Characteristics of type 2 diabetes mellitus patients at Puskesmas Sanden: a cross sectional study

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Abstract. Type 2 diabetes mellitus (T2DM) is a chronic disease characterized by insulin resistance and hyperglycemia. T2DM is a serious public health problem with increasing prevalence throughout the world. In Indonesia, the prevalence of type 2 diabetes mellitus is estimated at 10,3%. This study aims to determine the characteristics of type 2 diabetes mellitus patients at Puskesmas Sanden. This research is a descriptive observational study with a cross sectional approach. Data was collected from medical records of patients with T2DM at Puskesmas Sanden. Data were collected from medical records of T2DM patients in Puskesmas Sanden. A total of 96 respondents fulfilled the inclusion and exclusion criteria. The majority of T2DM patients were female (56.3%) and aged 51-65 years (51.0%). Hypertension was the most common comorbidity (63.0%). Many patients experienced complications such as nephropathy diabetic (4.0%), ophtalmic disease (9.0%), neuropathy diabetic (13.0%) and vascular disease (17.0%). T2DM is a serious disease with a high prevalence and can cause dangerous complications.

1 Introduction

Type 2 diabetes mellitus is a global health problem with prevalence continuing to increase. According to [1], one in eleven people in the world suffers from T2DM, and Asia is the epicenter of this epidemic [2]. In Indonesia T2DM ranks sixth as the highest cause of death [3]. T2DM is characterized by high blood sugar levels due to insulin deficiency or insulin resistance [4]. Damage to pancreatic cells that produce insulin and insulin resistance are the main causes of type 2 diabetes mellitus. Symptoms that often appear in T2DM patients include: increased thirst and desire to urinate, feeling weak, bacterial and fungal infections,

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delayed wound healing [5]. Data shows that T2DM is a fairly common disease in Indonesia. Of the 18.9 million National Health Insurance (Jaminan Kesehatan Nasional) participants, 812.204 people were diagnosed with T2DM, and 57% of them had complications [6]. In Yogyakarta, the prevalence of T2DM reached 2.4%, which is one of the highest in Indonesia [7]. Diagnosis of type 2 diabetes mellitus can be done in several ways, such as: single glucose test with symptoms (polyuria, polydipsia, polyphagia, and weight loss) [8], checking blood sugar and HbA1C levels [9].

Research by Nanami et al. (2018) shows that women are more susceptible to type 2 diabetes mellitus (56.40%). Other risk factors associated with type 2 diabetes mellitus are: Old age, living in urban areas, low education level, high body mass index (BMI). Other research shows that hypertension, coronary heart disease, and chronic kidney disease are comorbidities that are often found in type 2 diabetes mellitus patients [10]. Research on the characteristics of type 2 diabetes mellitus patients at Puskesmas Sanden has not yet been carried out much. Therefore, this study aims to describe the characteristics of type 2 diabetes mellitus patients at Puskesmas Sanden, providing useful information to improve the management of type 2 diabetes mellitus at Puskesmas Sanden.

Prevention and Treatment of type 2 diabetes mellitus requires effective prevention and management strategies to reduce the risk of complications and improve the quality of life of patients. Early Detection and Treatment. Early detection and treatment of type 2 diabetes mellitus can reduce premature mortality from Non-Communicable Diseases (NCDs) such as diabetes, in line with Sustainable Development Goals on Good Health and Well Being.

2 Material and Methods

This research is a descriptive observational study with a cross sectional approach. Data was collected in Februari-Maret 2024 from medical records of patients with type 2 diabetes mellitus at Puskesmas Sanden. Population of this study was all medical records of diabetes patients type 2 mellitus outpatient who undergoes at least two routine examinations times at Puskesmas Sanden. Calculation of the minimum sample size using a formula Slovin obtained a sample size of 96 samples. The inclusion criteria in this study were patients suffering from type 2 diabetes mellitus during January 2021 to December 2023, and patients aged > 40 years to > 65 years. We excluded pregnant women and type 2 diabetes mellitus patients have incomplete medical records. This research has received ethical approval from the Universitas Ahmad Dahlan (UAD) ethics committee. The variables studied were the characteristics of diabetes sufferers type 2 mellitus which includes age, gender, comorbidities, complications. Descriptive statistics were used to present patient characteristics.

3 Results and Discussion

Based on the results of the research, most of the 96 respondents with type 2 diabetes mellitus were female, about 54 people (56.3%), and the male were 42 people (44%). The results of this research are in line with Nur's (2018) research in Banyumas Regency, especially Purwokerto, which found that 53% of type 2 DM sufferers were female. Likewise, research by Sucipto & Zufry (2008) and Ramadhan & Marissa (2015) states that more women suffer from type 2 DM compared to men. Oktaviana's research (2021) is dominated by women (56.40%). Based on the 2022 WHO report, it is stated that the prevalence of type 2 DM in women in the world is 9.9%, while in men it is 8.3%. Likewise, a report from IDF (2023) states that the prevalence of type 2 diabetes mellitus in women in the world is 10.4%, while in men it is 8.8%. According to basic health research in 2018, more diabetes mellitus sufferers

in Indonesia were female (1.8%) than male (1.2%) (Ministry of Health of the Republic of Indonesia, 2020).

In prevalence, women and men have the same chance of developing diabetes. However, in terms of risk factors, women are more at risk of developing diabetes because physically women have a greater chance of increasing their body mass index. Post-menopausal monthly cycle syndrome (premenstrual syndrome), which causes the distribution of body fat to easily accumulate due to hormonal processes, putting women at risk of suffering from type 2 diabetes mellitus. Apart from that, in women who are pregnant there is a hormonal imbalance, high progesterone, which increases the body's working system to stimulate developing cells (including those in the fetus), the body will give a hunger signal and at its peak causes the body's metabolic system to not be able to receive direct calorie intake and use it in total so that there is an increase in blood sugar levels during pregnancy [11].

Table 1. Distribution of Respondents Based on Gender in Puskesmas Sanden

Gender	n	%
Male	42	44.00
Female	54	56.00

Gender is one of the factors associated with the occurrence of type 2 diabetes mellitus. Women tend to be more at risk of developing type 2 diabetes mellitus. This is because women have higher cholesterol than men and there are also differences in carrying out all daily activities and lifestyle. which greatly influences the incidence of type 2 diabetes mellitus. The amount of fat in men is 15-20% of body weight while in women it is 20-25% of body weight. So the increase in fat levels in women is higher than in men, so the risk of diabetes mellitus in women is 3-7 times higher than in men, namely 2-3 times [12]. The reduced concentration of the hormone estrogen in menopausal women causes fat reserves, especially in the abdominal area, to increase, resulting in increased release of free fatty acids, a condition related to insulin resistance.

There are several factors that cause more women to suffer from type 2 diabetes mellitus than men, namely hormones, obesity, genetic factors and lifestyle. Estrogen is a hormone produced by the ovaries. This hormone has various functions, including protecting the body from type 2 diabetes mellitus. Estrogen can help increase cell sensitivity to insulin, so the body can use glucose more efficiently. After menopause, estrogen levels decrease. This decrease in estrogen levels can increase a woman's risk of developing type 2 diabetes mellitus. This is because insulin becomes less effective in lowering blood sugar levels. Obesity is the main risk factor for type 2 diabetes mellitus. Obesity can cause insulin resistance, which is a condition where the body's cells become less sensitive to insulin. This causes blood sugar levels to become high. Genetic factors also play a role in increasing the risk of type 2 diabetes mellitus. Women are more likely to have genetic factors that increase the risk of type 2 diabetes mellitus. This is caused by various factors, including heredity and genetic mutations. Women are more likely to have a lifestyle that increases the risk of type 2 DM, such as lack of exercise and unhealthy eating patterns. Lack of exercise can cause insulin resistance. Unhealthy eating patterns, such as consuming foods high in sugar and fat, can also cause insulin resistance [13]. Based on the results of this study, researchers believe that in general, women are more at risk of developing type 2 diabetes mellitus due to various factors, including hormonal, genetic and lifestyle factors.

Increasing age is one of the risk factors for type 2 diabetes mellitus. In the elderly, physiologically there is a decrease in body organ function, one of which is related to a decrease in the function of pancreatic beta cells in producing insulin [14]. Based on the

research, most of the respondents were in the 51-65 year age group, 49 people (51.0%). The results of this research are in line with Oktaviana's research (2021) where the elderly group was more commonly found. Based on the 2018 RISKESDAS data analysis, the prevalence of type 2 diabetes mellitus in the 25-34 year age group is 1.5%, the 35-44 year age group is 2.2%, the 45-54 year age group is 3.1%, the 55-64 years is 5.2%, and the age group 65 years and over is 10.3% . According to data from the International Diabetes Federation (IDF), the most common age for type 2 diabetes sufferers is 45-64 years. This means that people with type 2 diabetes tend to be adults [15] The increased risk of developing DM will increase with increasing age, especially over 40 years. Increasing age causes changes in carbohydrate metabolism and changes in insulin release which is influenced by glucose in the blood and inhibits the release of glucose into cells because it is influenced by insulin. If we look at the respondent's age when they first suffered from diabetes mellitus, it can be seen that the older a person is, the greater the incidence of type two diabetes mellitus.

Table 2. Distribution of Respondents Based on Age in Puskesmas Sanden.

Age	n	%
40-50 years old	10	10.00
51-65 years old	49	51.00
>65 years old	37	39.00

There is a relationship between age and T2DM in the elderly because the age group 45 years and over is a group that is at high risk of developing diabetes mellitus. Increasing age will cause changes in the body's metabolic system, resulting in inhibited glucose release. Age is an important risk factor for type 2 diabetes mellitus. The risk of developing type 2 diabetes mellitus increases with age. This is due to various factors, including: Hormonal changes, metabolic changes, increased risk of lifestyle factors [16]. Estrogen is a hormone produced by the ovaries. This hormone has various functions, including protecting the body from type 2 diabetes mellitus. Estrogen can help increase cell sensitivity to insulin, so the body can use glucose more efficiently. After menopause, estrogen levels decrease. This decrease in estrogen levels can increase a woman's risk of developing type 2 diabetes mellitus. This is because insulin becomes less effective in lowering blood sugar levels [17]. Metabolism is the body's process of converting food into energy. The body's metabolism tends to slow down as we age. This can cause insulin resistance, which is a condition where the body's cells become less sensitive to insulin. Insulin resistance can cause high blood sugar levels. If blood sugar levels are not controlled, it can cause type 2 diabetes mellitus. Older people are more likely to be obese, exercise less, and have unhealthy eating habits. These three factors are the main risk factors for type 2 diabetes mellitus. Obesity is a condition where a person's body weight is too high. Obesity can cause insulin resistance, which is a condition where the body's cells become less sensitive to insulin. Lack of exercise can cause insulin resistance. Unhealthy eating habits, such as consuming foods high in sugar and fat, can also cause insulin resistance [18]. Based on the results of this study, researchers believe that age is an important risk factor for type 2 diabetes mellitus. The risk of developing type 2 diabetes mellitus increases with age, both in men and women. This is due to various factors, including hormonal changes, metabolic changes, and increased risk from lifestyle factors.

Based on the results of the research, most of the 96 respondents with type 2 diabetes mellitus had comorbid hypertension, 60 people (63%). The results of this study are in line with research [19] where as many as 78.3% had a comorbid disease in the form of hypertension. Likewise, research [20] showed that the majority of DM patients had

comorbidities, namely hypertension, 31 people (53.4%) out of 60 respondents. According to data from the Indonesian Endocrinology Association (PERKENI), hypertension is the most common comorbidity in people with type 2 diabetes. The prevalence of hypertension in people with type 2 diabetes in Indonesia is estimated to reach 60-70%. Based on research, around 70% of people with type 2 DM also suffer from hypertension. Hypertension can increase the risk of complications of type 2 DM, such as heart disease, stroke and kidney failure. Therefore, it is important for people with type 2 DM to control their blood pressure well [21]. Hypertension is also a risk factor associated with type 2 diabetes mellitus. High blood pressure causes the distribution of sugar in cells to not run optimally, resulting in a buildup of sugar and cholesterol in the blood. In essence, if blood pressure is good, blood sugar will also be maintained. Insulin acts as a substance that controls blood pressure and water levels in the body, so that sufficient insulin levels cause blood pressure to be maintained . The cause of hypertension in type 2 DM sufferers is insulin resistance, which is a condition in which the body's cells cannot use insulin properly. Insulin is a hormone that helps the body use glucose (blood sugar) as energy. When the body's cells cannot use insulin properly, the body produces more insulin to try to lower blood sugar levels. This can cause high blood pressure. Kidney disease can cause sodium and fluid retention. This can increase blood pressure. Apart from that, heart problems can cause an increase in hormone levels which can cause high blood pressure [22].

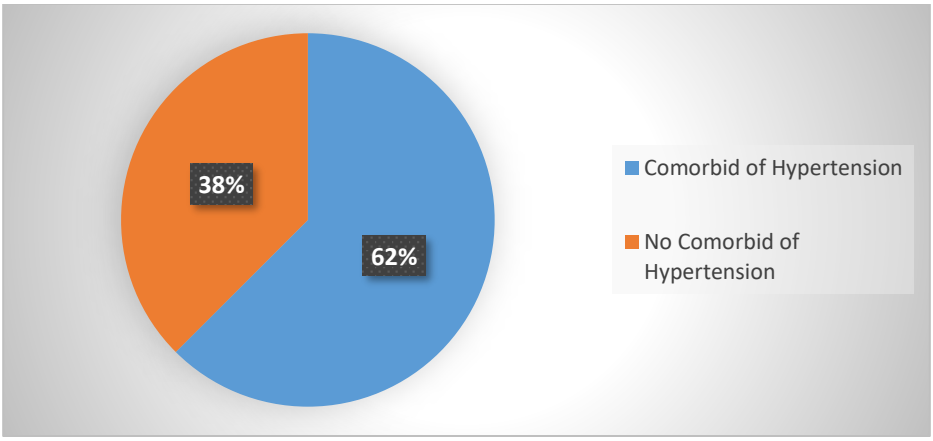

Fig. 1. Distribution of Respondents Based on Comorbid of Hypertension in Puskesmas Sanden

Likewise, [23] said that the main cause of hypertension in type 2 DM sufferers is an increase in blood pressure that occurs due to increased sodium retention caused by the action of the hormone insulin. Insulin can convert glucose into glycogen, but can also regulate sodium retention in the kidneys. Therefore, if insulin resistance occurs, the breakdown of glucose into simpler molecules does not occur, this can trigger an increase in blood pressure The presence of comorbidities can increase the social burden on DM sufferers due to the need for control by specialist doctors according to the comorbidities suffered so that expenses related to costs and time are greater [24]. Respondents who did not have comorbidities had better quality of life scores than those with comorbidities. Based on the results of this study, researchers believe that it is important for type 2 DM sufferers to control their blood pressure well. This can be done by taking medication, living a healthy lifestyle, and having regular health checks.

Based on the results of the research, many respondents with type 2 diabetes mellitus experienced complications. The results of this study are in line with research by Murgi (2023) where the majority of patients experienced complications (55%). Based on research data,

complications found in type 2 diabetes mellitus patients include diabetes mellitus with nephropathy diabetic (4 respondents, 4%), diabetes mellitus with ophtalmic disease (9 respondents, 9%), diabetes mellitus with neuropathy diabetic (12 respondents, 13%), diabetes mellitus with vascular complications (16 respondents, 17%), diabetes mellitus with multiple complications (in the kidneys, eyes, nerves and peripheral circulation) and diabetes mellitus with unspecified complications. Complications can occur and get worse due to many factors, including increasing age, gender, and the length of time you suffer from DM. Increasing age affects changes in carbohydrate metabolism and insulin release. Usually women tend to frequently experience DM which is caused by factors such as monthly cycle syndrome (premenstrual syndrome) and post-menopause. This results in easy accumulation of fat distribution in the body due to hormonal processes . The length of time suffering from DM will affect the patient's level of confidence in carrying out treatment which can put the patient at risk of experiencing complications, so that this has the effect of reducing the quality of life which is related to the incidence of mortality. This can affect the life expectancy of DM sufferers. Researchers assume that the longer DM sufferers suffer from the disease, the more it will affect their quality of life [25].

Table 3. Distribution of Respondents Based on Complications in Puskesmas Sanden.

Complication	n	%
Nephropathy Diabetic	4	4.00
Ophtalmic Disease	9	9.00
Neuropathy Diabetic	12	13.00
Vaskular Disease	16	17.00

Treatment compliance also influences the incidence of complications of type 2 diabetes mellitus. Treatment compliance is the patient's compliance with the recommendations for the medication that has been prescribed which is related to time, dose and frequency. One of the factors that plays a role in the failure to control blood glucose in patients with type 2 diabetes mellitus is the patient's non compliance with treatment which results in the emergence of various complications. Respondents' non-compliance was influenced by many factors, various arguments conveyed by respondents when asked regarding treatment compliance. Forgetting, bored, running out of medicine and not having time to buy it were the reasons given by respondents [26].

Complications in type 2 diabetes mellitus sufferers can occur in every organ of the body, but the most common is heart disease. Heart disease is the most common complication of type 2 diabetes mellitus. High blood sugar levels can cause damage to blood vessels, including the heart blood vessels. This can increase the risk of coronary heart disease, heart attack and stroke. Eye disorders are complications that can cause blindness. High blood sugar levels can damage blood vessels in the eyes, so that the eyes do not get enough oxygen and nutrients. This can cause various eye problems, such as diabetic retinopathy, glaucoma, and cataracts. Neuropathy is nerve damage that can cause a variety of symptoms, such as tingling, numbness, and pain. High blood sugar levels can damage nerves throughout the body. This can cause various problems, such as peripheral neuropathy, autonomic neuropathy, and autonomic neuropathy. Based on the results of this study, researchers believe that good blood sugar control can reduce the risk of complications from type 2 DM. Therefore, it is important for type 2 DM patients to follow treatment according to doctor's recommendations and live a healthy lifestyle.

4 Conclusion

The majority of type 2 diabetes mellitus patients were female (56.3%) and aged 51-65 years (51.0%). Hypertension was the most common comorbidity (63.0%). Many patients experienced complications such as nephropathy diabetic (4.0%), ophtalmic disease (9.0%), neuropathy diabetic (13.0%) and vaskular disease (17.0%). type 2 diabetes mellitus is a serious disease with a high prevalence and can cause dangerous complications. Good blood sugar control can reduce the risk of complications from type 2 diabetes mellitus. Therefore, it is important for type 2 diabetes mellitus patients to follow treatment according to doctor's recommendations and live a healthy lifestyle.

References

1. R. A. DeFronzo, E. Ferrannani, P. Zimmet, and A. George, International Textbook of Diabetes Mellitus Type 2, *International Textbook of Diabetes Mellitus Type 2* (Willey Blackwell, 2017)
2. C. Han, Q. Song, Y. Ren, X. Chen, X. Jiang, and D. Hu, Global prevalence of prediabetes in children and adolescents: A systematic review and meta-analysis, J. Diabetes **14**, 434 (2022)
3. D. Simbolon, A. Siregar, and R. A. Talib, Prevention and Control of Type 2 Diabetes Mellitus in Indonesia through the Modification of Physiological Factors and Physical Activities, Kesmas Natl. Public Heal. J. **15**, 120 (2020)
4. Lestari, Zulkarnain, Sijid, and S. Aisyah, Diabetes Mellitus: Review of Etiology, Pathophysiology, Symptoms, Causes, Examination Methods, Treatment Methods and Prevention Methods, UIN Alauddin Makassar **1**, 237 (2021)
5. R. Goyal, Mayank Singhal 2, and Ishwarlal Jialal, Type 2 Diabetes, *Type 2 Diabetes* (2023)
6. B. Hidayat, R. V. Ramadani, A. Rudijanto, P. Soewondo, K. Suastika, and J. Y. Siu Ng, Direct Medical Cost of Type 2 Diabetes Mellitus and Its Associated Complications in Indonesia, Value Heal. Reg. Issues **28**, 82 (2022)
7. Balitbangkes, 2018 National Riskesdas Report, Lemb. Penerbit Balitbangkes hal 156 (2018)
8. A. B. Olokoba, O. A. Obateru, and L. B. Olokoba, Type 2 Diabetes Mellitus: A Review of Current Trends, Oman Med. J. **27**, 269 (2012)
9. S. Soelistijo, Guidelines for the Management and Prevention of Type 2 Diabetes Mellitus in Adults in Indonesia 2021, Glob. Initiat. Asthma 46 (2021)
10. M. Nowakowska, S. S. Zghebi, D. M. Ashcroft, I. Buchan, C. Chew-Graham, T. Holt, C. Mallen, H. Van Marwijk, N. Peek, R. Perera-Salazar, D. Reeves, M. K. Rutter, S. F. Weng, N. Qureshi, M. A. Mamas, and E. Kontopantelis, The comorbidity burden of type 2 diabetes mellitus: patterns, clusters and predictions from a large English primary care cohort, BMC Med. **17**, 145 (2019)
11. S. Damayanti and S. Damayanti, Relationship Between Diabetes Mellitus Exercise Frequency With Blood Sugar Levels, Cholesterol Levels And Blood Pressure In Type 2 Diabetes Mellitus Clients in the Persadia Group Of Jogja Hospital, Med. Respati J. Ilm. Kesehat. **10**, (2015)
12. S. Imelda Akademi Kebidanan Dharma Husada Pekanbaru, Factors Influencing the Occurrence of Diabetes Mellitus at Harapan Raya Health Center in 2018, Sci. J. **8**, 28 (2019)
13. R. P. A. Barros, U. F. Machado, and J.-Å. Gustafsson, Estrogen receptors: new players in diabetes mellitus, Trends Mol. Med. **12**, 425 (2006)
14. Z. Adhayani Arda and A. Rahmat Ngobuto, Characteristics of Diabetes Mellitus

Patients in Several Health Centers in Gorontalo Regency, Kampurui J. Kesehat. Masy. (The J. Public Heal. **1**, 26 (2019)
15. S. Webber, International Diabetes Federation, *International Diabetes Federation* (2021)
16. Y. Wu, Y. Ding, Y. Tanaka, and W. Zhang, Risk Factors Contributing to Type 2 Diabetes and Recent Advances in the Treatment and Prevention, Int. J. Med. Sci. **11**, 1185 (2014)
17. V. Motlani, G. Motlani, S. Pamnani, A. Sahu, and N. Acharya, Changed Endocrinology in Postmenopausal Women: A Comprehensive View, Cureus **15**, (2023)
18. W. Sami, T. Ansari, N. S. Butt, and M. R. A. Hamid, Effect of diet on type 2 diabetes mellitus: A review, Int. J. Health Sci. (Qassim). **11**, 65 (2017)
19. M. J. C. Bezerra, I. M. Barbosa, T. G. D. E. Sousa, L. M. Fernandes, D. L. M. Maia, and L. M. Holanda, Profile of Patients Receiving Total Knee Arthroplasty: a Cross-Sectional Study Tt - Perfil De Pacientes Submetidos À Artroplastia Total De Joelho: Um Estudo Transversal, Acta Ortopédica Bras. **25**, 202 (2017)
20. I. F. D. Chiptarini, Overview of Knowledge and Behavior Regarding DM Management in DM Patients at Ciputat Timur Health Center, Overview of Knowledge and Behavior Regarding DM Management in DM Patients at Ciputat Timur Health Center, 2014
21. D. Anggraini and N. J. Zakiyah, Risk Factors of Type 2 Diabetes Mellitus in the Elderly, Nusant. Hasana J. **1**, 33 (2021)
22. H. F. Sakr, S. R. Sirasanagandla, S. Das, A. I. Bima, and A. Z. Elsamanoudy, Insulin Resistance and Hypertension: Mechanisms Involved and Modifying Factors for Effective Glucose Control, Biomedicines **11**, 2271 (2023)
23. C. Mancusi, R. Izzo, G. di Gioia, M. A. Losi, E. Barbato, and C. Morisco, Insulin Resistance the Hinge Between Hypertension and Type 2 Diabetes, High Blood Press. Cardiovasc. Prev. **27**, 515 (2020)
24. M. C. Petersen and G. I. Shulman, Mechanisms of Insulin Action and Insulin Resistance, Physiol. Rev. **98**, 2133 (2018)
25. J. V. Jorgetto and L. J. Franco, The impact of diabetes mellitus on quality of life – differences between genders, J. Diabetes Metab. Disord. **17**, 11 (2018)
26. A. K. Sendekie, A. K. Netere, A. E. Kasahun, and E. A. Belachew, Medication adherence and its impact on glycemic control in type 2 diabetes mellitus patients with comorbidity: A multicenter cross-sectional study in Northwest Ethiopia, PLoS One **17**, e0274971 (2022)