Co-Morbidity Pattern of the Type-2 Diabetic Indigenous Patients at Rangamati General Hospital and Its impact on the Glycemic Status

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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is a significant public health concern, contributing substantially to morbidity, mortality and healthcare costs. Effective management of diabetes requires a comprehensive understanding of associated comorbidities, including their type and frequency, as these conditions influence treatment outcomes and self-management practices. This study aimed to assess the pattern of comorbidities among indigenous patients with T2DM attending a secondary-level hospital in Bangladesh and to evaluate their impact on glycemic control.

Materials and methods: An analytic cross-sectional study was conducted among 132 adult T2DM patients attending Rangamati General Hospital between March and August 2023. Sociodemographic and clinical data were collected using a pretested structured case record form. Comorbidities were categorized as either previously diagnosed or newly detected through routine screening during the study. Glycemic status was classified based on HbA1c levels as follows: good control (<7%), inadequate control (7–8%) and poor control (>8%).

Results: Only 22 patients (16.7%) achieved good glycemic control, 33 (25%) had inadequate control and 77 (56.3%) had poor glycemic control. Comorbid conditions were identified in 88 patients (66.7%). The most prevalent comorbidity was hypertension (54.5%), followed by dyslipidemia (50.8%) ischemic heart disease (18.9%) liver disease (8.3%) stroke (7.6%) and respiratory disease (6.1%). A total of 45 patients (34.1%) had one comorbid condition, 35 (26.5%) had two and 8 (6.1%) had three or more comorbidities. Multivariatelogistic regression revealed that the likelihood of having comorbidities was significantly associated with age >60 years (OR: 3.12, 95% CI: 1.82–9.15) male gender (OR: 1.19, 95% CI: 1.03–4.25) current smoking (OR: 1.98, 95% CI: 1.01–5.25) duration of diabetes >10 years (OR: 2.11, 95% CI: 1.12–6.45) and poor glycemic control (OR: 3.01, 95% CI: 1.03–10.14).

Conclusion: The study highlights a high burden of comorbidities among indigenous patients with T2DM, with a significant impact on glycemic control. These findings underscore the need for targeted intervention strategies that address both diabetes and its associated comorbidities to improve health outcomes in indigenous populations.

Key words: Comorbidity; Glycemic Control; HbA1c; Indigenous Population; Type 2 Diabetes Mellitus.

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Introduction

T2DM) is a chronic metabolic disorder and a major public health challenge globally, contributing significantly to morbidity, mortality, and healthcare costs. It affects approximately 462 million individuals worldwide, accounting for 6.28% of the global population.[1] In Bangladesh, the burden of diabetes and prediabetes is considerable. According to the Bangladesh Demographic and Health Survey (BDHS) 2017–18, over 25% of adults aged 18 years and older were affected by diabetes or prediabetes, translating to an estimated 25 million individuals in 2020.[2]

T2DM negatively impacts quality of life, particularly in individuals with poor glycemic control.[3] Effective management of the disease is often complicated by the presence of co-existing chronic health conditions, commonly referred to as comorbidities. These co-occurring disorders not only increase clinical complexity but also pose significant challenges to treatment adherence and disease monitoring. Despite the well-documented clinical implications of comorbidity in diabetes, research in this area-particularly among marginalized populations-remains limited.[4-6]

Previous studies have shown that the majority of adults with T2DM present with at least one comorbid condition and up to 40% have three or more.[4-6] However, clinical care often remains narrowly focused on glycemic management alone, overlooking the broader burden of co-existing illnesses. Integrating comorbidity management into diabetes care is essential for achieving the health-related Sustainable Development Goals (SDGs), especially in low-resource settings.[7]

There is a dearth of literature addressing the burden and pattern of diabetes among indigenous populations in South and Southeast Asia. In Bangladesh, approximately 1.2 million people belong to over 30 distinct indigenous communities, with the Chakma, Marma and Tripura groups being the most prominent.[8] These groups, which make up 1.8% of the national population, have distinct cultural practices, lifestyles and health-seeking behaviors.[9] Their socio-cultural and geographical context likely influences both the prevalence and patterns of diabetes and related comorbidities. Addressing the healthcare needs of indigenous populations requires culturally appropriate, context-specific strategies. Diabetes among indigenous communities is known to be shaped by broader social and structural determinants, necessitating tailored research and interventions.[10,11] Given the geographical and ethnic diversity within Bangladesh, the comorbidity patterns and associated risk factors among diabetic individuals may vary significantly across regions.This study was designed to generate baseline evidence on the types and distribution of comorbidities among indigenous patients with T2DM in the hilly region of Chattogram Division. Specifically, it aimed to explore the relationship between sociodemographic and clinical characteristics and comorbidity burden in a secondary-level healthcare setting.

Materials and methods

This analytic cross-sectional study was conducted at Rangamati General Hospital, a 100-bed secondary-level healthcare facility that provides outpatient, inpatient and emergency services. The study was conducted between March and December 2023. Ethical approval was obtained from the Ethical Review Committee of Rangamati Medical College.

Eligible participants included adults (>18 years) from indigenous communities permanently residing in Rangamati, who had been previously diagnosed with T2DM and were receiving treatment with oral hypoglycemic agents or insulin. Patients newly diagnosed during the study period, pregnant women, those with psychiatric conditions, and critically ill individuals were excluded.

Data were gathered using a semi-structured case record form containing a questionnaire and a clinical checklist. The instrument was validated through a pilot test on ten patients not included in the final analysis. Following a brief training session, intern doctors served as data collectors under the supervision of the principal investigator. Sociodemographic data, clinical history and physical examination findings were recorded during face-to-face interviews and chart reviews. Physical measurements included weight (Measured to the nearest kg using a Secco weighing scale) and height (Using a non-stretchable tape) which were used to calculate Body Mass Index (BMI). Laboratory investigations included fasting blood samples collected between 8:00 AM and 11:00 AM after an overnight fast of at least 8 hours. HbA1c and other relevant biochemical parameters were assessed.

Socioeconomic class was categorized as modified Kuppuswamy scale.[12] Glycemic control was classified using HbA1c levels according to American Diabetes Association (ADA) guidelines: Good control: HbA1c < 7%, inadequate control: HbA1c 7–8% and poor control: HbA1c > 8%.[13] Comorbidities were identified based on self-reports, clinical history and routine diagnostic tests. Participants were asked whether a healthcare provider had previously diagnosed any chronic conditions and whether they were currently taking medications for those conditions. Verification was done using medical records and follow-up cards. Screening tests included serum creatinine, fasting lipid profile and electrocardiography. Dyslipidemia was categorized using the National Institutes of Health ATP III criteria.[14] Ischemic heart disease was defined by a compatible clinical history supported by ECG findings.

Data were entered into SPSS version 26.0 for statistical analysis. Descriptive statistics were used to summarize patient characteristics and comorbidity patterns. Categorical variables were expressed as frequencies and percentages, while continuous variables were reported as means (± standard deviation) or medians (Interquartile range) depending on data distribution. Chi-square tests were used for comparison of categorical variables. Multivariate logistic regression was performed to identify factors independently associated with comorbidity. Odds Ratios (ORs) and 95% Confidence Intervals (CIs) were calculated, with a p-value of <0.05 considered statistically significant.

Results

The study included 132 indigenous patients with T2DM. The majority (56.8%) were under 60 years of age, and the mean age was approximately in the late 50s. Males slightly outnumbered females, comprising 53.0% of the participants. Most patients resided in urban areas (68.2%) while 31.8% were from rural regions. In terms of education, 56.1% had attained education above the primary level, whereas 43.9% had primary education or less. Socioeconomically, nearly half (47.0%) belonged to the lower class, 45.5% to the upper-lower class and only 7.6% to the lower-middle class.

Nearly half (47.7%) had been living with diabetes for ≤5 years, while 28.0% for 6–10 years and 24.2% for >10 years. A positive family history of diabetes was reported by 28.8% of the participants. Regarding smoking habits, 28.3% were current smokers and 69.7% were either non-smokers or ex-smokers. In terms of nutritional status, half of the patients (50.0%) were overweight or obese, 47.0% had a normal body mass index and a small proportion (3.0%) were underweighted.

The assessment of diabetes-related self-care behaviors revealed suboptimal practices among the patients. Only 27.3% reported following a healthy diet, while the majority (72.7%) did not adhere to dietary recommendations. Physical exercise was practiced by 56.8% of the participants, whereas 43.2% did not engage in regular physical activity. Blood glucose monitoring was notably poor, with only 15.2% of patients regularly checking their blood sugar levels. Adherence to medication was reported by 30.3% of the participants, while 69.7% admitted to non-adherence. Furthermore, awareness of the optimal glycemic level was extremely low, with only 6.1% of patients knowing the target level for good glycemic control. Fifty-two (46.2%) patients have already developed one or more diabetic complications. Out of 132 patients, 49 (37.1%), 7 (5.3%) and 5 (3.8%) patients had one, two, and three diabetic complications, respectively (Figure 3). Diabetic neuropathy was the most common diabetes complication (25.4%) among the study patients, followed by diabetic nephropathy (20.5%) diabetic foot (9.1%) and diabetic retinopathy (3.8%).
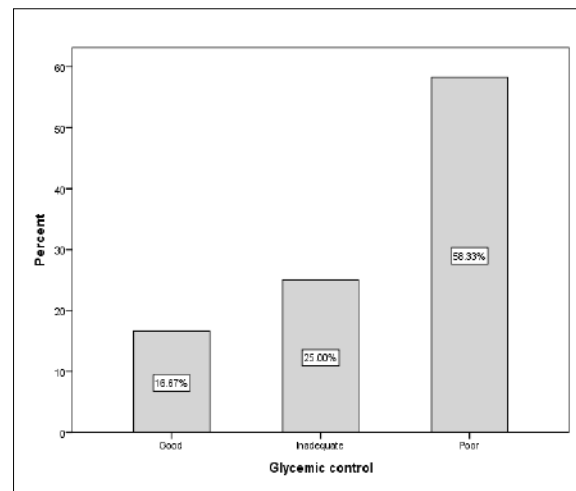

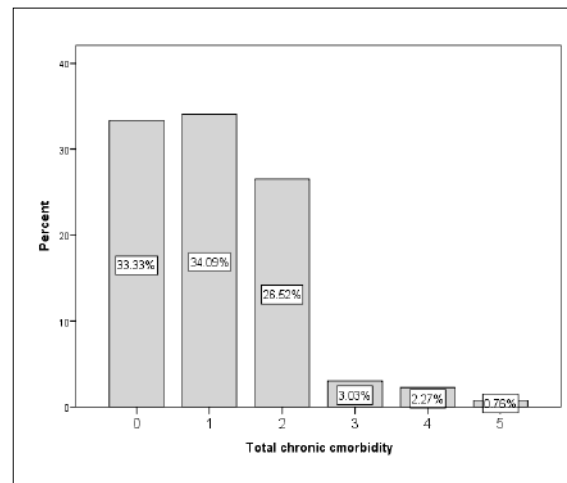**Figure 1** Glycemic control status of the patients

The median level of HbA1c of the study participants was 8.34% (IQR 7.4–9.9). Good glycemic control was achieved only in 22 (16.7%) of the total patients. Thirty-three (25%) patients had inadequate control, and more than half of the patients (56.3%) had poor glycemic control (Figure 1).

Comorbidities were present in 88 (66.7%) of the study patients, and one third (33.3%) of the patients had no chronic comorbidity, such as hypertension, ischemic heart disease, dyslipidemia, asthma, COPD, liver disease, or stroke. The most prevalent comorbidity was hypertension, followed by dyslipidemia, ischemic heart disease, liver disease, stroke and respiratory disease (Table I).

Table I Prevalence of individual chronic comorbid conditions in indigenous type 2 diabetic patients

Comorbidity	Frequency	Percentage (%)
Hypertension	72	54.5
Dyslipidemia	67	50.8
Ischemic heart disease	25	18.9
Liver diseases	11	8.3
Stroke	10	7.6
Asthma/COPD	8	6.1

COPD: Chronic Obstructive Pulmonary Disease.

Figure 2 Chronic comorbidity pattern of the studied indigenous type 2 diabetic patients

Out of 132 patients, 45 (34.1%), 35 (26.5%), and 8 (6.1%) patients had one, two, three or more chronic comorbidities, respectively (Figure 2).

Hypertension, dyslipidemia, and ischemic heart disease were significantly more prevalent among patients with poor glycemic control (p< 0.001, < 0.001 and 0.040, respectively). Stroke and asthma/COPD were also more common in the poorly controlled group, showing significant associations (p = 0.040 and 0.048, respectively). Overall, patients without comorbidities were more likely to achieve good glycemic control, whereas those with one or more comorbidities tended to have inadequate or poor control (Table II).

Table II Impact of comorbidity on glycemic control of the indigenous type 2 diabetic patients

Comorbidity	Glycemic control			p value
	Good (n=22)	Inadequate (n=33)	Poor (n=77)	
Hypertension				
Absent	17 (77.3)	19 (57.6)	24 (31.2)	<0.001
Present	5 (22.7)	14 (42.4)	53 (68.8)	

Comorbidity	Glycemic control			p value
	Good (n=22)	Inadequate (n=33)	Poor (n=77)	
Ischemic heart disease				
Absent	19 (86.4)	31 (93.9)	57 (74.0)	0.040
Present	3 (13.6)	2 (6.1)	20 (26.0)	
Dyslipidemia				
Absent	16 (72.7)	23 (69.7)	26 (33.8)	<0.001
Present	6 (27.3)	10 (30.3)	51 (66.2)	
Stroke				
Absent	22 (100.0)	31 (93.9)	69 (89.6)	0.040
Present	0 (0)	2 (6.1)	8 (10.4)	
Asthma/COPD				
Absent	22 (100.0)	33 (100.0)	69 (89.6)	0.048
Present	0 (0)	0 (0)	8 (10.4)	

COPD: Chronic Obstructive Pulmonary Disease, *Chi-square test.

Patients aged over 60 years were more likely to have comorbidities compared to those 60 or younger (OR: 3.12). Male patients had significantly higher odds of having comorbidities than females (OR: 1.19) Urban residence showed a trend toward higher comorbidity risk, though the association was not statistically significant (p = 0.098). Compared to those with lower education, patients with education above the primary level did not show a significant difference in comorbidity risk (p = 0.198). Socioeconomic status was inversely related to comorbidity, patients from upper-lower and lower-middle classes had lower odds of comorbidities than those from the lower class (OR: 0.79). Current smokers had nearly twice the odds of having comorbid conditions compared to non-smokers (OR: 1.98). Longer duration of diabetes (>10 years) was significantly associated with increased comorbidity (OR: 2.11). In terms of glycemic control, patients with poor control had higher odds of comorbidities compared to those with good control (OR: 3.01) whereas inadequate control was not significantly associated (Table III).

Table III Factors associated with comorbidities among the indigenous T2D patients

Characteristics	Comorbidity		p value
	Odds ratio	95% CI for OR	
Age			
≤60 Years (Reference)	1		
>60 Years	3.12	1.82-9.15	0.039
Gender			
Female (Reference)	1		
Male	1.19	1.03-4.25	0.015

Characteristics	Comorbidity		p value
	Odds ratio	95% CI for OR	
Residence			
Rural (Reference)	1		
Urban	2.41	0.89-6.15	0.098
Education			
Primary or below (Reference)	1		
Above primary level	0.88	0.05-2.15	0.198
Socioeconomic class			
Low class (Reference)	1		
Upper lower and lower middle	0.79	0.66-0.92	0.008
Smoking			
Nonsmoker (Reference)	1		
Smoker	1.98	1.01-5.25	0.048
Duration of diabetes			
≤5 Years (Reference)	1		
6-10 Years	1.78	0.95-3.43	0.124
>10 Years	2.11	1.12-6.45	0.007
Glycemic control			
Good (Reference)	1		
Inadequate	1.02	0.75-5.12	0.225
Poor	3.01	1.03-10.14	0.034

OR: Odds Ratio, CI: Confidence Interval.

Discussion

The current study found that approximately two-thirds (66.7%) of indigenous patients with Type 2 Diabetes Mellitus (T2DM) had at least one chronic comorbidity. Importantly, individuals with comorbid conditions were significantly more likely to exhibit inadequate or poor glycemic control compared to those without comorbidities. Understanding the burden and types of comorbidities in specific populations-such as indigenous communities-is essential for optimizing healthcare resource allocation, improving diabetes care strategies and reducing overall healthcare costs through better targeted interventions.

In this study, glycemic control among the indigenous T2DM patients attending Rangamati General Hospital was suboptimal, with 56.3% having poor and 25% having inadequate glycemic control. These findings are consistent with previous studies conducted in both Bangladeshi and international settings, which reported similarly high rates of uncontrolled diabetes.[15-17] Several earlier Bangladeshi studies indicated poor glycemic control in 69% to 88% of diabetic patients, reflecting a widespread issue in both urban and rural contexts.

The prevalence of comorbidities among the study participants was also notable. Hypertension (54.5%), dyslipidemia (50.8%) and ischemic heart disease (18.9%) were the most commonly reported comorbid conditions, along with stroke, asthma/COPD, and liver disease. These patterns are in line with findings from other studies on Bangladeshi populations. For instance, Shuvo et al. reported that 41.4% of T2DM patients had two or more chronic conditions, while Mannan et al. noted that 80.7% had at least one comorbidity, with a mean of 1.6 comorbid conditions per patient.[18,19] In that study, 32% had one comorbidity, 27% had two and smaller proportions had three or more.

Diabetes-related complications were also common, with 46.2% of patients developing at least one complication. Diabetic neuropathy (25.4%) was the most frequent, followed by nephropathy (20.5%) diabetic foot (9.1%) and retinopathy (3.8%). These figures are comparable to those reported by Abera et al. where 35.1% of patients had one or more complications and 9% had multiple.[20]

Hypertension was strongly associated with poor glycemic control in this study, reinforcing findings from previous research.[21] Similar associations were reported in studies such as that by Chen et al. who found elevated blood glucose to be an independent predictor of hypertension in middle-aged and older Chinese adults with diabetes.[22] Derakhshan et al. also demonstrated that individuals with prediabetes were significantly more likely to develop hypertension compared to those with normal glucose tolerance.[23]

Dyslipidemia, confirmed through fasting lipid profile in addition to self-reported diagnosis, was present in over half of the patients (50.8%). This is considerably higher than previously reported rates, such as 12.2% in studies relying solely on clinical diagnoses without biochemical confirmation.[18,19] The incorporation of screening data in this study likely contributed to a more accurate estimate.

Cardiovascular disease is known to affect about one-third of individuals with T2DM globally and is the leading cause of diabetes-related mortality.[24] In this study, 18.9% of patients were found to have IHD, confirmed by electrocardiography and

it was significantly linked with poor glycemic control. Prior research has shown that patients with T2DM and poor glycemic control exhibit more severe coronary artery disease and impaired vascular function,[25] highlighting the importance of stringent glucose regulation.

Age was another significant determinant of comorbidity. Patients aged over 60 years had a higher likelihood of having one or more comorbidities, consistent with numerous studies demonstrating that comorbid conditions increase substantially with age.[18,26] Age-related physiological decline likely contributes to the accumulation of multiple chronic conditions.

Gender differences were also evident, with male patients exhibiting higher odds of comorbidities compared to females. This observation aligns with findings from earlier studies.[18,27] Potential reasons include biological differences in disease presentation and healthcare-seeking behavior. For example, cardiovascular symptoms in females with T2DM are often atypical and may be underrecognized.[28]

While educational attainment was not significantly associated with comorbidity in this study-possibly due to limited sample size-patients with lower educational levels did show a trend toward higher risk. Prior evidence supports an inverse relationship between education and multimorbidity, suggesting that higher education promotes health literacy, adoption of healthier lifestyles, and better access to care.[29,30] Similarly, patients from higher socioeconomic groups in our study were less likely to have comorbidities, consistent with findings that low-income populations may have poorer health outcomes and lower healthcare access.[31]

The duration of diabetes was another key factor associated with comorbidity. Patients with T2DM for over 10 years were more likely to have one or more comorbid conditions. This is supported by findings from Bangladesh, Ethiopia, China and Malaysia, where longer disease duration has been linked with increased complications and disease burden.[18,20,32,33] Poor glycemic control further exacerbates the risk of complications by promoting vascular damage through glycation of structural proteins and enhanced atherogenesis.[26]

Limitations

Several limitations should be acknowledged when interpreting the findings of this study. Firstly, the study was confined to a single secondary-level healthcare facility and utilized a convenience sampling method, which may limit the generalizability of the results to the broader indigenous population. Secondly, data on lifestyle factors and comorbidities were primarily self-reported, raising the possibility of social desirability and reporting biases. Thirdly, due to the cross-sectional study design, causal relationships could not be established and recall bias may have influenced participants' responses. Lastly, the assessment of comorbid conditions was limited by the scope of available diagnostic investigations, potentially underestimating their true prevalence.

Conclusions

This study revealed a considerable burden of comorbidities among indigenous patients with type 2 diabetes attending Rangamati General Hospital. Notably, 66.7% of participants had at least one comorbid condition, and glycemic control was found to be suboptimal in the majority of cases—over 80% of patients exhibited either inadequate or poor glycemic control. These findings underscore the urgent need for targeted interventions to manage both diabetes and its associated comorbidities within this vulnerable population. Comprehensive care strategies are essential to reduce complications and improve overall health outcomes among indigenous T2D patients.

Recommendations

To address the fragmented nature of diabetes management in the region, an integrated approach to diabetes and comorbidity care is imperative. Tailored interventions should focus on the early identification and management of high-risk groups, particularly older adults, individuals with a longer duration of diabetes, and those with poor glycemic control. Strengthening follow-up care through regular hospital visits, enhanced monitoring and patient education may improve disease outcomes. Additionally, greater investment in community-based health education programs, lifestyle modification strategies, and accessible diagnostic services is essential. Further research

involving larger, more representative samples is recommended to better understand the interplay between comorbidities and glycemic control in indigenous populations.

Contribution of authors

MKHL-Conception, design, acquisition of data, data analysis, drafting & final approval.

GD-Design, acquisition, interpretation of data, critical revision & final approval.

MRI-Data analysis, interpretation of data, critical revision & final approval.

HC-Data analysis, drafting & final approval.

NM-Acquisition of data, drafting & final approval.

Disclosure

All the authors declared no conflict of interest.

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