

The Influence of Macrovascular and Microvascular Complications on the Quality of Life of Diabetes Mellitus Patients at Mardi Rahayu Kudus Hospital

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Abstract

Diabetes Mellitus or also known as diabetes is a chronic disease characterized by blood sugar levels that exceed normal limits. Poor management of diabetes mellitus patients can cause various macrovascular and microvascular complications. Complications in diabetes mellitus patients are one of the factors that can affect quality of life. This study aims to determine the effect of macrovascular and microvascular complications on the quality of life of diabetes mellitus patients at Mardi Rahayu Kudus Hospital. The method used in this study is a prospective quantitative study with a cross-sectional approach. Data for quality of life researchers using the WHOQOL-BREF questionnaire. Respondents involved met the inclusion criteria, and there were 104 patients. The results showed that there were macrovascular and microvascular complications. The highest incidence of complications was macrovascular (37.5%), followed by microvascular complications (26.0%), and macrovascular + microvascular complications (36.5%). Meanwhile, the quality of life category with the highest complications was the high category (52.9%) and the moderate category (47.1%). DM and its complications are mostly suffered by women (58.7%), with an average age of 45-65 years. The highest use of antidiabetic therapy includes metformin (53.1%), metformin + glimepiride (31.8%) and glimepiride + metformin + Insulin log-g (21.4%), as well as treatment of comorbidities given according to the complications suffered by the patient. The study showed that macrovascular and microvascular complications did not affect quality of life because of the results of the binary logistic regression test (Sig. > 0.05).

Keywords: Diabetes Mellitus, Complications, Macrovascular, Microvascular, Quality of Life.

Introduction

According to the Ministry of Health of the Republic of Indonesia¹, diabetes mellitus, or what is known as diabetes, is a chronic disease characterized by blood glucose levels that exceed normal limits. According to the International Diabetic Federation (IDF), the global prevalence of diabetes in the 20-79 year age group in 2021 is estimated to be 10.5% (536.6 million) increasing to 12.2% (783.2 million) in 2045. The prevalence of diabetes mellitus is the same between men and women². The results of Basic Health Research in 2018 showed that the prevalence of diabetes mellitus in Indonesia increased by 1.5% in 2013, and increased in 2018 to 2.0%.

The problem of diabetes mellitus is a public health problem that needs attention and good treatment because the prevalence is increasingly high and continues to increase every year and diabetes mellitus can cause quite serious complications, especially type 1 and type 2 diabetes mellitus³. Type 1 diabetes mellitus is an autoimmune disease that causes damage to the pancreatic β cells that produce insulin. Pancreatic β cells are the only body cells that produce insulin which functions to regulate glucose levels in the body⁴. Type 2 diabetes occurs especially when the patient's blood glucose levels are not well controlled, which will increase the risk of complications, both acute and chronic⁵.

Chronic complications that are often found in type 2 diabetes mellitus patients undergoing outpatient therapy are macrovascular (Coronary Heart Disease (CHD), hypertension, stroke, cerebrovascular) and microvascular (neuropathy, nephropathy and retinopathy) complications⁶. According to the World Health Organization (WHO) in 2022⁷, diabetic patients who experience complications must be balanced with a healthy lifestyle so that they will create a good quality of life, and

can guarantee the occurrence of long-term complications.

This quality of life measurement uses WHOQOL-BREF (World Health Organization Quality of Life-BREF) as a research instrument. WHOQOL-BREF is an international collaboration that has been ongoing for several years to develop a reliable, valid and responsive quality-of-life assessment that applies across cultures⁸.

Method

This type of quantitative research is carried out by collecting primary data in the form of written questions using a questionnaire. This research used a cross-sectional approach, and data collection was carried out from March to April 2024 at X Hospital Kudus. The research instrument used in this study was the WHOQOL-BREF instrument in the form of a questionnaire sheet, and data on complications obtained from medical records of diabetes mellitus patients. According to the World Health Organization (WHO) in 2022, diabetic patients who experience complications must be balanced with a healthy lifestyle so that they will create a good quality of life, and can guarantee the occurrence of long-term complications¹¹. Respondents were asked to choose one number from 1-5 on each question, this study has a score for each domain (raw score) which is transformed on a scale of 0-100.

This study used the WHOQOL-BREF questionnaire, which is a valid ($r = 0.89-0.95$) and reliable ($r = 0.66-0.87$) measuring tool. Previously, validity and reliability tests had been carried out with a sample of 30 elderly people, with the validity test results calculated as an r-value of 0.390 to 0.798, while the reliability test results were 0.941. From these results, it was concluded that all the

WHOQOL-BREFF questionnaire question items were valid and reliable.

Study Population

This study included all patients suffering from diabetes mellitus who underwent medical therapy at the X Hospital Kudus. The sample used in this study was 104 patients with diabetes mellitus at X Hospital Kudus who met the inclusion criteria.

Inclusion Criteria

The following are patient eligibility criteria:

1. Outpatients at Hospital Kudus
2. Diabetes mellitus patients aged ≥ 26 years
3. Diabetes mellitus patients with a duration of < 5 years.
4. Type I and II diabetes mellitus patients with macrovascular or microvascular complications.
5. Agree to fill out informed consent.

Patient characteristics were analyzed using a frequency test, and a Chi-Square test was carried out to determine the relationship between the two variables. In addition, the Binary Logistic Regression test is used to determine the influence between two variables.

Result and Discussion

The results of the research showed that patients suffering from diabetes mellitus with complications in the outpatient installation at X Hospital Kudus had a total of 113 patients who were agree to be interviewed.

There were 104 samples of diabetes mellitus patients who met the inclusion criteria and 9 samples were included in the exclusion criteria because they did not meet the criteria due to the presence of comorbidities that did not match the data to be taken. This research has gone through Ethical Clearance which aims to protect research subjects or respondents from

the research ethical code that has been issued by the Health Research Ethics Commission of Muhammadiyah University Purwokerto with an ethical permit number KEPK/UMP/69/III/2024.

The characteristics of diabetes mellitus patients with complications at X Kudus Hospital. Hospital are shown in the following Table 1.

Based on Table 1, it shows that of the 104 patient data, DM was mostly suffered by female patients, 61 patients (58.7%). This is due to the large number of women who consume dry food and interfere with physical activity which causes obesity so that women are susceptible to diabetes mellitus. This research is in line with research conducted by Rita (2018) which stated that DM sufferers are mostly women, which is 37 people (80.4%)¹⁰. According to Shim et al. (2016) women experience monthly cycle syndrome, and post-menopause which will result in the distribution of body fat easily accumulating due to this hormonal process, so that women will physically experience a greater increase in body mass index¹¹.

Diabetes mellitus patients in the outpatient clinic at X Kudus Hospital who suffered from DM with the most complications were in the elderly age group (46-65 years), with as many as 80 patients (76.9%). At age > 46 years this is the influence of low activity, sedentary lifestyle, and having a family history of diabetes.

According to Komariah & Rahayu (2020) the results of the study showed that the largest number of DM sufferers were in the elderly age group (46-65 years) with a total of 93 sufferers with an overall percentage (69.4%)¹². The age group of 46 years and over is a less active age group where the body will begin to experience

decreased muscle mass function, weight gain, and the effects of the aging process which results in a progressive reduction in β cells.

Patient characteristics based on the most common complications experienced by diabetes mellitus patients are macrovascular complications in 39 patients (37.5%) and macrovascular and microvascular complications in 39 patients (37.5%). as many as 38 patients (36.5%). Macrovascular complications in patients with diabetes mellitus are complications caused by blockages in large blood vessels such as the heart and brain which can result in death. Macrovascular complications that occur such as CHD (Coronary heart disease), hypertension, stroke and cerebrovascular disease. Diabetes mellitus causes macrovascular complications through various pathogenetic pathways including hyperglycemia and insulin resistance¹³.

Microvascular complications are complications that attack small blood vessels, including diabetic retinopathy when patients experience damage to the blood vessels of the eye which increases the risk of visual impairment such as cataracts and glaucoma. Next, it results in diabetic neuropathy in the form of recurrent infections, diabetic ulcers. Other microvascular complications of diabetic nephropathy in the form of kidney failure due to damage to small blood vessels, and kidney failure¹⁴.

Macrovascular and microvascular complications are also included in the highest category, namely 38 people (36.5%). This can happen because someone who has suffered from DM for a long time can experience more than one complication. These complications are often related to the length of suffering and quality of life. Macrovascular and microvascular complications can develop simultaneously in diabetes mellitus, which

attacks large and small blood vessels¹⁵.

Characteristics of DM patients based on the duration of suffering from DM are divided into 2, namely <5 years and >5 years. The group of patients who suffer the most from DM for a long period is <5 years with a total of 104 (100%). DM patients who suffer from DM for a long period are patients who do not regularly control their health, do not regularly take medication, and often have negative feelings such as loneliness, anxiety, so that this can cause diabetes mellitus sufferers to find it difficult to recover. According to Bakri et al. (2023) caused by uncontrolled blood sugar causing HbA1c not to be achieved and can also be caused by uncontrolled food consumption and irregular medication¹⁶.

Characteristics based on work data obtained showed that DM patients with the most complications were in the private sector with a total of 28 patients (26.9%). Because someone who is a private employee has the pressure to complete tasks in a short time, which can cause stress, fatigue, and even sleep disorders. So it has the potential to increase blood glucose levels and insulin resistance.

Characteristics based on DM classification in this study were divided into 2 types, namely type 1 DM with a percentage of 23 patients (22.1%) and type 2 DM with a percentage of 81 patients (77.9%). Type 2 diabetes mellitus occurs more often due to several factors, namely frequent consumption of foods that are too sweet, unhealthy lifestyle, family history, age, obesity/overweight, and lack of physical activity.

Type 1 diabetes mellitus can occur because these sufferers usually have a normal insulin response, especially in the early stages. Type 1 diabetes mellitus is called an autoimmune condition. Based on the World Health

Organization (WHO) in 2019, type 1 DM can also be caused by hereditary factors, for women who have risk factors, it is very important to maintain a balance in their blood sugar levels so that they remain normal.

Characteristics based on the treatment of diabetes mellitus in this study are grouped based on the type and class of drugs given to diabetes mellitus patients at X Hospital Kudus. The percentage for antidiabetic therapy to DM patients at X Hospital Kudus can be seen in Table 2.

Table 2 shows that metformin, from the biguanide group, is the most widely used single oral antidiabetic drug, with 17 drugs (53.1%). Because metformin lowers high blood sugar levels, its cost is relatively low, and it reduces the incidence of cardiovascular disease. Because metformin is able to lower high blood sugar levels, its cost is relatively low and reduces the incidence of cardiovascular disease.

This research is in line with research conducted by Pelawi & Fauzia (2022) which stated that the highest use of a single oral antidiabetic was metformin with a total of 41 (40.2%)¹⁷. Metformin is a drug that has a glucose-lowering effect, does not cause hypoglycemia, and does not cause weight gain in patients. According to Rena et al. (2017), metformin is a biguanide OAD with a mechanism of action that increases the body's sensitivity to insulin, works effectively without triggering hypoglycemia or weight gain with minimal side effects¹⁸.

After a single drug is unable to reduce blood sugar levels in a patient with diabetes mellitus, within a period of 3 months the patient will be given oral antidiabetic therapy with a combination of 2 drugs. The results of this study showed that the two most common oral

antidiabetic combinations were metformin and glimepiride from the biguanide and sulfonylurea groups, with a total of 14 (31.8%). According to the Indonesian Endocrinology Association (PERKENI) in 2021¹⁹ and the American Diabetes Association (ADA) in 2021²⁰, if a combination therapy of 2 drugs for 3 months still does not reach the target of HbA1c <7%, a combination of 3 drugs with additional insulin therapy is used as treatment therapy. The combination therapy of 3 drugs that were widely used in this study was a combination of glimepiride, metformin and sansulin (insulin glargine) with a total of 6 (21.4%).

Management of microvascular complications such as diabetic neuropathy, patients are given gabapentin and pregabalin. Gabapentin is recommended as the first line for neuropathic pain, including diabetic neuropathy. Gabapentin plays a role in restoring the endogenous inhibitory system, namely compounds that play a role in local inhibition²⁰. Meanwhile, the management of macrovascular complications such as hypertension was given amlodipine to 18 patients. Amlodipine works by inhibiting the entry of calcium into smooth muscle cells and blood vessels and myocardial cells, this can reduce peripheral vascular resistance¹⁹.

The statin drug class, simvastatin, is 4.9%. Simvastatin can reduce cholesterol production. High cholesterol levels can cause damage to the arteries, potentially causing heart complications and stroke²¹. The second most cholesterol drug is atorvastatin with a level of 3.0%. This drug is more effective in lowering LDL-C and the risk of cardiovascular disease. The most widely used classes of antiplatelet drugs are clopidogrel 2.5% and aspirin 2.5%. Aspirin therapy as a secondary therapy is a preventive strategy for DM patients with a history of atherosclerotic cardiovascular

disease.

Gastrointestinal drugs that are widely used are lansoprazole from a PPI target of 3.8%. This drug is used to overcome side effects due to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) given as therapy for concomitant diseases such as proxime tab, diclofenac sodium, meloxicam, ketoprofen and also neurosanbe.

The most supplements, vitamins and minerals are mecobalamin at 3.8% and vitamin B12 at 2.7%. The mechanism of action is to repair disorders of nucleic acid and protein metabolism in nerve cell tissue, and stimulate cells to increase protein synthesis and nerve cell regeneration.

Ramipril is 2.5% of the Angiotensin-Converting Enzyme Inhibitor (ACEI) class. It can prevent the development of heart failure without symptoms of decreased ejection fraction after myocardial infarction.

Patient characteristics based on the incidence of macrovascular and microvascular complications are shown in Table 3. Table 3 shows that the most common complications for macrovascular patients with diabetes mellitus were coronary heart disease (CHD) and hypertension, 16 (41.0%). This is because patients with comorbid coronary heart disease (CHD) and hypertension are caused by several factors such as less than optimal physical activity, family history, and also smoking habits.

In addition to coronary heart disease (CHD), the second most common macrovascular complication is hypertension, which is 14 (35.9%). This study is in line with research conducted by Sari et al. (2017) found that the number of diabetes mellitus patients with comorbid hypertension was the highest, which

was 26 patients (50%)²². Hypertension can occur due to blood pressure against the artery walls when blood is pumped from the heart to the tissues.

The most common patient characteristics based on the occurrence of microvascular complications were diabetic neuropathy with a total of 24 (88.9%). This can occur due to nerve damage caused by weakness and damage to the walls of blood vessels that provide nutrition to the nerves²³.

Based on the incidence of macrovascular and microvascular complications, the most common are coronary heart disease and diabetic neuropathy with a percentage of 10 (26.3%). This can occur because people with diabetes mellitus with these complications initially experience damage to the walls of blood vessels, causing fat accumulation on the damaged walls and causing narrowing of the blood vessels²⁴.

The influence of macrovascular and microvascular complications on quality of life can be seen in Table 4. Based on the significance value obtained from the incidence of complications with the quality of life of patients, the P Value was obtained $0.141 > 0.05$. This means that there is no influence between the incidence of macrovascular and microvascular complications with the quality of life of patients with diabetes mellitus.

The results of the study showed that there were 16 patients with a moderate level of quality of life who had macrovascular complications and 16 patient with a high level of quality of life. As many as 23 patients, moderate quality of life with microvascular complications as many as 12 patients and high quality of life as many as 15 patients, while the level of moderate quality of life with macrovascular and microvascular complications as many as

22 patients and high quality of life as many as 16 patients.

The inconsistency of the results of this study is because the quality of life of patients with diabetes mellitus with complications from the results of the questionnaire data shows that the quality of life of the majority is high. So it can be said that complications have no effect on quality of life. This is because patients really enjoy their lives without thinking about the pain they experience and get support from relatives or friends and family so that they can reduce negative thoughts about themselves.

The results of this research data are in line with research conducted by Sari (2022) shows that there is no influence between the incidence of complications and the quality of life of elderly people with type 2 diabetes mellitus with a P value of $0.545 > 0.05^{25}$. This can occur because of several factors in patients with diabetes mellitus with macrovascular and microvascular complications who have a high level of quality of life. These factors can be caused by patients with diabetes mellitus with routine complications to carry out health checks, there is very good support from the family as encouragement so that patients feel that they are very meaningful and can recover, and also patients are very obedient in taking medication as a treatment therapy because the success of the control process for diabetes mellitus with complications is very much determined by high compliance with treatment²⁶.

The incidence of macrovascular and microvascular complications that should have a low quality of life is inversely proportional to the results of the study. The results of the study data show that macrovascular and microvascular complications have a high quality of life of 16 patients, one of the diabetes mellitus patients with macrovascular

and microvascular complications is Mr. S, 64 years old, a civil servant who suffers from type 2 diabetes mellitus with complications of CHD, hypertension, neuropathy and nephropathy. Mr. S has macrovascular and microvascular complications but his quality of life category is high. This can happen because of full support from family and friends so that he can enjoy life quite well, often have vacation time to relax the mind, fill free days with fitness sports so that the body feels healthy, and always routinely check and take medication that has been prescribed by a doctor.

Conclusion

The incidence of macrovascular and microvascular complications in diabetes mellitus patients at Mardi Rahayu Kudus Hospital was highest in macrovascular complications (37.5%) and macrovascular + microvascular complications (36.5%). And the level of quality of life for diabetes mellitus sufferers at Hospital Kudus is in the high category at 55 (52.9%). There was no influence of macrovascular and microvascular complications on the quality of life of diabetes mellitus patients with a P value of $0.141 > 0.05$.

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Conflict of Interest

None declared.

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Table 1. Characteristics of Diabetes Mellitus Patients.

Patient Characteristics	Number of patients (N=104)	Percentage (%)
Gender		
Man	43	41.3
Woman	61	58.7
Patient Age		
Adult (26-45 years)	5	4.8
Elderly (46-65 years)	80	76.9
Seniors (>65 years)	19	18.3
Complications		
Macrovascular	39	37.5
Microvascular	27	26.0
Macrovascular + Microvascular	38	36.5
Long Suffering		
< 5 years	104	100.0
> 5 years	0	0
Work		
Laborer	17	16.3
self-employed	22	21.2
Private	28	26.9
Farmer	9	8.7
Housewife	14	13.5
Government employees	14	13.5
DM classification		
DM type 1	23	22.1
DM type 2	81	77.9

Table 2. Treatment Profile of DM Patients at Mardi Rahayu Kudus Hospital.

Antidiabetic Therapy	Drug Class	Medicine Name	Frequency	Percentage (%)
Single	Biguanide	Metformin	17	53.1
	Sulfonylurea	Glimepiride	4	12.5
		Gliquidone	3	9.4
		Gliclazide	2	6.3
	Tiazolidindione	Pioglitazone	2	6.3
	DPP inhibitor 4	Vildagliptin	2	6.3
	Long-acting	Lantus Solostar/ insulin glargine	2	6.3
Total			32	100.0
Combination 2	Biguanide + Sulfonylurea	Metformin + Glimepiride	14	31.8
		Metformin + Gliclazide	6	13.6
		Metformin + Gliquidone	2	4.5
	Sulfonylurea + Long-acting	Glimepiride + Insulin glarginee	3	6.8
		Gliquidone + Insulin glarginee	3	6.8
		Gliclazid + Insulin glarginee	4	9.1
	Biguanide + DPP inhibitor 4	Metformin + Vildagliptin	2	4.5
		Metformin + Sitagliptin	2	4.5
	Sulfonylurea + Tiazolidindione	Gliquidone + Pioglitazone	2	4.5
		Glimepiride + Pioglitazone	1	2.3
	Biguanide + α -Glukosidase	Metformin + Acarbose	1	2.3
	Tiazolidindione + Rapid-acting	Pioglitazone + Insulin glulisinee	1	2.3
	Biguanide + Long-acting	Metformin + Insulin glarginee	3	6.8
Total			44	100.0

Combination 3	Sulfonylurea + Biguanide + Long-acting	Glimepiride + Metformin + Insulin glargine	6	21.4
		Glimepiride + Metformin + Levemir	4	14.3
		Gliclazid + Metformin + Levemir	3	10.7
		Gliclazid + Metformin + Insulin glargine	2	7.1
		Gliquidone + Metformin + Insulin glargine	1	3.6
		Gliquidone + Metformin + Insulin glargine	1	3.6
	Sulfonylurea + Biguanide + α -Glukosidase	Glimepiride + Metformin + Acarbose	3	10.7
		Gliclazid+ Metformin + Acarbose	3	10.7
	Biguanide + Rapid-acting + Long-acting	Metformin + Insulin glulisine + Insulin glargine	1	3.6
		Gliquidone + Acarbose + Vildagliptin	1	3.6
	Sulfonylurea + α -Glukosidase + DPP inhibitor 4	Glimepiride + Acarbose + Vildagliptin	1	3.6
		Glimepiride + Acarbose + Insulin glargine	1	3.6
	Sulfonylurea + Biguanide + DPP inhibitor 4	Glimepiride + Metformin + Vildagliptin	1	3.6
		Gliclazid + Metformin + Vildagliptin	1	3.6
Total			28	100.0
Total			104	100.0

Table 3. Incidence of Macrovascular and Microvascular Complications.

Complication Category	Frequency	Percentage (%)
Macrovascular		
CHD + Hypertension	16	41.0
Hypertension	14	35.9
CHD	5	12.8
CHD + Hypertension + Strokes	2	5.1
CHD + Strokes	1	2.6
Cerebrovascular	1	2.6
Total	39	100,0
Microvascular		
Diabetic Neuropathy	24	88.9
Diabetic Nephropathy	2	7.4
Neuropathy + Nephropathy	1	3.7
Total	27	100.0
Macrovascular & Microvascular		
CHD + Neuropathy	10	26.3
CHD, Hypertension + Neuropathy	8	21.1
Hypertension + Neuropathy	7	18.4
Hypertension + Nephropathy	3	7.9
Cerebrovascular + Neuropathy	2	5.3
CHD + Nephropathy	1	2.6
Strokes + Neuropathy	1	2.6
CHD, Hypertension + Retinopathy	1	2.6
CHD, Hypertension + Nephropathy	1	2.6
Hypertension, Strokes + Nephropathy	1	2.6
Hypertension + Neuropathy, Nephropathy	1	2.6
CHD, Hypertension, Cerebrovascular + Nephropathy	1	2.6
CHD, Hypertension + Neuropathy, Nephropathy	1	2.6
Total	38	100.0

Table 4. Effect of Complications with Quality of Life Level.

Complications	Quality of Life Level		Total	P Value Sig
	Currently	Tall		
Macrovascular	16	23	39	0.141
Microvascular	12	15	27	
Macrovascular & Microvascular	22	16	38	