

Factors Associated with Type 2 Diabetes Mellitus Complications at Kitamura Clinic, Pontianak

Faktor Yang Berhubungan Dengan Diabetes Melitus Tipe 2 Yang Mengalami Komplikasi di Klinik Kitamura Pontianak

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ABSTRACT

Diabetes Mellitus (DM) type 2 is a lifelong disease that can cause complications in various organs. This study aims to describe the risk factors of type 2 DM with complications at Klinik Kitamura Pontianak. The research uses a cross-sectional design with an analytical survey method. The population consists of 1,309 DM type 2 patients in December 2021, with a sample of 93 patients selected through accidental sampling. Chi-square test was used for data analysis. The results show that age ($p = 0.002$), body mass index ($p = 0.000$), physical activity ($p = 0.001$), smoking behavior ($p = 0.009$), family history ($p = 0.000$), family support ($p = 0.002$), and duration of DM ($p = 0.015$) have significant relationships with DM type 2 complications. However, gender ($p = 0.076$) and education ($p = 0.284$) were not significantly related. It is recommended that patients with DM type 2 and complications become more proactive in seeking information about complication prevention and treatment, as well as adopt healthier lifestyles such as regular exercise, reducing smoking, taking medication regularly, and maintaining a healthy diet. Family support is also crucial in helping patients recover.

ABSTRAK

Diabetes Melitus (DM) tipe 2 merupakan penyakit seumur hidup yang dapat menyebabkan komplikasi pada berbagai organ tubuh. Penelitian ini bertujuan menggambarkan faktor risiko DM tipe 2 yang mengalami komplikasi di Klinik Kitamura Pontianak. Penelitian menggunakan desain cross-sectional dengan metode survei analitik. Populasi penelitian terdiri dari 1.309 pasien DM tipe 2 pada Desember 2021, dengan sampel 93 pasien yang dipilih secara accidental sampling. Uji chi square digunakan untuk analisis data. Hasil penelitian menunjukkan bahwa usia ($p = 0,002$), indeks massa tubuh ($p = 0,000$), aktivitas fisik ($p = 0,001$), perilaku merokok ($p = 0,009$), riwayat keluarga ($p = 0,000$), dukungan keluarga ($p = 0,002$), dan lama menderita DM ($p = 0,015$) memiliki hubungan signifikan dengan komplikasi DM tipe 2. Sementara itu, jenis kelamin ($p = 0,076$) dan pendidikan ($p = 0,284$) tidak berhubungan signifikan. Disarankan agar pasien DM tipe 2 yang mengalami komplikasi lebih aktif mencari informasi tentang pencegahan dan pengobatan komplikasi, serta mengubah pola hidup dengan rutin berolahraga, mengurangi konsumsi rokok, minum obat teratur, dan menjaga pola makan. Dukungan keluarga juga penting untuk membantu pemulihan pasien.



1. INTRODUCTION

Non-communicable diseases (NCDs) are chronic diseases that cannot be transmitted from person to person, and the majority of NCDs are non-infectious diseases. Non-communicable diseases are the leading cause of death globally. In 2018, these diseases accounted for approximately 86% of deaths and 77% of the disease burden in developing countries¹.

Countries in the North Africa and Middle East region, as well as the Western Pacific region, rank first and second with the highest prevalence of diabetes among the 7 regions globally, at 12.2% and 11.4%, respectively. Southeast Asia, where Indonesia is located, ranks third with a prevalence of 11.3%. The IDF also projects the number of diabetes cases in the top 10 countries with the highest numbers, including China (116.4 million), India (77.0 million), the United States (31.0 million), Pakistan (19.4 million), Brazil (16.8 million), Mexico (12.8 million), Indonesia (10.7 million), Germany (9.5 million), Egypt (8.9 million), and Bangladesh (8.4 million)².

Indonesia is the only country in Southeast Asia to be included in the list of the top 10 countries with the highest number of diabetes cases. Indonesia ranks 7th with 10.7 million diabetes sufferers. The prevalence of diabetes in Indonesia in 2020 reached 6.2%, meaning that more than 10.8 million people are living with diabetes³.

The 2018 Riskesdas results show that the prevalence of diabetes mellitus in women is higher than in men, with a ratio of 1.78% to 1.21%. In the 2013 Riskesdas, the prevalence in women compared to men was 1.7% to 1.4%. Over the past 5 years, the prevalence in women has slightly increased, while the prevalence in men has decreased⁴. The prevalence of diabetes mellitus in West Kalimantan in 2018 was 1.6%⁵.

Diabetes mellitus also has risk factors that contribute to the occurrence of the disease. Risk factors for diabetes consist of non-modifiable factors such as race, ethnicity, age, gender, and family history, while modifiable risk factors include overweight, abnormal obesity, lack of physical activity, smoking, and others³.

Complications of type 2 DM include iatrogenic hypoglycemia, hyperosmolar hyperglycemic non-ketotic coma (24-44 per 1 million), diabetic retinopathy leading to blindness (14.8%), diabetic nephropathy (10.7%), diabetic neuropathy (17.8%), cardiovascular disease (36.9%), diabetic foot (0.8%), and it can also lead to lactic acidosis or ketoacidosis (17.5 per 100,000)⁶.

Type 2 diabetes mellitus patients also face the risk of complications such as heart disease and stroke (100%), diabetic ulcer complications (9.5%), kidney complications (8.4%), retinopathy complications (43.2%), and metabolic syndrome complications (26.3%) among a total of 95 patients⁷.

Often, type 2 DM patients are unaware that they have the disease, and by the time they find out, it is already in the complication stage or nearly a decade after being diagnosed. The impact of type 2 DM is most severe when complications occur. These complications can affect all systems in the human body, from the skin to the heart.⁸

This study will be conducted at the Kitamura Clinic in Pontianak, with initial observations showing that there are 56 patients with type 2 DM who are experiencing complications. Therefore, the researcher is interested in conducting a study titled *Factors Associated with Type 2 Diabetes Mellitus Complications at Kitamura Clinic, Pontianak in 2022*.

2. METHODS

The research design used in this study is an observational analytic design with a cross-sectional approach. This study was conducted at the Kitamura Clinic, located in Pontianak City, West Kalimantan. The population for this study consists of all type 2 diabetes patients who visited the Kitamura Clinic for outpatient care between January and December 2021, totaling 1,309 DM examination visits. The sample in this study consisted of 93 individuals diagnosed with Type 2 Diabetes Mellitus. Based on sample calculation, 93 samples were obtained. The sample consists of both type 2 diabetes patients who experienced complications and those who did not. The sampling technique used in this study is accidental sampling, which is a sampling method based on chance, where anyone who happens to meet the researcher can be included as a sample. This analysis was conducted to explore the potential relationship between independent and dependent variables. The bivariate analysis in this study used the chi-square test.

3. RESULTS

Table 1. Respondent Characteristics

Characteristic	Frequency (N)	Percentage (%)
Umur		
≥ 45 years	61	65,6
< 45 years	32	34,4
Gender		
Male	48	51,6
Female	45	48,4
Occupation		
Civil Servant (PNS)	14	15,1
Private Sector	43	46,2
Entrepreneur	3	3,2
Laborer	10	10,8
Farmer	2	2,2
Other	8	8,6
Unemployed	13	14,0
Education		
Primary School (SD)	9	9,7
Junior High School (SMP)	21	22,6
Senior High School (SMA)	50	53,8
University (PT)	13	14,0
Body Mass Index		
Normal	44	47,3
Overweight	41	44,1
Obese	8	8,6
Blood Pressure		
Normal	38	40,9
Pre-hypertension	36	38,7
Hypertension	19	20,4
Blood Sugar Levels		
Normal	47	50,5
High	46	49,5
Smoking Behavior		

Characteristic	Frequency (N)	Percentage (%)
Yes	32	34,4
No	61	65,6
Family History		
Mother	29	31,2
Female sibling	9	9,7
Father	10	10,8
Male sibling	10	10,8
None	35	37,6
Complications		
Hypertension	4	4,3
Diabetic Foot Ulcer	10	10,8
Diabetic Retinopathy/Eye	6	6,5
Cardiovascular	18	19,4
Diabetic Nephropathy	2	2,2
Diabetic Retinopathy	7	7,5
Diabetic Neuropathy	1	1,1
No Complications	45	48,4

Source: Primary Data, 2021

Based on the analysis of respondent characteristics, it was found that the majority of respondents were aged over 45 years, with 61 individuals (65.6%). The most common gender was male, with 48 individuals (51.6%). The most common occupation was in the private sector, with 43 individuals (46.2%), and the most common education level was high school (SMA), with 50 individuals (53.8%). The most common blood pressure condition was pre-hypertension, with 38 individuals (38.7%), and 32 respondents (34.3%) were smokers. The highest family history of diabetes mellitus (DM) was found in mothers, with 29 individuals (31.2%), and the most common complication was cardiovascular disease, affecting 18 individuals (19.4%).

Table 2. Bivariate Analysis

Characteristics	Complications				Total		P Value	OR (CI 95%)
	Yes		No		N	%		
	N	%	N	%				
Age								
≥ 45 years	39	41.9	22	23.7	61	65.6	0.002	2,273 (1,266 – 4,081)
< 45 years	9	9.7	23	24.7	32	34.4		
Gender								
Man	20	21.5	28	30.1	48	51.6	0.076	0.670 (0.447 – 1.004)
Woman	28	30.1	17	18.3	45	48.4		
Education								
Low (Elementary – High School)	39	41.9	41	44.1	80	86.0	0.284	0.704 (0.406 – 1.079)
Height (PT)	9	9.7	4	4.3	13	14.0		
BMI								
Obesity	34	36.6	14	15.1	48	51.6	0,000	2,277 (1,421 – 3,647)
Not obese	14	15.1	31	33.3	44	48.4		

Characteristics	Complications				Total		P Value	OR (CI 95%)
	Yes		No		N	%		
	N	%	N	%				
Physical Activity								
Light	31	33.3	12	12.9	43	46.2	0.001	2,120 (1,381 – 3,255)
Heavy	17	18.3	33	35.5	50	53.8		
Smoking Behavior								
Yes	23	24.7	9	9.7	32	34.4	0.009	1,754 (1,210 – 2,542)
No	25	26.9	36	38.7	58	65.6		
Family History of DM2 Sufferers								
Yes	42	45.2	16	17.2	58	62.4	0.000	4,224 (2,004 – 8,902)
No	6	6.5	29	31.2	35	37.6		
Family Support								
Not good	38	40.9	21	22.6	59	63.4	0.002	2,190 (1,258 – 3,812)
Good	10	10.8	24	25.8	34	37.5		
Long-term Suffering from Type 2 DM								
≥ 5 years	28	30.1	14	15.1	42	45.2	0.015	1,700 (1,136 – 2,544)
15 years	20	21.5	31	33.3	51	54.8		

Source: Primary Data, 2021

Based on Table 2, it is evident that there is a significant relationship between age ($p = 0.002$), body mass index ($p = 0.000$), physical activity ($p = 0.001$), smoking behavior ($p = 0.009$), family history of diabetes mellitus ($p = 0.000$), family support ($p = 0.002$), and the duration of having type 2 diabetes ($p = 0.015$) with complications. However, no significant relationship was found between gender ($p = 0.076$) and education ($p = 0.284$).

4. DISCUSSION

The factors associated with complications in type 2 diabetes mellitus include age, body mass index (BMI), physical activity, smoking behavior, family history, family support, and the duration of diabetes. On the other hand, factors that are not associated with complications in type 2 diabetes mellitus include gender and education.

The Chi-Square test analysis in this study showed that there is a significant relationship between several factors and complications of type 2 diabetes mellitus in the working area of Kitamura Clinic. For example, the relationship between age and complications of type 2 diabetes mellitus, with a p-value of 0.002, indicates that age has an impact on the occurrence of complications in diabetes patients. This finding is in line with research conducted by Sartikah, which also found a relationship between age and complications as well as the mortality of type 2 diabetes patients⁹. The minimum age in the case group was 30 years, while in the control group it was 21 years. The maximum age in the case group was 71 years, while in the control group it was 70 years. Additionally, Mutia's (2021) study showed that half of the diabetes patients over the age of 65 are hospitalized every year. The aging process, coupled with the presence of diseases, further increases the risk of complications, making it crucial for diabetes patients to pay close attention to their health to prevent complication¹⁰.

Unlike the age factor, the analysis of the relationship between gender and complications in type 2 diabetes mellitus showed a p-value of 0.076, which means there is no significant relationship between gender and complications of diabetes mellitus. This is consistent with previous research that showed no relationship between gender and complications or quality of life in diabetes patients⁷. Among respondents over the age of 45, 36 men (81.8%) experienced diabetes complications, while only 8 women (18.2%) had the same issue. Previous studies also showed that elderly people aged 75 and above with diabetes are often unaware of the complications that occur⁸.

The education factor, which was also examined in this study, showed no significant results in relation to complications of type 2 diabetes mellitus, with a p-value of 0.284. This indicates that education level does not have a direct impact on diabetes complications. However, there are indications that individuals with higher education levels tend to recognize certain symptoms more quickly and seek medical help sooner. Despite this, higher education levels may also lead to unhealthy consumption patterns, which can increase the likelihood of complications from diabetes¹¹. Education is a process of behavioral change, and with higher education, individuals typically have more knowledge about health. Therefore, it is expected that such individuals will engage in healthier behaviors, such as preventing themselves from diseases like complications in diabetes mellitus¹².

Meanwhile, the relationship between body mass index (BMI) and complications of type 2 diabetes mellitus showed significant results, with a p-value of 0.000. This study is consistent with previous research that indicates obesity is linked to an increased risk of complications in diabetes patients. The findings of this study also revealed that, in the case group, 35.2% of respondents were obese, while in the control group, a larger proportion of respondents (14.8%) were not obese¹³. Central obesity, characterized by fat accumulation in the abdominal area, is strongly associated with an increased risk of cardiometabolic complications and diabetes because abdominal fat is more sensitive to the regulation of lipolysis enzymes and endocrine hormones related to insulin resistance in type 2 diabetes¹². Overweight ($\geq 20\%$ above ideal weight) or a BMI (Body Mass Index) $\geq 27 \text{ kg/m}^2$ is defined as obesity. Obesity leads to peripheral insulin resistance, meaning the number of insulin receptors in skeletal muscle and adipose tissue decreases. Obesity also disrupts insulin secretion when blood glucose levels increase, which is a function of beta cells¹⁴.

Physical activity is also significantly associated with complications of type 2 diabetes mellitus, with a p-value of 0.001. Regular physical activity can reduce the risk of complications from type 2 diabetes. Safe exercises for diabetes patients, such as activities that improve blood flow and glucose uptake into cells, are highly recommended, with a frequency of at least three times per week. Mahmud's research also indicates that physical activity is linked to a reduced risk of complications and mortality in type 2 diabetes patients⁹. Exercise for diabetes patients should not be performed by those with poorly controlled diabetes (plasma glucose $> 240 \text{ mg/dl}$), as this can lead to paradoxical hyperglycemia and ketosis. Thus, a routine exercise regimen can significantly reduce the risk of complications¹². The recommended exercise for diabetes patients is in accordance with CRIPE (Continuous Rhythmic Intensity Progressive Endurance), which involves continuous activity without breaks, allowing the muscles to contract and relax regularly. These regular muscle contractions stimulate increased blood flow and glucose uptake into cells. CRIPE exercises should be done at least three

times a week, with two other days dedicated to activities that the diabetes patient enjoys¹⁴.

Additionally, smoking behavior was found to be significantly associated with complications of type 2 diabetes mellitus, with a p-value of 0.009. Respondents who have a smoking habit have a greater potential to experience complications from type 2 diabetes^{14,15}. Smoking can worsen the body's insulin utilization, which ultimately increases the risk of complications in diabetes patients, such as peripheral arterial disease and gangrene¹². Previous studies have also revealed that those who smoke more than 20 cigarettes a day have a 62% higher risk of diabetes complications compared to non-smokers¹⁶.

On the other hand, family history also showed a significant relationship with complications in type 2 diabetes mellitus, with a p-value of 0.000. Respondents with a family history of type 2 diabetes have a 4.224 times higher risk of developing complications. The genetic predisposition from the mother is greater than from the father, meaning the risk of developing type 2 diabetes is higher if the mother has a history of diabetes. The decline in estrogen levels in women also affects insulin sensitivity and glucose uptake, which decreases as they age^{17,18}.

Family support was also found to be significantly associated with complications of type 2 diabetes mellitus, with a p-value of 0.002. Research shows that family plays a crucial role in supporting the treatment and healthy lifestyle of diabetes patients. Those who receive support from their families tend to be more compliant with their treatment and medical check-ups, which helps prevent worsening complications. A decline in family support can lead to patients becoming irregular in following their treatment and medical check-ups, ultimately increasing the risk of complications¹⁸.

Finally, the duration of having type 2 diabetes was also found to be related to complications of type 2 diabetes mellitus, with a p-value of 0.015. Previous studies have shown that the risk of complications in diabetes patients increases as the duration of the disease increases. One of the complications often found in long-term diabetes patients is diabetic retinopathy, which is influenced by prolonged hyperglycemia. However, some studies also suggest that the duration of diabetes does not always correlate with complications¹⁹.

Overall, factors such as age, obesity, physical activity, smoking habits, family history, and family support play a significant role in the occurrence of complications in type 2 diabetes mellitus patients. These factors highlight the importance of attention to a healthy lifestyle and proper diabetes management to reduce the risk of complications that can have fatal consequences.

5. CONCLUSION

The results of the study show a significant relationship between age, body mass index (BMI), physical activity, smoking behavior, family history, family support, and the duration of having diabetes with complications of type 2 diabetes mellitus. On the other hand, gender and education were not significantly associated. Based on these findings, it is recommended to increase awareness of healthy lifestyle practices, provide more intensive monitoring for patients with a family history of diabetes, and offer strong family support. Smoking cessation programs and weight management, particularly for obese patients, are also crucial to prevent complications.

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Author's Contributions

FR,IA,DA: Conceptualized and designed the research; FR: Collected and analyzed data; IA&DA: Reviewed empirical studies; FR,IA,DA: Designed the methodology; FR: Wrote the introduction and edited the manuscript.

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