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Clinical Profile, Risk Factors, and Comorbidities among Patients with Type 2 Diabetes Mellitus: A cross-sectional study at a Tertiary Level Hospital in Nepal

Roshani Maharjan*
PhD Scholar
Central Department of Population Studies,
Tribhuvan University, Kathmandu, Nepal
maharjanroshani7@gmail.com
https://orcid.org/0009-0009-3234-5410

Yogendra Bahadur Gurung
Professor
Central Department of Population Studies,
Tribhuvan University, Kathmandu, Nepal
gurungyb@gmail.com
https://orcid.org/0000-0002-7233-5104

Corresponding Author*
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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is a major global public health concern associated with increasing prevalence, a substantial socioeconomic burden, and long-term complications. Patients with T2DM are at increased risk of developing multiple comorbidities and diabetes-related complications that adversely affect quality of life and clinical outcomes. This study aimed to assess the clinical profile, risk factors, comorbidities and glycemic control among patients with T2DM attending a tertiary level hospital in Nepal.

Methods: A hospital-based analytical cross-sectional study was conducted among 400 patients with T2DM attending the outpatient department of Shree Birendra Hospital, Kathmandu, Nepal, from June 2024 to December 2024. Participants diagnosed with T2DM for more than six months were recruited using non-probability purposive sampling technique. Data on socio-demographic characteristics, biochemical parameters, risk factors, comorbidities, and diabetic

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complications were collected using a semi-structured questionnaire and medical record review. Descriptive statistics were used for data analysis using SPSS version 25. Bivariate analyses using the chi-square test were performed to examine association between selected risk factors (e.g., BMI category, family history of diabetes, and obesity) and glycemic control.

Results: The mean age of participants was 68.3 ± 6.8 years, and 59.8% were male. Nearly half (46.8%) belonged to the age group of 61–70 years. The mean body mass index was 27.53 ± 3.53 kg/m², and the mean HbA1c level was 6.03 ± 0.59%, indicating good glycemic control. Family history of diabetes was present in 28.5% of participants. According to WHO BMI classification for Asian population, 53.2% of participants were classified as obese class II (BMI ≥27.5 kg/m²). Hypertension was the most prevalent comorbidity (29.2%), followed by cardiovascular disease (3.2%) and hyperlipidemia (2.5%). Diabetic neuropathy (3.2%) and diabetic nephropathy (2.8%) were the most commonly documented complications. Metformin was the most commonly prescribed anti-diabetic drug. Bivariate analysis showed a significant association between obesity and glycemic control.

Conclusion: The study found that older adults were predominantly affected by T2DM and family history as a major risk factor. Hypertension was the most common comorbidity, whereas diabetic neuropathy and diabetic nephropathy were the most frequently observed complications. Comprehensive diabetes care emphasizing lifestyle modification, regular glycemic monitoring, and early screening for comorbidities and complications is essential to improve clinical outcomes and reduce the burden of T2DM.

Novelty: This study provides hospital-based evidence on the clinical characteristics, risk factors, comorbidities, and complications among patients with T2DM in Nepal, contributing to the limited literature available in this setting.

Keywords: Diabetic complications; Glycemic control; Hypertension; Lifestyle factors; Metabolic syndrome.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by insufficient insulin secretion, impaired insulin action, or both. This results from the interaction between genetic susceptibility and environmental influences (Banday et al., 2020).

Diabetes mellitus represents a major global public health challenge due to its increasing prevalence, associated complications, and substantial socioeconomic burden. It is classified into type 1 diabetes mellitus, type 2 diabetes mellitus (T2DM), hybrid forms of diabetes, other specific types, unclassified diabetes, and hyperglycemia first detected during pregnancy. Among these, T2DM is the most common form, accounting for more than 90% of all diabetes cases worldwide (Forouhi & Wareham, 2014).

Review of Literature

Global burden of T2DM

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The global burden of T2DM has risen sharply over the past two decades and continues to accelerate. According to the International Diabetes Federation (IDF) Diabetes Atlas, the number of adults living with diabetes worldwide exceeded 500 million in 2024 and is projected to approach 900 million by 2050 (IDF Diabetes Atlas, 2025). The associated global health expenditure reached an estimated US$1.015 trillion in 2024, a 338% increase over the preceding 17 years (IDF Diabetes Atlas, 2025). The global prevalence of diabetes among adults aged 20–79 years is estimated to be 10.5% and is projected to increase to 12.2% by 2045 (Magliano & Boyko, 2021).

Risk factors for T2DM

Risk factors for T2DM include non-modifiable factors such as age, sex, and family history, and modifiable factors such as obesity, physical inactivity, and unhealthy dietary habits. Patients with T2DM are also at increased risk of developing comorbid conditions like hypertension, cardiovascular disease, and renal impairment. Persistent hyperglycemia plays a central role in the pathogenesis of microvascular complications, while other factors such as hypertension, dyslipidemia, smoking, and genetic predisposition further contribute to disease progression (Crasto et al., 2021). In addition, lifestyle modifications, including smoking cessation, reduction in alcohol consumption, regular physical activity, optimal blood pressure control, management of dyslipidemia, and routine monitoring of renal function, are essential strategies for preventing or delaying diabetes-related complications (Viswanathan, 2015).

Complications of T2DM

T2DM is associated with significant morbidity and mortality owing to its multisystem involvement and long-term complications. Diabetes-related complications are broadly categorized into vascular and non-vascular complications. Vascular complications are further classified into macro-vascular complications, including coronary artery disease, peripheral arterial disease, and cerebrovascular disease, and micro-vascular complications, comprising diabetic retinopathy, nephropathy, and neuropathy (Chawla et al., 2016; Powers et al., 2018). Globally, the prevalence of diabetes-related complications among individuals with T2DM ranges from 14.5% to 23.5% (Kosiborod et al., 2018). The reported prevalence of diabetic retinopathy, nephropathy, and neuropathy is approximately 35%, 30–50%, and 16–87%, respectively (Bellou et al., 2018; Gheith et al., 2016; Sobhani et al., 2014). Intensive glycemic control has been shown to reduce the risk of developing complications and slow their progression, although the magnitude of benefit varies across patient populations (Boussageon et al., 2017).

Diabetes in Nepal

Nepal reflects the broader South Asian pattern of a rapidly escalating T2DM burden layered onto a health system still transitioning from communicable to non-communicable disease priorities. The first nationally representative, population-based survey of diabetes in Nepal covering 13,200 adults aged 20 years and older across 400 clusters in 72 districts found a diabetes prevalence substantially higher than the International Diabetes Federation's 2017 estimate of 4% for the country (Shrestha et al., 2022). This same survey reported that the study

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was conducted using a standardized questionnaire adapted from the WHO STEP wise approach, with both fasting and postprandial blood glucose testing performed across all seven provinces of Nepal between 2016 and 2018 (Shrestha et al., 2022). A systematic review covering the period 2000–2014 documented a rising trend in T2DM prevalence across Nepali studies, reinforcing that the disease burden has been on an upward trajectory well before the most recent national estimates (Gyawali et al., 2015).

Rationale for the study

The prevalence of diabetes is increasing rapidly, particularly in low- and middle-income countries. Understanding the clinical profile and comorbidities of diabetic patients helps improve treatment outcomes and prevent complications. Therefore, this study aimed to assess the clinical profile, associated risk factors, and comorbidities among patients with T2DM attending a tertiary level hospital in Nepal.

Objective

The objective of this paper is to assess the clinical profile, risk factors, comorbidities and glycemic goal among patients with T2DM attending a tertiary-level hospital in Nepal.

Methods

Study Design and Setting

A hospital-based analytical cross-sectional study was conducted at Shree Birendra Hospital, a tertiary level hospital located in Chhauni, Kathmandu, Nepal, from June 2024 to December 2024.

Study Population and Sampling

Patients diagnosed with T2DM attending the outpatient department of Shree Birendra Hospital for more than six months were included in the study. A non-probability purposive sampling technique was employed to recruit study participants.

The sample size was calculated using Cochran's formula: i.e. Sample size (n) = $(\mathbf{Z^2 \times p \times q)/d^2}$, where n denotes the required sample size, $Z = 1.96$ corresponding to a 95% confidence interval, p is the estimated prevalence (0.5), $q = 1-p$, and d is the allowable margin of error (5%). The calculated sample size was 385. To improve precision and account for incomplete data, the sample size was increased to 400 participants.

Inclusion and Exclusion Criteria

Patients diagnosed with T2DM according to the American Diabetes Association (ADA) criteria and attending the outpatient department for more than six months were included in the study. T2DM was diagnosed based on the presence of any one of the following criteria: fasting plasma glucose ≥126 mg/dL (≥7.0 mmol/L), 2-hour plasma glucose ≥200 mg/dL (≥11.1 mmol/L) following a 75 g oral glucose load, random plasma glucose ≥200 mg/dL (≥11.1 mmol/L) in the presence of classical symptoms of hyperglycemia, or glycated hemoglobin (HbA1c) ≥6.5% (48 mmol/mol) (ElSayed et al., 2023).

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Patients diagnosed with Type 1 diabetes mellitus, other specific types of diabetes, unclassified diabetes, gestational diabetes mellitus, and diabetes first detected during pregnancy were excluded from the study.

Data Collection Procedure

Data were collected using a semi-structured questionnaire and review of patients' medical records. Information regarding socio-demographic characteristics, biochemical parameters, risk factors, comorbidities, and diabetes-related complications was obtained. Face-to-face interviews were conducted in the Nepali language by the principal investigator.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the Nepalese Army Institute of Health Sciences (NAIHS), Sanobharyang, Kathmandu, Nepal. Administrative approval was obtained from Shree Birendra Hospital through an official request letter issued by NAIHS.

Written informed consent was obtained from all participants prior to data collection. Privacy was ensured by conducting interviews in a separate room, and confidentiality was maintained by using the collected information solely for research purposes.

Statistical Analysis

Data were entered, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize socio-demographic characteristics, clinical profile, risk factors, comorbidities, and diabetes-related complications. Continuous variables were tested for normality using the Shapiro-Wilk test prior to analysis. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and classified according to the WHO-recommended BMI cut-offs for Asian populations: underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–24.9 kg/m^2), obese I (25.0–27.4 kg/m^2), and obese II (≥27.5 kg/m^2) (Lim et al., 2017; Low et al., 2009; WHO Expert Consultation, 2004). Bivariate analyses using chi-square test was performed to examine associations between poor glycemic control and BMI category, family history and obesity. Glycemic control was categorized as good (HbA1c <7%) and poor (HbA1c ≥7%). Associations between categorical variables were assessed using the chi-square test, while continuous variables were compared using the independent samples t-test. A p-value <0.05 was considered statistically significant.

Results

Socio-demographic characteristics

A total of 400 patients with T2DM were included in the study. Nearly half of the participants (46.8%) belonged to the age group of 61–70 years, followed by 35.2% aged 71–80 years. The mean age was 68.3 ± 6.8 years. Most participants were male (59.75%), married (96.8%), Hindu (88.8%), and belonged to the Chhetri ethnic group (72.8%). The majority resided in urban areas (90.5%) and had attained secondary-level education up to Grade 12 (89.3%) (Table 1).

Table 1. *Socio-demographic characteristics of study participants* **(N = 400)**

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Variable	N	%
Age (years)		
≤ 50	8	2.0
51 – 60	50	12.5
61 – 70	187	46.8
71 – 80	141	35.2
> 80	14	3.5
Mean ± SD	**68.3 ± 6.8 years**	
Sex		
Male	239	59.75
Female	158	39.5
Other / Not specified	3	0.75
Religion		
Hindu	355	88.8
Buddhism	45	11.2
Ethnicity		
Chhetri	291	72.8
Brahmin	60	15.0
Tamang	40	10.0
Other	9	2.2
Marital Status		
Married	387	96.8
Unmarried	13	3.2
Residential Area		
Urban	362	90.5
Rural	38	9.5
Education Level		
Primary (up to Grade 5)	25	6.2
Secondary (up to Grade 12)	357	89.3
Bachelor's Degree	18	4.5

Clinical and biochemical characteristics

The mean BMI of the participants was 27.53 ± 3.53 kg/m², ranging from 18.54 to 38.75 kg/m². The mean fasting blood glucose level was 130.83 ± 17.40 mg/dL, while the mean post-prandial blood glucose level was 165.25 ± 33.48 mg/dL. The mean HbA1c level was 6.03 ± 0.59%. The mean total cholesterol and triglyceride concentrations were 207.90 ± 48.17 mg/dL and 136.67 ± 44.31 mg/dL, respectively (Table 2).

Table 2*. Clinical and biochemical characteristics* **(N = 400)**

Parameter	Mean	SD	Min	Max

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Body Mass Index (kg/m²)	27.53	3.53	18.54	38.75
Fasting Blood Glucose (mg/dL)	130.83	17.40	69	200
Post-prandial Blood Glucose (mg/dL)	165.25	33.48	100	335
HbA1c (%)	6.03	0.59	5.1	9.2
Total Cholesterol (mg/dL)	207.90	48.17	123	350
Triglycerides (mg/dL)	136.67	44.31	75	387

Risk factors

The risk factors reported prior to the diagnosis of T2DM are presented in table 3. A family history of diabetes mellitus was present in 28.5% of participants, while smoking and alcohol consumption were reported by 12.2% and 9.5% of participants, respectively. Self-reported obesity and mental stress were reported by 7.2% and 3.5% of participants, respectively (Table 3).

***Table 3**. Distribution of risk factors* **(N = 400)**

Risk Factor (Before diagnosis of T2DM)	**n (Yes)**	**%**
Family history of T2DM	114	28.5
Hypertension (self-reported)	64	16.0
Smoking	49	12.2
Alcohol consumption	38	9.5
Obesity (self-reported)	29	7.2
Mental stress	14	3.5

Distribution of body mass index categories

According to WHO BMI classification, the majority of participants were classified as obese Class II or above (53.2%), while 19.3% were categorized as obese Class I and 17% of participants were overweight (Table 4).

***Table 4**. BMI categories according to WHO classification* for Asian **(N = 400)**

BMI Category (WHO Asian)	**BMI (kg/m²)**	**Frequency (n)**	**Percentage (%)**
Underweight	<18.5	0	0.0
Normal	18.5–22.9	42	10.5
Overweight (At risk)	23.0–24.9	68	17.0
Obese I	25.0–27.4	77	19.3
Obese II	≥27.5	213	53.2

Table 4 represents measured BMI at study enrollment.

Comorbidities and diabetic complications

Hypertension was the most prevalent comorbidity, affecting 29.2% of participants, followed by heart disease (3.2%) and hyperlipidemia (2.5%). Among diabetic complications, diabetic neuropathy was documented in 3.2% of participants, diabetic nephropathy in 2.8%, and diabetic retinopathy in 0.2%.

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***Table 5**. Comorbidities and diabetic complications* **(N = 400)**

Condition	n (Yes)	%
Comorbidities		
Hypertension HTN (Previously diagnosed)	117	29.2
Cardiovascular Disease	13	3.2
Hyperlipidemia	10	2.5
Stroke	0	0.0
Liver Disease	0	0.0
Diabetic Complications		
Diabetic neuropathy	13	3.2
Diabetic nephropathy	11	2.8
Diabetic retinopathy	1	0.2
Urinary Glucose by Urine strip method (as per document)		
Absent (0)	388	97.0
1+ Glycosuria	5	1.2
2+ Glycosuria	7	1.8

Lifestyle practices and self-care behaviors

Regular physical activity was reported by 65.5% of participants, whereas 34.5% reported no regular physical activity. Alcohol consumption and smoking were reported by 9.5% and 12.2% of participants, respectively. All participants were receiving anti-diabetic medication at the time of the study (Table 6).

***Table 6**. Lifestyle and self-care practices* **(N = 400)**

Practice	Yes (n)	Yes (%)	No (n)	No (%)
Regular physical activity	262	65.5	138	34.5
Alcohol use	38	9.5	362	90.5
Smoking	49	12.2	351	87.8
Anti-diabetic medication	400	100.0	0	0.0

Anti-diabetic Medication Profile

The commonly used anti-diabetic drug was metformin followed by glimepiride (Table 7). Amlodipine (n=106), atorvastatin (n=10), aspirin (n=13), and losartan (n=11) were prescribed for other comorbidities. Psychological counseling was taken by 26 participants; dietary counseling by 72 participants and ophthalmology referral by 3 participants.

***Table 7.** Anti-diabetic medication prescribed for participants* **(N=400)**

Drug	Frequency (n)	%
Metformin (monotherapy)	164	41.0
Metformin + Glimepiride	98	24.5
Metformin + Linagliptin	61	15.3

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Metformin + Sitagliptin	37	9.3
Metformin + Empagliflozin	21	5.3
Metformin + Sitagliptin+ Acarbose	8	2.0
Metformin + Empagliflozin+ Glimepiride	6	1.5
Insulin + Metformin	3	0.8
Insulin + Metformin + Acarbose	2	0.5

Bivariate Analysis of Factors Associated with Glycemic Control

Bivariate analysis showed a significant association between obesity and glycemic control. Participants classified as obese according to the WHO Asian BMI classification had a higher proportion of good glycemic control than non-obese participants (91.4% vs. 83.6%; $p = 0.035$). A significant association was also observed for family history of diabetes ($p > 0.001$) (Table 8).

Table 8*. Bivariate analysis of factors significantly associated with poor glycemic control (HbA1c ≥7%) among patients with type 2 diabetes mellitus* **(N = 400)**

Variable	Good glycemic control n (%) (HbA1c < 7%)	Poor glycemic control n (%) (HbA1c ≥7%)	p-value
BMI category			
Normal	33 (78.6)	9 (21.4)	0.016
Overweight	59 (86.8)	9 (13.2)	
Obese I	66 (85.7)	11 (14.3)	
Obese II	199 (93.4)	14 (6.6)	
Family history of diabetes			
Yes	72 (86.7)	11 (13.3)	0.001
No	285 (89.9)	32 (10.1)	
Obesity (Obese I and II)			
Yes	265 (91.4)	25 (8.6)	0.035
No	92 (83.6)	18 (16.4)	

Discussion

The present study assessed the clinical profile, risk factors, and comorbidities among patients with T2DM attending a tertiary level hospital in Nepal.

The findings showed that T2DM predominantly affected older adults, consistent with reports from Nepal, India, and Bangladesh. Increasing age has been recognized as a major determinant of T2DM because of progressive insulin resistance, pancreatic β-cell dysfunction, and cumulative exposure to metabolic risk factors.

The Nepal STEPS Survey conducted by Aryal et al. demonstrated that the prevalence of diabetes increases substantially after the age of 45 years (Aryal et al., 2015; Akter et al., 2014;

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Anjana et al., 2011). The predominance of male participants in the present study may reflect differences in healthcare-seeking behavior, occupational exposure, and accessibility to healthcare services.

Physical inactivity was highly prevalent among participants in the present study, highlighting their important contribution to the development and progression of T2DM. Obesity was common among the participants, as reflected by the elevated mean body mass index. Similar findings were reported in Nepali adults (Shrestha et al., 2022) and in an umbrella review of meta-analysis (Bellou et al., 2018). In contrast, the prevalence of diabetic complications observed in the present study (diabetic neuropathy 3.2%, diabetic nephropathy 2.8%, and diabetic retinopathy 0.2%) was substantially lower than that reported globally. This difference may be explained by the study capturing only clinically diagnosed complications documented in medical records, not systematically screened complications. Patients may be relatively well-controlled in the hospital where comprehensive screening protocols may not be in practice.

Bi et al. demonstrated that sedentary lifestyle, obesity, smoking, and unhealthy dietary practices contribute substantially to insulin resistance and impaired glucose metabolism, thereby increasing the risk of diabetes (Bi et al., 2012). Basit et al. further reported that physical inactivity is a significant predictor of diabetes in South Asian populations (Abdul Basit et al., 2021). These findings underscore the importance of lifestyle modification strategies, including regular physical activity, weight management, smoking cessation, and dietary interventions, in preventing and managing T2DM.

The mean HbA1c level observed in the present study (6.03 ± 0.59%) suggests good glycemic control among participants according to the ADA recommendations. The mean HbA1c observed in the present study was lower than that reported in several previous studies, where the average HbA1c exceeded the recommended target of <7.0% (Adhikari et al., 2023; Borgharkar & Das, 2019; Al Dawish et al., 2016). This finding suggests relatively better glycemic control among the study participants and may be explained by differences in medication adherence, lifestyle modification, regular follow-up, availability of diabetes care services, and variations in the demographic and clinical characteristics of the study populations.

In the present study, obesity was significantly associated with glycemic control (p = 0.035). Although obesity is a well-established risk factor for the development of type 2 diabetes, studies evaluating its association with glycemic control have reported inconsistent findings. Similar associations have been reported in some studies, where excess adiposity was associated with poorer glycemic control due to increased insulin resistance, whereas other studies found no significant relationship after adjustment for demographic and clinical factors. The TIGHT study demonstrated a mean HbA1c of 7.7 ± 1.09%, with approximately three-fourths of patients exhibiting poor glycemic control (HbA1c ≥7%). Hypertension was the most prevalent comorbidity identified in the present study, followed by diabetic neuropathy and nephropathy. This finding is consistent with previous report from South Asia, where it commonly coexists with T2DM because of shared pathophysiological mechanisms, such as insulin resistance, endothelial dysfunction, obesity, and chronic low-grade inflammation (Chawla et al., 2016).

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Kosiborod et al. found that diabetes-related complications affect approximately 14.5%–23.5% of individuals with T2DM globally, with cardiovascular disease, hypertension, and chronic kidney disease contributing substantially to morbidity and mortality (Kosiborod et al., 2018). In addition, Crasto et al. highlighted that persistent hyperglycemia significantly increases the risk of diabetic nephropathy, retinopathy, and neuropathy (Crasto et al., 2021). These findings emphasize the need for early screening, optimal glycemic control, and comprehensive management of cardiovascular risk factors to prevent diabetes-related complications.

In this study, metformin was included in the treatment regimen of all participants, either as monotherapy or in combination with other anti-diabetic agents, which is consistent with current treatment guidelines that recommend metformin as the first line drug for T2DM with patients who are overweight or obese, with additional agents introduced when glycemic targets are not achieved. This is also in line with the findings from other studies from Nepal that reported metformin as the most commonly prescribed drugs (Gyawali et al., 2016; Shrestha et al., 2023).

This study used hospital-based data and medical record review providing valuable insights into the burden of diabetes among patients attending a tertiary care center in Nepal. However, certain limitations should be considered while interpreting the findings. The cross-sectional design precludes establishing temporal or causal relationships between risk factors and outcomes. As the study was conducted at a single tertiary care hospital using a non-probability purposive sampling technique, the findings may not be generalizable to the wider Nepali population. In addition, some lifestyle-related variables were based on self-reported information, which may have introduced recall and reporting bias. Although anti-diabetic medications were recorded, medication adherence was not assessed. Despite these limitations, the study provides important evidence regarding the clinical profile, risk factors, and comorbidities among patients with T2DM in Nepal and may serve as a basis for future multicenter and longitudinal studies.

Conclusion and Recommendation

T2DM predominantly affected older adults in the present study; physical inactivity, sedentary lifestyle, obesity, and family history emerged as major risk factors. Hypertension ranked as the most prevalent comorbidity, while diabetic neuropathy and nephropathy ranked as the most commonly documented complications. The relatively low prevalence of diabetic complications observed in the present study may be partly explained by the fact that complication status was based on documented clinical diagnoses in patients' medical records rather than systematic screening of all participants. The mean HbA1c level indicated good glycemic control among study participants, underscoring the need for enhanced diabetes management strategies. Comprehensive diabetes care encompassing lifestyle modification, regular glycemic monitoring, and early screening for comorbidities and diabetes-related complications remains essential to reduce disease burden and improve clinical outcomes.

Based on these findings, healthcare providers should emphasize patient education, promote healthy lifestyle behaviors, routinely assess cardiovascular risk factors, and screen patients

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promptly for chronic complications. Strengthening multidisciplinary diabetes care services and implementing targeted preventive interventions may improve disease control and enhance quality of life among patients with T2DM. Future research should pursue multicenter prospective studies to explore the determinants and long-term outcomes of T2DM in the Nepali population.

Author Contribution

RM: Conceptualization, methodology, data collection, formal analysis, interpretation of results, manuscript drafting, and revision.
YBG: Study supervision, methodology development, critical review, manuscript editing, and final approval.
All authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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