, depressed, and guilty. If the individual cannot accept his illness by managing his emotions and feelings in the long term, it can lead to an inability to adapt. These mechanisms include feelings of self-blame and rejection of circumstances. In this study, the respondent's coping mechanism affects the behaviour of monitoring blood glucose levels. Some respondents who have had diabetes for a long time thought that this disease was the way of God, and respondents said that they must adhere to treatment so that complications do not occur. Suitable coping mechanisms can help individuals with diabetes change their negative habits or lousy lifestyle. The distress did not significantly affect the behaviour of blood glucose monitoring. The result of the study is not in line with a previous study that states that distress in individuals with diabetes can affect self-care, one of which is routine blood glucose monitoring (Tanaka et al., 2018). The study explains that individuals who monitor blood

glucose levels feel the burden and cause distress because of pain and fear.

The perceived family support variable significantly affected the behaviour of monitoring blood glucose levels. This study is in line with a previous study that stated the family has a vital role in supporting sick individuals to improve health. Family support can help individuals to change their habits by providing motivation, accompanying them when monitoring blood glucose levels, and reminding them when to take medication. Family support can strengthen individuals to continue self-management (Rayanti et al., 2018). The perceived nurse support significantly affected the behaviour of blood glucose level monitoring. Several previous studies also stated an effect between nurse support and monitoring blood glucose levels. Monitoring blood glucose levels is the main focus for nurses in providing support, namely by communicating achievements related to maintaining stable blood glucose levels. Health education can also be given as a form of increasing knowledge, motivating people with diabetes and their families or partners who accompany the people with T2DM to monitor blood glucose independently (Jutterstrom, 2013).

This study has several limitations, including that this study uses quite several questionnaires, namely six questionnaires with a large number of question items that allow bias. Another limitation is that the researcher did not analyze the effect of other factors, such as sociodemographic conditions, on blood glucose monitoring behaviour. The next researcher can use a simpler questionnaire with fewer question items, thus minimizing bias. In addition, researchers can also conduct further research with the method of modelling the formation of blood glucose monitoring behaviour by analyzing the influence of psychosocial factors, sociodemographic factors and other factors.

Conclusions:

Psychosocial factors, namely knowledge, coping, distress, family support, and support from nurses, simultaneously and significantly affect the behaviour of monitoring blood

glucose levels in T2DM patients. However, only three influential variables, namely coping, perception of family support, and perception of nurse support, affect the behaviour of monitoring blood glucose. The nurse can increase the behaviour of people with T2DM in blood glucose monitoring by considering the psychosocial aspects. Preventive promotion efforts to improve coping, family support, and nurse support to improve blood glucose monitoring impact on decreasing morbidity and improving people's quality of life with T2DM.

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