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Prevalence of depression among diabetes mellitus patients at primary health centers in Sleman

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Abstract

Background: Depression is a common psychological disorder in diabetic patients that potentially causes non-adherence and complications. However, information regarding the prevalence and risk factor of depression in diabetic patients in Indonesia remains inconsistent.

Objective: This study is aimed to determine the prevalence of depression and its associated factors among patients with type II diabetes mellitus (T2DM) in primary public health centers.

Method: This cross-sectional study involved adult patients with T2DM in primary health centers in Sleman, Indonesia. Subjects were recruited using the purposive sampling method, and depression was assessed using the PHQ-9 questionnaire. The association between subject characteristics and depression was determined using the chi-square of Fisher's exact test.

Results: Among 268 subjects, most of them were women, aged <60 years old, had at least 1 comorbidity, and were taking a combination of oral antidiabetics. More than half of subjects had T2DM for <5 years. The prevalence of depression among T2DM was 36.6%. Being aged ≥60 years old, having a low education level, being a provider of family, and having T2DM for 5-10 years ($p<0.05$) were significantly associated with depression.

Conclusion: T2DM patients aged ≥60 years old, who have a low education level, are providers of family, and have had T2DM for 5-10 years are more vulnerable to depression, thus needing more attention from healthcare providers to achieve diabetes goal therapy.

Keywords: depression, PHQ-9, risk factor, primary health care, diabetes mellitus

1. Background

Diabetes Mellitus (DM) is one of the chronic diseases with a considerable impact on the sufferers. This degenerative disease affects not only the elderly and middle-aged population but also the young adult population. In 2021, as many as 536.6 million people in the world suffered from DM. This number is expected to increase and reach 783.2 million people by 2045 (Sun *et al.*, 2022). Having 19.5 million people diagnosed with DM, Indonesia ranked 5th among the countries with the highest number of DM patients in 2021. By 2045, the number of Indonesia's population suffering from DM is predicted to increase to 28.6 million people (Sun *et al*., 2022).

Diabetes Mellitus affects not only the physical condition but also the psychological condition of the sufferers. People with DM are vulnerable to experiencing psychological disorders due to various factors. Depressive disorders or symptoms are quite common among DM patients (Akhaury & Chaware, 2022). The incidence of depression in people with DM can reach 2-3 times more frequently compared to the population without DM. Diabetes Mellitus and depression are two diseases that affect each other or have a bidirectional correlation. Hyperglycemia that lasts for a long time will lead to structural changes in the brain and trigger the neurodegenerative process. On the other hand, depression can trigger the hypothalamic-pituitary-adrenal axis (HPA-axis) system, or

what is often called the stress pathway, and the sympathetic nervous system. As a result, the production of cortisol in the adrenal cortex and adrenaline as well as noradrenaline in the adrenal medulla will increase, leading to insulin resistance and type-2 DM (Bădescu *et al*., 2016; Dziurkowska & Wesolowski, 2021). In the presence of such mechanism, depression can interfere with the glycemic control in people who already suffer from DM (Moshomo *et al*., 2022). In addition, DM patients with depression tend to be noncompliant with DM treatment regimen and healthy lifestyle recommendations, thus posing a risk of therapy failure (Lunghi *et al.*, 2017; Sumlin *et al*., 2014; Yang *et al*., 2023). As an example of non-compliance, DM patients who show symptoms of depression often unilaterally discontinue medication without consulting or discussing first with the physician (Lunghi *et al*., 2017). If non-compliance occurs over a long period of time, it will lead to various complications, including macrovascular and microvascular complications (Nouwen *et al*., 2019).

According to this explanation, it is necessary to perform a screening for assessing the symptoms of depression in DM patients, thus allowing health workers to decide further action to prevent serious symptoms of depression and optimize DM therapy. However, with the limited resources available at public health centers, it is necessary to prepare a priority scale to determine which patients need screening first. Therefore, it is necessary to conduct a study to assess which characteristics of DM patients show the potential for depression.

Several studies have been conducted to look for patient factors related to the incidence of depression. However, previous studies have found different results, and some studies were single centered. Single-center studies are less likely to represent the characteristics of DM patients comprehensively. In addition, the assessment instruments used in prior studies to measure the symptoms of depression had a fairly large number of question items, such as the Beck Depression Inventory (BDI), making them less suitable for primary health care facilities that require rapid screening (Putri *et al*., 2023; Saleh *et al*., 2020; Shofiyati, 2020). This study complements previous studies by using the multi-center approach and the Patient Health Questionnaire-9 (PHQ-9) instrument which is more in line with the setting of primary health care facilities. According to this, this study aims to determine the prevalence of patients who experience depressive disorders and to analyze the factors related to depression in DM patients.

2. Method

2.1. Research design

This study was an analytical observational study with a cross-sectional design. The research was conducted in several primary health centers in Yogyakarta. The research procedures had been

approved by Medical and Health Research Ethics Committee of the Faculty of Medicine of Universitas Islam Indonesia with the letter No. 15/Ka.Kom.Et/70/KE/V/2021. During the recruitment process, each prospective participant received an explanation about the data to be collected, and there was no research procedure that endangered the participants. To ensure the confidentiality of patient data, the interviews were conducted in a separate room. The prospective participants who were willing to be the subjects of the research then signed an informed consent.

2.2. Research subjects and sampling methods

The population of this study was type-2 DM patients in primary health centers. Meanwhile, the subjects of this study were the patients who met the inclusion criteria, which included adult patients (≥18 years old) who had been diagnosed with DM for at least one year and were willing to become participants. Patients with severe psychiatric disorders that limited them from interpreting the questions in the questionnaire and patients with impaired verbal communication were excluded from the study. The sampling technique chosen in this study was the non-random sampling with a purposive sampling design.

2.3. Research instrument

The depressive disorders in DM patients were assessed by filling out the Indonesian version of the PHQ-9 which had been validated by Dian *et al.* (2022). This questionnaire consists of 9 questions (**Table 1**). The subjects were asked to answer each question item with never (score: 0), several days (score: 1), more than half of the time in question (score: 2), or almost every day (score: 3) according to their own conditions. The total score was obtained by adding the scores of each question item. In assessing depressive disorders, the researcher referred to the interpretation of the previous research conducted by Kroenke *et al*. (2001). The subjects were categorized into depressed patients (total score: ≥10) and non-depressed patients (total score: <10). The data reporting form was used to summarize the patient information related to the demographic characteristics and clinical characteristics data.

Table 1. Quetionnaire PHQ-9

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly everyday
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3
3. Trouble falling asleep pr sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly everyday
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed or the opposite – being so figety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself	0	1	2	3

2.4. Data collection procedures

The data collection process was carried out prospectively. The patient recruitment was conducted at the Pharmacy Installation of the primary health centers in Sleman after the patients received their medicine. The researcher explained the research procedures and the guarantee of confidentiality of the data obtained. The questionnaire was filled out after the patients agreed to be the subjects of the study and signed the informed consent. The direct interviews with the research subjects were conducted to obtain data on their demographic characteristics (age, gender, level of education, and source of income) and clinical characteristics (duration of DM, family history with DM, comorbidities, smoking habits, and oral antidiabetic therapy modalities). The clinical characteristics data on the weights and heights was obtained from the results of the last measurement at the polyclinic. The data was then recorded in the case report form. The weight and height measurements were carried out by nurses to calculate the body mass index (BMI). The body mass index is obtained by calculating the ratio of the body weight (kg) to the square of the height (m^2) and is categorized into underweight, normal weight, overweight, and obesity based on the WHO classification.

2.5. Data analysis

The data obtained was then analyzed using SPSS version 23. Frequencies were used to describe demographic characteristics, clinical characteristics, and depressive disorders. Meanwhile, the Chi-squared test or Fisher's exact test was used to assess the significance of the correlation between the independent variables (demographic characteristics and clinical characteristics and potential depressive disorders). The Fisher's exact test is used when the conditions of the Chi-squared test are not met; for example, there is a column with zero (0) value or more than 20% of the

expected value is less than 5. The correlation between two variables is significant if the value of *p* is <0.05.

3. Results and discussion

3.1. Characteristics of the research subjects

A total of 268 patients who met the inclusion and exclusion criteria were recruited as the study subjects and included in the statistical analysis. Based on **Table 2**, most of the research subjects were female, and the majority were <60 years old. More than half of the study subjects had low educational attainment or completed only the elementary school level. In addition, most of the study subjects relied on their spouses as the breadwinner.

Table 2. Socio-demographic characteristics of the research subjects

Demographics	Frequency (n)	Percentage (%)
Gender		
Male	76	28.4
Female	192	71.6
Age		
<60 years	174	64.9
≥60 years	94	35.1
Educational level		
Low (elementary school)	136	50.7
Moderate (high school)	98	36.6
High (Higher education)	34	12.7
Source of income		
Oneself	112	41.8
Spouse	135	50.4
Others	21	7.8

More than 50% of the study subjects had DM with a duration of less than 5 years and had no family history of DM. Most of the research subjects had comorbidities, either one or more than one comorbidity. More than 90% of the subjects did not have a smoking habit. All the study subjects used oral antidiabetics, and the majority used a combination of oral antidiabetics.

Table 3. Clinical characteristics of the research subjects

Variable	Frequency (n)	Percentage (%)
DM duration		
< 5 years	143	53.4
5–10 years	89	33.2
>10 years	36	13.4
Family history with DM		
Yes	116	43.3
No	152	56.7

Variable	Frequency (n)	Percentage (%)
Comorbidities		
None	77	28.7
1 Comorbidity	108	40.3
>1 Comorbidities	83	31.0
Smoking habits		
Yes	26	9.7
No	242	90.3
Body mass index (BMI)		
Underweight (<18.5 kg/m2)	15	5.6
Normal weight (18.5-24.99 kg/m2)	163	60.8
Overweight (25-29.99 kg/m2)	65	24.3
Obesity (≥30 kg/m2)	25	9.3
Oral antidiabetic modalities		
Monotherapy	118	44.0
Combination	150	56.0

3.2. Prevalence of depression in patients with diabetes mellitus

The prevalence of depression in type-2 DM patients in the primary health centers assessed with PHQ-9 was 36.6% (**Table 4**). Several studies predicting the prevalence of depression in DM patients have been conducted in many developing and developed countries, showing different results. The research conducted by Qusaibi *et al.* (2022) dan Abuhegazy *et al.* (2022) on the population of Saudi Arabia showed that the prevalence of type-2 DM patients with depression was 54% and 36.6%, respectively. Meanwhile, the research in other developing countries, such as Ethiopia, resulted in a figure of 21.3% (Engidaw *et al.*, 2020). A multinational study involving 21 developing countries conducted by Aschner *et al.* (2021) on type-2 DM patients who used oral antidiabetics indicated that the prevalence of patients with depression was only 29%. Some other studies in developed countries showed much smaller prevalence compared to this study (<20%) (Jung *et al*., 2021; Salinero-Fort *et al*., 2018).

The result variation of these studies can be influenced by several factors, such as the socio-demographic conditions of each country, research instruments, research design, and size of the research sample. Several prior studies used the PHQ-8 instrument with a cohort design. Socio-cultural conditions and public perception of certain diseases can also play a role in triggering depression. People in some developing countries still have a negative perception of DM (Nabila *et al*., 2022) and have a fatal belief in DM (Al-Sahouri *et al*., 2019) thus increasing the potential of suffering depression. The level of knowledge also contributes to the depression incidence in DM patients (Holt *et al.*, 2014). The level of knowledge related to DM in the population of developing countries is still

relatively low compared to that in developed countries (Fottrell *et al*., 2018). Meanwhile, the level of knowledge will determine an individual's attitude and perception towards a certain disease which therefore has the potential to cause depression.

Table 4. Prevalence of depressive disorders in the study subjects

Variable	Frequency (n)	Percentage (%)
Depression	98	36.6
No depression	170	63.4

3.3. Factors related to depression

As presented in **Table 5**, the proportion of patients with depression in the male and female groups were almost similar (p>0.05). Several previous studies have found that gender is one of the predictors of depression in DM patients. In these studies, female DM patients were more likely to experience depression than male (Aschner *et al*., 2021; Salinero-Fort *et al*., 2018). Meanwhile, other studies have shown that gender has no effect on depression (Abuhegazy *et al*., 2022; Qusaibi *et al.*, 2022). Women are twice as likely to have depressive disorder than men because women experience hormonal fluctuations during their lifetime. These hormonal fluctuations mainly begin when women begin to experience puberty phase (Kuehner, 2017). In addition, the burden of various roles or demands toward women in society also contributes to increasing the risk of depression in women (Moshomo *et al.*, 2022).

In terms of age, the patients with the age of ≥60 years (the elderly) were significantly more potential to suffer from depression (p<0.05) (Table 5). This result is contrary to the previous research by Abuhegazy *et al*. (2022). In their study, the age group of <60 years tended to have a higher potential for depression. In general, the elderly were more vulnerable to experience depression compared to other age groups because their cognitive function and physical disability declined. In addition, they tend to experience various comorbidities (Szymkowicz *et al*., 2023). This condition will be worsen if the elderly patients experience anxiety over their illness, have conflicts with the family, and have financial problems or a lack of activities in society (Naviganuntana *et al.*, 2022). On the other hand, the elderly who receive emotional support and have a good perception of the quality of life will be able to avoid depression (Didoné *et al*., 2020). The difference between the results of this study and those of previous studies can occur because the subjects in the previous studies had a good perception of old age, thus enabling them to avoid depression (Karlin *et al*., 2016).

The socio-demographic aspects associated with potential depression were educational attainment and source of income (p<0.05) (**Table 5**). The highest percentage of the patients who had the potential to experience depression was found in the group of patients with low educational

attainment. It can be seen in **Table 5** that there was an inverse correlation between the level of education and depression. The higher the educational attainment of an individual, the lower the possibility of the individual suffering from depression. These results are in line with the research conducted by Patria (2022) in Indonesia. Higher educational attainment will positively correlate with a patient's literacy related to the disease that he suffers from, allowing him to better respond to his conditions (Hsu *et al*., 2020). However, other studies suggest that educational attainment increases the potential for depression (Chen *et al.*, 2013). This can occur due to the difference in the criteria of the research subjects. The research by Chen *et al*. (2013) only recruited patients who had just been diagnosed with DM while this study used subjects who had been diagnosed with DM for at least one year.

The patients who relied on themselves as the source of family income, or patients who became the breadwinner of the family, were more likely to suffer from depression (Table 5), which is in line with previous research (King *et al.*, 2020; Nene *et al.*, 2023). Patients who become the breadwinner bear the burden to meet the needs of their families. In addition, conflicts in the workplace, expectations for the job that does not match reality, and workload increase the tendency to experience depression (Nene *et al.*, 2023).

Table 5. Correlation between socio-demographic characteristics and depressive disorders

Demographics	Depression		No depression		*P* value
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
Gender					
Male	28	36.8	48	63.2	1.000
Female	70	36.5	122	63.5	
Age					
<60 years	55	31.6	119	68.4	0.022*
≥60 years	43	45.7	51	54.3	
Educational attainment					
Low	60	44.1	76	55.9	0.026*
Moderate	30	30.6	68	69.4	
High	8	23.5	26	76.5	
Source of income					
Oneself	56	50.0	56	50.0	<0.001*
Spouse	39	28.9	96	71.1	
Others	3	14.3	18	85.7	

* Statistically significant

According to **Table 6**, the patients who had been experiencing DM for 5-10 years were significantly more likely to suffer from depression compared to those in the other groups (p<0.05). However, the percentage of the patients with <5 years and >10 years of DM was less than that of patients with 5-10 years of DM. An increase in the duration of DM does not necessarily increase the

potential for depression, or an increase in the duration of DM is not linear with the potential to suffer from depression. There are variations in the results of previous studies. Previous research conducted by Almeida *et al.* (2016) has also found that the correlation between the duration of suffering from DM and the potential for depression is not linear. However, in the research by Almeida *et al*. (2016), the potential for depression decreased when the duration of DM reached 10-19.9 years then always increased along with the longer duration. Differences in the results of these studies can occur due to differences in the research subjects, sampling systems, research designs, and instruments used to assess depression. Meanwhile, the research conducted by Asefa *et al*. (2020) has shown that patients with DM for 5 years or more were twice more at risk of suffering from depression compared to those with less than 5 years of DM. The research conducted by Asefa *et al*. (2020) used the same research subjects, sampling methods, research designs, and research instruments as this study, but the difference in the classification of the duration of DM may have caused a difference in the results of the two studies. Another study conducted by Mokoagow *et al*. (2022) has shown that patients who have suffered from DM for more than 10 years tend to be more at risk of developing depression. However, the research by Mokoagow *et al*. (2022) involved COVID-19 patients as the subjects. These patients had different psychological conditions from DM patients without COVID-19 infection. The presence of a pandemic will increase patients' concerns about their health conditions, thereby increasing the risk of depression, especially if the patients have suffered from DM for a long time.

In this study, comorbidities were not significantly associated with potential depression (**Table 6**). This result is contrary to the previous research conducted by Mokoagow *et al*. (2022) and Sekhri & Verma (2023). In general, patients with comorbidities tend to be more susceptible to depression, especially if the comorbidities involve cardiovascular and nervous system disorders (Aljohani *et al*., 2021).

Oral antidiabetic modalities were also insignificantly associated with depression (**Table 6**). This result is supported by a previous study conducted by Kessing *et al*. (2020) which indicates that there is no difference in depression incidence between monotherapy and combination of oral antidiabetic users. Each type of oral antidiabetic has a different correlation with the incidence of depression in DM patients. The study conducted by Kessing *et al*. (2020) shows that the use of oral antidiabetics, either as monotherapy or in combination, especially in combination with metformin, may lower the incidence of depression. Other antidiabetics such as DPP4 inhibitors, GLP1 analogues, and SGLT2 inhibitors have also been shown to be associated with a reduced risk of depression in DM patients as highlighted in a study conducted by Wium Andersen *et al.* (2022).

Tabel 6. Correlation between clinical characteristics and depressive disorders

Variable	Depression		No depression		*P* value
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
DM Duration					
< 5 years	47	32.9	96	67.1	0.027*
5–10 years	42	47.2	47	52.8	
>10 years	9	25.0	27	75.0	
Comorbidities					
None	34	44.2	43	55.8	0.254
1 Comorbidity	37	34.3	71	65.7	
>1 Comorbidities	27	32.5	56	67.5	
Oral antidiabetic modalities					
Single	39	33.1	79	66.9	0.309
Combination	59	39.3	91	60.7	

* Statistically significant

3.4. Research limitations

This research is an observational study which therefore cannot determine or explain the causality between variables. Nevertheless, this study provides an overview of which factors have the potential to cause depression in DM patients. This study only classifies comorbidities based on the number, not based on the types. In fact, each comorbidity can pose a different risk of depression. This is the same case with the antidiabetic therapy modalities used. Not all antidiabetics are at risk of causing depression.

4. Conclusion

The prevalence of the symptoms of depression in the DM patients undergoing treatment in the public health centers in this study was 36.6%. Several factors, including age, educational attainment, source of income, and duration of suffering from DM correlated with the incidence of depression in the DM patients in the primary health centers. Further research is needed regarding the correlation between the type of comorbidities or the type of oral antidiabetics and the incidence of depression in DM patients.

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