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CHARACTERISTICS OF T2DM PATIENTS AND THE RISK LEVEL OF ATHEROSCLEROTIC CARDIOVASCULAR DISEASE AT THE DIABETES POLYCLINIC OF PROF. DR. I. G. N. G. NGOERAH GENERAL HOSPITAL

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease characterized by insulin resistance and can cause macrovascular complications such as atherosclerotic cardiovascular disease (ASCVD). Patient characteristics can influence ASCVD risk. This study determined the sociodemographic and clinical characteristics of T2DM patients and their ASCVD risk at the Diabetes Polyclinic of Prof. Dr. I. G. N. G. Ngoerah General Hospital.

Methods: This was a cross-sectional descriptive observational study involving 75 T2DM patients. Data were obtained through consecutive sampling and collected from questionnaires and medical records. Data analysis was performed univariately. The ASCVD risk level was calculated using the "WHO Cardiovascular Disease Risk Laboratory-Based Charts with Diabetes for Southeast Asia", as modified by PERKI and confirmed using the WHOPEN calculator. Out of the 75 samples, the dominant sociodemographic characteristics were the 55–59 age group (25.3%), male gender (54.7%), and non-smokers (94.7%).

Results: Clinical characteristics showed the majority of patients had hypertension (65.3%, 51% controlled), obesity based on BMI (49.3%), central obesity (65.3%), poor glycemic control (68%), hypercholesterolemia (50.7%, 55.3% controlled), hyper-LDL cholesterolemia (76%, 75.4% uncontrolled), hypo-HDL cholesterolemia (78.7%, 88.1% uncontrolled), hypertriglyceridemia (54.7%, 56.1% uncontrolled), and dyslipidemia (94.7%, 95.8% uncontrolled). It was found that all patients (100%) were in the uncontrolled T2DM category.

Conclusion: The ASCVD risk level analysis showed the majority of patients were in the moderate-risk category (40%), followed by high-risk category (37.3%). T2DM patients at the Diabetes Polyclinic of Prof. Dr. I. G. N. G. Ngoerah General Hospital mostly had uncontrolled clinical characteristics and a moderate to high 10-year ASCVD risk.

Keywords : Type 2 diabetes mellitus, atherosclerotic cardiovascular disease risk, patient characteristics

INTRODUCTION

Diabetes mellitus (DM) is a disease characterized by poor regulation of blood glucose levels, with type 1 and type 2 being its major subtypes. Among these, type 2 diabetes mellitus (T2DM) accounts for nearly 90% of all diabetes cases. Initially, the body compensates for insulin resistance by increasing insulin production to maintain glucose homeostasis. Over time, pancreatic β-cell dysfunction leads to a decline in insulin secretion, resulting in the development of T2DM.[1] T2DM is characterized by insulin resistance, abnormal lipid metabolism, impaired insulin secretion, low-grade systemic inflammation, and excessive hepatic glucose production.[2] Common clinical symptoms include increased thirst and urination, fatigue, recurrent bacterial or fungal infections, and delayed wound healing. The global prevalence of T2DM is considerably high, affecting approximately 9.45% of the world population. [1] Among the ten countries with the highest estimated number of diabetes cases, Indonesia ranks seventh. Bali is one of the Indonesian provinces with a substantial number of diabetes cases. According to the 2018 National Basic Health Research (Riskesdas), the prevalence of DM in Bali based on physician diagnosis was 1.5% in 2013 and increased to 1.8% in 2018 among individuals aged ≥15 years.[3]

Long-term complications remain a major concern for patients with DM. These complications are broadly classified into microvascular and macrovascular types.[4] Soeatmadji et al. (2023) reported that 26.2% of T2DM patients tend to develop macrovascular complications.[5] Consequently, the risk of atherosclerotic cardiovascular disease (ASCVD) is particularly high in this population. Atherosclerosis in individuals with T2DM is considered more aggressive than in those without diabetes. Factors such as age, sex, smoking status, obesity, blood pressure,

glycemic control, and lipid profile abnormalities may trigger earlier onset and more rapid progression of atherosclerosis, leading to multivessel involvement.[6,7]

Atherosclerosis is a chronic inflammatory condition characterized by plaque formation within arterial walls. These plaques consist primarily of lipids, which contribute to turbulent blood flow and inflammatory responses that lead to ASCVD.[8] Other components, including smooth muscle cells, extracellular matrix, calcium, and immune system elements, may also be present within the plaques.[9] The clinical manifestations of ASCVD may present as either acute or chronic conditions.[10] Numerous pathological pathways link DM to the development of atherosclerosis. Studies in diabetic patients have demonstrated an increased risk and accelerated progression of atherosclerosis. As the process advances, it ultimately leads to cardiovascular disease, which underlies the development of ASCVD.[11]

Given the high prevalence of T2DM and the limited number of studies conducted in Bali, further investigation is needed regarding the characteristics of T2DM patients and their risk of developing ASCVD, particularly at the Diabetes Polyclinic of Prof. Dr. I. G. N. G. Ngoerah General Hospital. This study aims to describe the characteristics of T2DM patients and determine their ASCVD risk levels using WHO laboratory-based risk charts modified by PERKI.

MATERIALS AND METHODS

This study was conducted from July to October 2025 using a descriptive observational study with a cross-sectional design. The data sources were primary data obtained through patient interviews to collect sociodemographic characteristics and secondary data from medical records to obtain clinical characteristics. The sample collection technique was consecutive sampling, with inclusion criteria including patients with T2DM who were treated at the Diabetes Polyclinic of Prof. Dr. I. G. N. G. Ngoerah General Hospital, aged 40–74 years, and who agreed to participate by completing the informed consent form and research questionnaire. The exclusion criteria included patients with incomplete medical records. Eligible and consenting patients were interviewed using a structured questionnaire, and their clinical data were subsequently obtained from medical records. Recruitment continued until the required sample size of 75 patients was achieved. Data were analyzed univariately using the Statistical Package for the Social Sciences (SPSS) version 26 for Windows. The ASCVD risk level was calculated using the "WHO Cardiovascular Disease Risk Laboratory-Based Charts with Diabetes for Southeast Asia" guidelines modified by PERKI and confirmed using the WHOPEN calculator. This study was approved by the Ethics Committee with approval number 0071/UN14.2.2.VII.14/LT/2025.

RESULT

In this study, 75 patients were obtained that met the inclusion and exclusion criteria of the study. Table 1 shows that the majority of patients were in the 55 – 59 age group (25.3%) with an overall mean age of 58.96 ± 9.13 years, were male (54.7%), were non-smoker (94.7%). The mean of blood pressure was 129.41 ± 21.35 mmHg for systolic and 78.29 ± 12.37 mmHg for diastolic, the median BMI was 24.97 (17.33-46.38), the mean central obesity was 91.33 ± 14.43 cm, the median of glycemic control at 7.5% (5.5-14). Regarding the lipid profile, the mean total cholesterol was 167.41 ± 48.26 mg/dL, LDL cholesterol was 110.12 ± 45.67 mg/dL, HDL cholesterol was 38.36 ± 14.44 mg/dL, and the median triglyceride level was 109 mg/dL (40-387).

Table 1. Characteristics of T2DM patients

Characteristics of T2DM patients	Frequency		Mean ± SD/Median (Min-Max)
	n	%	
Age			58.96 ± 9.13
40 – 44	4	(5.3)	
45 – 49	6	(8.0)	
50 – 54	13	(17.3)	
55 – 59	19	(25.3)	
60 – 64	11	(14.7)	
65 – 69	7	(9.3)	
70 – 74	15	(20.0)	
Gender			
Male	41	(54.7)	
Female	34	(45.3)	
Smoking status			
Smoker	4	(5.3)	
Non-smoker	71	(94.7)	
Blood pressure			
Systolic			129.41 ± 21.35
Diastolic			78.29 ± 12.37
Body mass index			24.97 (17.33-46.38)
Central obesity			91.33 ± 14.43

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Glycemic control	7.5 (5.5-14)
Lipid profile	
Total cholesterol	167.41 ± 48.26
LDL	110.12 ± 45.67
HDL	38.36 ± 14.44
Triglycerides	109 (40-387)

In table 2, majority of patients had hypertension (65.3%, 51% controlled). Furthermore, based on BMI most patients were classified as obese (49.3%) and based on waist circumference most patients have central obesity (65.3%). Most patients also demonstrated poor glycemic control (68%).

Lipid profile abnormalities were also frequently observed. Hypercholesterolemia (50.7%, 55.3% controlled), hyper-LDL cholesterolemia (76%, 75.4% uncontrolled), hypo-HDL cholesterolemia (78.7%, 88.1% uncontrolled), and hypertriglyceridemia (54.7%, 56.1% uncontrolled) were found. As a result, most patients experienced dyslipidemia (94.7%, 95.8% uncontrolled). Based on these findings, it can be concluded that all patients were classified as having uncontrolled T2DM (100%).

Table 2. Managements of T2DM patients

Managements of T2DM patients	Frequency	
	n	%
Hypertension		
Yes	49	(65.3)
Controlled	25	(51.0)
Uncontrolled	24	(49.0)
No	26	(34.7)
BMI		
Underweight	2	(2.7)
Normal	18	(24.0)
Overweight	18	(24.0)
Obese	37	(49.3)
Central obesity		
Yes	49	(65.3)
No	26	(34.7)
Glycemic control		
Good	24	(32.0)
Poor	51	(68.0)
Hypercholesterolemia		
Yes	38	(50.7)
Controlled	21	(55.3)
Uncontrolled	17	(44.7)
No	37	(49.3)
Hyper-LDL cholesterolemia		
Yes	57	(76.0)
Controlled	14	(24.6)
Uncontrolled	43	(75.4)
No	18	(24.0)
Hypo-HDL cholesterolemia		
Yes	59	(78.7)
Controlled	7	(11.9)
Uncontrolled	52	(88.1)
No	16	(21.3)
Hypertriglyceridemia		
Yes	41	(54.7)
Controlled	18	(43.9)
Uncontrolled	23	(56.1)
No	34	(45.3)

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Dyslipidemia		
Yes	71	(94.7)
Controlled	3	(4.2)
Uncontrolled	68	(95.8)
No	4	(5.3)
T2DM control status		
Controlled	0	(0)
Uncontrolled	75	(100)

In table 3, it was found that most patients were in the moderate-risk category (40%) and followed by the high-risk category (37.3%).

Table 3. ASCVD risk level of T2DM patients

ASCVD risk level of T2DM patients	Frequency	
	n	%
Risk level		
Low	10	(13.3)
Moderate	30	(40.0)
High	28	(37.3)
Very high	7	(9.3)
Extremely high	0	(0)

DISCUSSION

In this study, most patients were in the 55–59 year age group. This finding is consistent with the 2023 Indonesian Health Survey (SKI), which reported that the prevalence of diabetes mellitus increases with age and peaks in the 55–74 year age group.[12] However, this result differs from the 11th edition of the IDF Diabetes Atlas, which reported the highest prevalence in the 75–79 year age group.[13] This increased risk is associated with age-related physiological changes, including reduced insulin secretion and impaired pancreatic β-cell function. Aging also diminishes the ability of β-cells to adapt to insulin resistance, leading to a progressive decline in insulin secretory capacity. Although the reduction in β-cell mass is generally minimal, the regenerative capacity of β-cells decreases with advancing age. In addition, aging indirectly contributes to insulin resistance through lifestyle-related factors commonly observed in older adults, such as reduced physical activity, increased adiposity, obesity, and loss of muscle mass[14].

The majority of patients in this study were male. This aligns with findings by Ciarambino et al. (2022), who reported a higher prevalence of T2DM in men, although it differs from SKI (2023) which reported a higher prevalence among women.[12,15] These differences may be influenced by variations in population characteristics across study locations. Theoretically, women have a higher tendency to develop impaired glucose tolerance, particularly at older ages, which may be related to relatively higher insulin resistance beginning in early adulthood.[16] Among younger women, the development of T2DM is often associated with greater weight gain, which subsequently results in a more adverse cardiometabolic risk profile.[17]

Most patients in this study were non-smokers. This is similar to the findings of Ali et al. (2023) in Gorontalo Regency, which reported a lower proportion of active smokers among T2DM patients.[18] In contrast, a study by Harahap (2021) in North Padang Lawas Regency found the opposite.[19] These differences may be influenced by sociodemographic factors and variations in smoking habits across populations. Nevertheless, biological mechanisms clearly indicate that smoking is an important risk factor for the development of T2DM. Nicotine has been shown to damage pancreatic β-cell function and mass, thereby disrupting feedback regulation and glucose homeostasis. Smoking also affects gastrointestinal function, including a reduction in bile acid levels, which play an important role in glucose metabolism. Furthermore, cigarette exposure negatively impacts the nervous system, including the vagus nerve, hypothalamus, and circadian rhythm, all of which are key regulators of glucose metabolism. Smoking-induced inflammation, characterized by increased pro-inflammatory factors and C-reactive protein (CRP), further contributes to insulin resistance, β-cell dysfunction, and metabolic dysregulation.[20]

Additionally, most patients in this study had hypertension. This finding is consistent with Tjendera and Chiuman (2025) in Medan, as well as the study by Akalu and Belsti (2020) in Ethiopia, who reported a high prevalence of hypertension among T2DM patients.[21] Insulin resistance plays a central role in linking these two conditions. Insulin resistance and hyperinsulinemia can induce metabolic alterations and vascular dysfunction that contribute to elevated blood pressure. Conversely, hypertension may exacerbate endothelial dysfunction and impaired tissue perfusion, thereby accelerating the decline in insulin sensitivity and worsening metabolic dysfunction in patients with T2DM. Metabolic factors such as obesity, increased visceral adiposity, and impaired metabolic regulation further strengthen this pathogenic interaction.[22]

Nutritional status data showed that most patients were classified as obese. This finding is consistent with Sagala et al. (2024) study in Medan, as well as the data from Riskesdas (2018),

which reported a strong association between obesity and increased prevalence of diabetes.[3,23] The pathogenesis of diabetes and obesity shares common biological pathways. In obesity, adipocyte hypertrophy, increased visceral adiposity, and abnormal fat accumulation, including ectopic fat deposition in non-adipose organs such as the liver and skeletal muscle, are commonly observed. Dysfunctional adipose tissue subsequently releases various metabolic mediators, including free fatty acids (FFAs), pro-inflammatory cytokines, and adipokines. These mediators disrupt insulin signaling in target tissues, leading to insulin resistance.[24]

Regarding glycemic control, most patients had HbA1c levels in the poor category. This finding aligns with the CDC (2024) report indicating that nearly half of diabetic patients have not achieved glycemic targets.[25] HbA1c is formed through a non-enzymatic glycation process between glucose and hemoglobin, and its concentration increases with rising average blood glucose levels.[26] Poor HbA1c control increases the risk of ASCVD in T2DM patients.[27]

Based on lipid profiles, most patients had hypercholesterolemia, hyper-LDL cholesterolemia, hypo-HDL cholesterolemia, and hypertriglyceridemia, resulting in a high prevalence of dyslipidemia. This finding is in line with studies by Suastika et al. (2019) in Bali and Hasnat et al. (2022) in Bangladesh, who also reported a high prevalence of lipid abnormalities among T2DM patients.[28,29] Insulin resistance in T2DM triggers increased lipolysis, leading to elevated FFAs. This subsequently drives metabolic processes that result in elevated triglycerides, increased sdLDL, and decreased HDL levels.[30] HDL, which is normally antiatherogenic, becomes dysfunctional under hyperglycemic conditions due to oxidation and glycation, altering its proteome into a proinflammatory profile.[31]

Based on the overall characteristics of T2DM patients in this study, many risk factors remained uncontrolled. This contributed to the finding that all patients were classified as having uncontrolled T2DM. This is consistent with the study by Linda (2023) in Batang and Lorestanifar et al. (2023) in Iran, which also reported a high prevalence of uncontrolled diabetes. This condition may be influenced by limited access to healthcare services, treatment costs, unhealthy lifestyle practices, poor adherence to medical recommendations, and low awareness of T2DM complications.[32]

In this study, most patients were categorized as having moderate and high 10-year ASCVD risk. This finding differs from studies by Sujarwoto et al. (2025) in Malang and Rifin et al. (2024) in Malaysia, which reported the highest proportions in the low-risk category.[33,34] These differences may be due to variations in sample characteristics. This study included only T2DM patients, whereas the other studies included mixed populations with and without diabetes. In addition, the smaller sample size in this study may influence the distribution of ASCVD risk levels among participants.

CONCLUSION AND SUGGESTION

Based on the findings and discussion of this study, several conclusions can be drawn. Sociodemographically, most patients belonged to the 55–59 year age group, male, and non-smokers. Clinically, the majority of patients had controlled hypertension, obesity based on BMI, central obesity, poor glycemic control, uncontrolled dyslipidemia, and overall uncontrolled T2DM. Furthermore, most patients were classified as having moderate to high levels of ASCVD risk.

From an academic perspective, this study is expected to serve as a foundation for future research related to the characteristics of T2DM patients and their risk of developing ASCVD. Subsequent studies are recommended to include additional variables related to patient characteristics and to employ a larger sample size for improved generalizability. From a practical standpoint, healthcare providers are encouraged to conduct comprehensive evaluations of both pharmacological and non-pharmacological management in T2DM patients to ensure optimal disease control and to prevent complications such as ASCVD.

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