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Determinants of Complications in Patients with Diabetes Mellitus at the Mangasa and Tamamaung Community Health Centers in Makassar

Determinantes de complicaciones en pacientes con diabetes mellitus en los centros de salud comunitarios de Mangasa y Tamamaung en Makassar

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SUMMARY

Objective: *Diabetes mellitus is also known as the "silent killer" if the symptoms are neglected, and complications are found. Diabetes mellitus is one of the four non-communicable diseases causing 60 % of deaths—and the prevalence of diabetes mellitus complications in South Sulawesi is 32.71 %. This study aimed to examine the risks of obesity, duration of diabetes, physical activity, smoking habits, and hypertension for complications in patients with diabetes mellitus.* **Methods:** *This study is analytical observational with a case-control study design, in which data were collected from 150 patients with diabetes mellitus in Makassar, selected by purposive sampling with 50 respondents in the case group and 100 respondents in the control group, respectively. Data were collected using a questionnaire and the relationship between research variables was analyzed using the Odds Ratio and multiple logistic regression.* **Results:** *The results showed that obesity status (OR = 2.346; 95 % CI: 1.172-4.696), duration of diabetes (OR = 9.793; 95 % CI: 4.328-22.159), and hypertension status (OR = 2.455; 95 % CI: 1.218-4.948) are risk factors for complications in patients with diabetes mellitus. Meanwhile, physical activity (OR = 1.282; 95 % CI: 0.644-2554) and smoking habits (OR = 1.882; 95 % CI: 0.871-4.066) are not risk factors. The logistic regression test showed that the duration of diabetes is the variable most at risk for diabetes mellitus complications with a magnitude of risk of 10.123 times greater.* **Conclusion:** *It is expected that patients with diabetes mellitus will pay attention to the condition of their bodies, especially in controlling blood sugar levels, managing their diet, and maintaining blood pressure to prevent complications.*

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RESUMEN

Objetivo: *La diabetes mellitus también es conocida como el "asesino silencioso" si se descuidan los síntomas y se producen complicaciones. La diabetes mellitus es una de las cuatro enfermedades no transmisibles que causan el 60 % de las muertes, y la prevalencia de complicaciones de la diabetes mellitus en Sulawesi del Sur es del 32,71 %. Este estudio tuvo como objetivo examinar los riesgos de obesidad, la duración de la diabetes, la actividad física, los hábitos de fumar y la hipertensión para las complicaciones en pacientes con diabetes mellitus.* **Métodos:** *Este estudio es analítico observacional con un diseño de estudio de casos y controles, en el que se recopilaron datos de 150 pacientes con diabetes mellitus en Makassar, seleccionados por muestreo intencional con 50 encuestados en el grupo de casos y 100 encuestados en el grupo de control, respectivamente. Los datos fueron recolectados a través de un cuestionario y la relación entre las variables de la investigación fue analizada utilizando el Odds Ratio y la regresión logística múltiple.* **Resultados:** *Los resultados mostraron que el estado de obesidad (OR = 2,346; IC 95 %: 1,172-4,696), la duración de la diabetes (OR = 9,793; IC 95 %: 4,328-22,159) y el estado de hipertensión (OR = 2,455; IC 95 %: 1.218-4.948) son factores de riesgo de complicaciones en pacientes con diabetes mellitus. Por su parte, la actividad física (OR = 1,282; IC 95 %: 0,644-2554) y el tabaquismo (OR = 1,882; IC 95 %: 0,871-4,066) no son factores de riesgo. La prueba de regresión logística mostró que la duración de la diabetes es la variable con mayor riesgo de complicaciones de la diabetes mellitus con una magnitud de riesgo de 10,123 veces mayor.* **Conclusión:** *Se espera que los pacientes con diabetes mellitus presten atención al estado de su organismo, especialmente en el control de los niveles de azúcar en la sangre, el manejo de la dieta y el mantenimiento de la presión arterial para prevenir complicaciones.*

Palabras clave*: Complicaciones de la diabetes mellitus, estado de obesidad, duración de la diabetes, actividad física, hábito tabáquico.*

INTRODUCTION

Diabetes mellitus is also known as the "silent killer" if the symptoms are neglected and complications are found (1). Complications that occur because of diabetes mellitus are manifested as blood vessel disorders, both macrovascular and microvascular, as well as nervous system or neuropathy disorders. These disorders can occur in patients with diabetes mellitus who have been suffering from the disease for a long time or in newly diagnosed patients with diabetes mellitus. Macrovascular complications generally affect the heart, brain, or blood vessels while microvascular complications can occur in the eyes and kidneys. Diabetic neuropathy is a serious diabetes complication that may affect as many as 50% of people with diabetes, and is defined as signs and symptoms of peripheral nerve dysfunction in a patient with diabetes mellitus in whom other causes of peripheral nerve dysfunction have been excluded (2).

The International Diabetes Federation (IDF) organization found that at least 537 million people of 20-79 years old in the world had diabetes in 2021, or the equivalent of a prevalence rate of 10.5 of the total population at the same age. Based on gender, the prevalence of diabetes in 2021 was 10.2 % for females and 10.8 % for males (3).

Indonesia is included in the 10 countries with the highest number of patients with diabetes mellitus with 19.5 million people, placing Indonesia in the fifth rank after China (140 million), India (74.2 million), Pakistan (33 million), and the United States (32 million) (3).

The prevalence of diabetes mellitus in Indonesia in 2013 was 6.9 %, increased in 2018 to 8.5 %, and is expected to increase in 2030 to 11.3 %. In 2018, based on age category, the largest number of patients with diabetes mellitus were in the age range of 55-64 years old 6.4 %, and 65-74 years old 6.03 % (4).

The prevalence of diabetes mellitus vascular complications in Indonesia in 2021 were microvascular complications such as Nephropathy at 7.7 %, Retinopathy at 2.7 %, and Neuropathy at 17.6 %, while macrovascular complications were coronary artery disease at 5.4 %, Cerebrovascular disease 5.4 %, Peripheral artery disease 0.5 % and Heart failure: 5.0 % (3,4).

Diabetes mellitus is one of the four non-communicable diseases causing 60 % of deaths. The prevalence of diabetes in South Sulawesi based on diagnoses of doctors for the age group of ≥ 15 years old, namely in 2013 was 1.6 %, and in 2018 was 1.8 %. The highest prevalence of diabetes in South Sulawesi was found in Wajo

2.19 %, Makassar 1.73 %, and Parepare 1.59 % while the lowest prevalence of diabetes was found in Tana Toraja 0.34, Enrekang 0.61 %, and Sidenreng Rappang 0.75 %. Based on age category, the largest number of patients with diabetes mellitus were in the age group of > 75 years old 2.14 % while in the gender category, there were more females (1.67 %) than males 0.92 %. Also, patients with diabetes mellitus living in urban areas are more 1.71 % than those living in rural areas 1.01 % (5).

The prevalence of diabetes mellitus complications in South Sulawesi in 2021 was 32.71 % (6). The Mangasa and Tamamaung Community Health Centers (*Puskesmas*) are in the 4th and 5th ranks of Community Health Centers with the greatest number of patients with diabetes mellitus in Makassar. Data from the Mangasa Community Health Center showed that the number of patients with diabetes mellitus in 2021 was 683 patients, of which 108 people experience complications, while the data from the Tamamaung Community Health Center showed that the number of patients with diabetes mellitus in 2021 was 556 patients, of which 125 people experience complications (7). Based on the background we assess the determinants of complications in patients with diabetes mellitus at the Mangasa and Tamamaung Community Health Centers in Makassar.

METHODS

This study is analytical and observational with a case-control study design. Was conducted at the Mangasa and Tamamaung Community Health Centers, Makassar, from November 28 - December 31, 2022. The population was all patients with diabetes mellitus at the Mangasa and Tamamaung Community Health Centers with a total sample of 150 respondents, where the sample size for the case group was 50 respondents and the control group was 100 respondents (comparison of cases and controls in this study was 1:2). Selection of the sample was done by purposive sampling method. The instrument used was a questionnaire sheet to collect data from the respondents studied. Analysis methods by Multiple Logistic Regression and ethical approval Number: 13076/UN4.14.1/TP.01.02/2022

RESULTS

Table 1 shows that in the case and control groups of diabetes mellitus complications, most respondents are 56-65 years old, 24 respondents (48.0 %) in the case group and 48 respondents (48.0 %) in the control group. Of the 150 respondents, most respondents are female, 32 respondents (64.0 %) in the case group and 64 respondents (64.0 %) in the control group. Most respondents in the case group are Diploma/ Univerisity graduates, 16 respondents (32.0 %), whereas most respondents in the control group are elementary school and high school graduates, 29 respondents (29.0 %). Most respondents in the case and control groups are not working/ housewives, 23 respondents (46.0 %) in the case group and 48 respondents (48.0 %) in the control group. Based on the Brinkman index, most respondents in the case and control groups do not smoke, 34 respondents (68.0 %) in the case group and 80 respondents (80.0 %) in the control group.

Table 2 shows that the obesity status variable has an Odds Ratio (OR) value of 2.346 (95 % CI: 1.172-4.696) with a lower limit and upper limit (LL-UL) values not including a value of 1. This means that obesity status is a statistically significant risk factor for complications in patients with diabetes mellitus. So, it can be concluded that respondents who have obesity status are at risk of developing complications 2.346 times greater than respondents who are not obese.

The duration of the diabetes variable has an Odds Ratio (OR) value of 9.793 (95 % CI: 4.328-22.159) with a lower limit and upper limit (LL-UL) values not including a value of 1. This means that the duration of diabetes is a statistically significant risk factor for complications in patients with diabetes mellitus. Thus, it can be concluded that respondents with a duration of diabetes of > 5 years are at risk of developing complications 9.793 times greater than respondents whose duration of diabetes is < 5 years.

The physical activity variable has an Odds Ratio (OR) value of 1.282 (95 % CI: 0.644-2.554) with a lower limit and upper limit (LL-UL) values including a value of 1. This means that physical activity is not a risk factor for complications in patients with diabetes mellitus.

Table 1

Distribution Based on Respondent Characteristics at the Mangasa and Tamamaung Community Health Centers, Makassar

Characteristics	Respondent Group			
	Case (n=50)		Control (n=100)	
	N	%	N	%
Age (Years old)				
46-55	11	22.0	22	22.0
56–65	24	48.0	48	48.0
66-75	12	24.0	24	24.0
>75	3	6.0	6	6.0
Gender				
Male	18	36.0	36	36.0
Female	32	64.0	64	64.0
Educational Background				
Not graduated	3	6.0	14	14.0
Elementary school graduate	11	22.0	29	29.0
Junior high school graduate	8	16.0	15	15.0
Senior high school graduate	12	24.0	29	29.0
Diploma/University graduate	16	32.0	13	13.0
Occupation				
Not Working/Housewife	23	46.0	48	48.0
Entrepreneur	12	24.0	29	29.0
Civil servant/TNI/POLRI	13	26.0	15	15.0
Farmers/Laborers	2	4.0	8	8.0
Brinkman Index (Smoking degree)				
Do not smoke	34	68.0	80	80.0
Mild	8	16.0	12	12.0
Moderate	7	14.0	8	8.0
Severe	1	2.0	0	0

Source: Primary data, 2022

The smoking habit variable has an Odds Ratio (OR) value of 1.882 (95 % CI: 0.871-4.066) with a lower limit and upper limit (LL-UL) value including a value of 1. This means that smoking habits are not a risk factor for complications in patients with diabetes mellitus.

The hypertension status variable has an Odds Ratio (OR) value of 2.455 (95 % CI: 1.218-4.948) with a lower limit and upper limit (LL-UL) values not including a value of 1. This means that hypertension status is a statistically significant risk factor for complications in patients with diabetes mellitus. It can be concluded that respondents who have hypertension status are at risk of developing complications 2.455 times greater than respondents who are not hypertensive.

Table 3 shows that the duration of the diabetes variable is the most influential risk for complications in patients with diabetes mellitus with a Wald value of 27.741 and an Exp (B) value of 10.123 and a significance of 0.0001. Thus, the duration of diabetes is the most influential risk factor for complications in patients with diabetes mellitus after controlling for other variables. The other factors that significantly influence the overall regression analysis are hypertension status and obesity status. Whereas smoking habits do not have a significant effect.

Table 2

Determinants of Complications in Patients with Diabetes Mellitus at the Mangasa and Tamamaung Community Health Centers in Makassar

Research variable	Respondent Group				P	Unadjusted OR (95% CI)
	Case (n=50)		Control (n=100)			
	N	%	n	%		
Obesity Status						
High Risk	30	60.0	39	39.0	0.024*	2.346*
Low Risk	20	40.0	61	61.0		(1.172-4.696)
Duration of Diabetes						
High Risk	40	80.0	29	29.0	0.0001*	9.793*
Low Risk	10	20.0	71	71.0		(4.328-22,159)
Physical Activity						
High Risk	22	44.0	38	38.0	0.596	1.282
Low Risk	28	56.0	62	62.0		(0.644-2.554)
Smoking habits						
High Risk	16	32.0	20	20.0	0.156	1.882
Low Risk	34	68.0	80	80.0		(0.871-4.066)
Hypertension Status						
High Risk	32	64.0	42	40.0	0.018*	2/455*
Low Risk	18	36.0	58	58.0		(1.218-4,948)

*Statistically significant
Source: Primary data, 2022

Table 3

Analysis of Variables in the Equation of Multiple Logistic Regression regarding Determinants of Complications in Patients with Diabetes Mellitus at the Mangasa and Tamamaung Community Health Centers in Makassar

Research variable	B	S. err	Wald	Sig	Exp (B)	95% CI	
						LL	ul
Obesity Status	0.841	0.426	3.905	0.048*	2.320	1.007	5.344
Duration of Diabetes	2.315	0.439	27.741	0.0001*	10.123	4.278	23.956
Smoking habits	0.948	0.486	3.800	0.051	2.580	0.995	6.691
Hypertension Status	0.922	0.427	4.663	0.031*	2.515	1.089	5.807

*Statistically significant
Source: Primary data, 2022

DISCUSSION

The results of this study indicate that out of 50 cases of diabetes mellitus complications, 30 (60.0 %) respondents have an obesity status. The bivariate test found that obesity status has a statistically significant relationship, where respondents with obesity status have a 2.346 times greater risk of developing complications than respondents who are not obese.

These results are in line with a study by (8), showing that respondents who have obesity status in the case group of 90.1 %, with a p-value = 0.001, which means that there is a significant relationship between obesity status and the incidence of micro and macrovascular diabetes mellitus complications, where respondents with obesity status are at risk of 25.35 times greater of developing macro and microvascular diabetes mellitus complications (8). A similar study was also conducted (9) showing that obesity is associated with an increased risk of diabetes mellitus complications.

Being overweight is not necessarily a dangerous situation. However, the fatter a person is the higher the body fat content. Fat is an important part of a healthy diet. Choose foods with "good" unsaturated fats, limit foods high in saturated fat, and avoid "bad" trans fat. "Good" unsaturated fats — Monounsaturated and polyunsaturated fats — lower disease risk. Bad fat contributing factor to coronary heart disease. Obesity is a triggering factor for diabetes associated with insulin resistance. In individuals who are obese, higher amounts of non-esterified fatty acids, glycerol, hormones, and pro-inflammatory cytokines that could participate in the development of insulin resistance are released by adipose tissue. Thus, obesity increases the risk of several debilitating, and deadly diseases, including diabetes, heart disease, and some cancers (10).

Duration of diabetes in the case group of diabetes mellitus complications presented 80.0 %, which means 40 respondents have suffered from diabetes for more than 5 years, and in the control group, it was 29.0 %, which means 29 respondents have suffered from diabetes for more than 5 years. The results of the bivariate test show that the duration of diabetes has a statistically significant relationship with diabetes mellitus complications, where respondents with a duration of diabetes of more than 5 years have a 9.793 times greater risk of developing complications than respondents with a duration of diabetes of fewer than 5 years.

Furthermore, our results of the multivariate analysis show that the dominant factor that has the most influence on, diabetes mellitus complications is the duration of the diabetes variable with a p-value = 0.0001 with OR = 10.123 at the confidence level (CI = 95 %), with LL = 4.278 and UL = 23.956. Because the lower and upper limit values do not include a value of 1, the duration of diabetes is a risk factor for complications in patients with diabetes mellitus. This means people who have suffered from diabetes mellitus for >5 years have a 10.123 times greater risk of developing complications than people who have suffered from diabetes mellitus for <5 years. In this regard, Korsa et al. (11) showed that the duration of diabetes mellitus is a risk factor for diabetes mellitus complications. The study revealed that 1 out of 3 adults with diabetes mellitus has≥1 complication in their chronic ambulatory care clinics. Diabetic ketoacidosis was the most common acute complication whereas hypertension was the most common chronic complication. The presence of diabetes mellitus complications was associated with the age of the patients, duration of diabetes mellitus, family history of DM, DM regimen, and the presence of other chronic diseases (11). A similar study was also conducted by Purwandari et al. (12), who demonstrated that there is a relationship between the duration of diabetes and the occurrence of chronic complications of type 2 diabetes mellitus in the pre-elderly, where respondents with a duration of diabetes of more than 5 years are at risk of 2.274 times greater of chronic complications of type 2 diabetes mellitus in pre-elderly. The duration of diabetes mellitus can affect the occurrence of complications where the longer patients suffer from diabetes mellitus, the higher the risk of complications. The longer a person suffers from diabetes mellitus with hyperglycemia, the higher the occurrence of chronic complications due to abnormal blood glucose levels, especially after suffering from diabetes mellitus for more than 5 years (13).

Besides the beneficial effects of controlling weight, physical activity also benefits in increasing the absorption or metabolism of sugar and fat in muscle cells and tissue cells, thereby reducing the concentration of sugar and fat in the blood. Physical activity is not only beneficial for preventing diabetes but also has an impact on treatment and reduces the risk of complications for those who already suffer from diabetes mellitus (14). In this study, the majority of respondents had a good physical activity where

OR = 1.282 (95 % CI = 0.644-2.554) with lower limit and upper limit values including a value of 1. This means that physical activity is not a risk factor for complications in patients with diabetes mellitus. Similarly, the results of Purwandari et al. (12), showed that physical activity was not associated with chronic diabetes mellitus complications. In addition, a study by (15) also shows that there is no relationship between physical activity and the incidence of diabetes mellitus complications (15).

This contrasts with a study by (16), showing that a large number of urban Bangladeshi residents also state that physical activity is a risk factor for developing diabetic neuropathy in patients with diabetes mellitus. Physical activity can lower fasting blood sugar levels and prevent complications. Muscles in the body will react with glucose stored in the body. Glucose in the blood will decrease so that blood sugar in the body can be controlled (17).

Smoking has long been known to have a negative effect on human health. Smoking can increase a person's risk of developing diabetes mellitus more than those who do not smoke. Smoking and diabetes are related, smoking can cause diabetes and smoking will exacerbate diabetes that has been suffered. The relationship between smoking and diabetes is related to the occurrence of insulin resistance and interference with pancreatic insulin production, where nicotine and tar will interfere with the in the functioning of the pancreas to produce insulin. Smoking can not only increase a person's risk of developing diabetes but also other diabetes mellitus complications (18).

In this study, most respondents do not smoke where OR = 1.882 (90 % CI = 0.871-4.066) with lower limit and upper limit (LL-UL) values including a value of 1. This means that smoking is not a risk factor for complications in patients with diabetes mellitus.

This study is in line with Musyawirah et al. (15), who stated that smoking habits are not associated with the incidence of diabetes mellitus complications. In addition, Rachman and Dwipayana (19), also show that smoking status is not associated with the incidence of peripheral neuropathy in patients with diabetes mellitus. Furthermore, Cheema et al. (20) show that smoking status is also not associated with diabetic microvascular complications. This contrasts with a study by Jaya et al., in 2021, showing that smoking history is associated with neuropathic diabetes mellitus complications in the elderly (21), as well as the study of Tracey et al. (22), who also show that smoking status is associated with macro and microvascular diabetes mellitus complications. Smoking can increase the risk of developing diabetes and exacerbate micro and macrovascular diabetes mellitus complications. Quitting smoking is an important target in controlling diabetes and preventing diabetes mellitus complications (22).

Our results demonstrate that hypertension of the respondents in the diabetes mellitus complications case group is 64.0 % or 32 respondents are at high risk, whereas in the control group, 42 % or 42 respondents are at low risk. Bivariate analysis shows that hypertension status has a statistically significant relationship with diabetes mellitus complications, where respondents with hypertension status have a 2.455 times greater risk of developing complications than respondents who are not hypertensive. This is in line with the data reported by Ponesai et al. (23), showing that hypertension is associated with the incidence of diabetes mellitus complications, where patients with diabetes mellitus who also are hypertensive, have a 4.10 times greater risk of suffering from complications than those who do not have hypertension. Similarly, Stanifer et al., state that there is a relationship between hypertension and the incidence of diabetes mellitus complications (24). Furthermore, Rahmawati and Hargono (17) also show that hypertension is associated with the incidence of diabetic neuropathy in patients with type 2 diabetes mellitus, with OR = 3.14, meaning that patients with a history of hypertension have a risk of suffering diabetic neuropathy 3.14 times greater than patients who are not hypertensive. Hypertension is a risk factor that can increase the occurrence of heart and blood vessel diseases, stroke, and other complications. Increased blood pressure is commonly found in people with diabetes. People with diabetes are twice more likely to have hypertension than those without diabetes (25).

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Conflict of interests

The authors have no conflict of interest to declare.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

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