Prevalence and Determinants of Type-2 Diabetes Mellitus in Selected Diabetes Centers of Coastal Bangladesh

*Rabeya S,[1] Jharna DE,[2] Muttalib MA,[3] Uddin ME,[4] Mehnaz F,[5] Sarkar MRA[6]

Abstract

Background: Diabetes mellitus is a major health problem worldwide and it is growing at an alarming rate in the underprivileged regions and developing countries as well. Early detection of diabetes is an important tool for identifying the risk factors and applying the preventive measures. Based on the reviews, this research focused on detecting the prevalence and associated risk factors of prediabetes and diabetes in patients attending four diabetes centers in Barishal coast of Bangladesh.

Objectives: The general objective of this research was to ascertain the prevalence rate of diabetes mellitus along with its sociodemographic, biochemical and anthropometric risk factors.

Methods: A cross-sectional study with 432 study subjects was conducted in four diabetes centers viz. Barishal, Bakerganj, Patuakhali and Dumki. Socio-demographic information, clinical data and biochemical information were collected by using a structured questionnaire, clinical measurements and laboratory investigations through standard procedures. Criteria of glycaemia were utilized to diagnose diabetes mellitus and prediabetes. Multivariate and bivariate logistic regression analyses were performed to identify T2DM associated risk factors.

Results: Among the subjects, the prevalence rate of diabetes was 68.8% wherein the contribution of individual centers were 26.9, 15.0, 17.1 and 10.0% in Barishal, Bakergonj, Patuakhali and Dumki, respectively. Diabetes was more prevalent among female individuals age >51years, with a positive family history of diabetes, elevated total cholesterol and triglyceride levels. Multivariate logistic regression showed that high total cholesterol and triglyceride levels were strongly associated with diabetes. Participants with high total cholesterol had more than eight fold higher odds of diabetes (AOR = 8.16, 95%CI: 3.89-20.03), while elevated triglyceride levels were associated with 8.74 times increased risk (AOR = 8.74, 95%CI: 5.41-14.36). Individuals with a positive family history of diabetes were also found to have higher odds of diabetes (AOR = 3.54, 95%CI: 1.92-6.79). Moderate association existed between age and diabetes. On the other hand, there was a significant relationship between prediabetes with age, education status and smoking. Higher education appeared to exerts protective effect against diabetes.

Conclusion: In general, this study shows high prevalence of diabetes and prediabetes among the subjects visiting the selected diabetes centers. Diabetes is highly dependent on positive family history followed by higher cholesterol and triglyceride levels. In order to restrict the rate of prevalence and associated risk factors of diabetes, increasing awareness along with systematic lifestyle and early interventions are crucial for the studied area.

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1. **Dr. Sultana Rabeya, MBBS, MPhil (Biochemistry, MMC), PhD Fellow, Department of Biochemistry and Molecular Biology, Patuakhali Science and Technology University, Patuakhali- 8660, Bangladesh. src762001@yahoo.com. ORCID: https://orcid.org/0009-0009-6153-1079.*
2. *Professor Dr. Dilruba Easmin Jharna, PhD, Professor of Biochemistry and Molecular Biology, Patuakhali Science and Technology University, Patuakhali- 8660, Bangladesh, jharnabcm@pstu.ac.bd. ORCID:https://orcid.org/0009-0006-5574-4623*
3. *Professor Dr. Mohammed Abdul Muttalib, MBBS, MPhil (Biochemistry), Ex-Professor & Head, Biochemistry, Mymensingh Medical College and Ex-Director, Laboratory Services, BIRDEM, dramuttalib007@gmail.com. ORCID:https://orcid.org/0009-0002-2206-047X*
4. *Professor Md. Ektear Uddin. PhD, Professor of Agricultural Extension and Rural Development, Patuakhali Science and Technology University Dumki, Patuakhali- 8660, Bangladesh Email: ektear@pstu.ac.bd. ORCID: https://orcid.org/0000-0002-8003-8134*
5. *Farin Mehnaz, Zainul Haque Sikder Women's Medical College, Dhaka – 1209. fmehnaz973@gmail.com. ORCID:https://orcid.org/0009-0001-2298-0308*
6. *Md. Ripon Ali Sarker, PhD Fellow, Department of Biochemistry and Molecular Biology, Patuakhali Science and Technology University, Patuakhali-8660. riponalisarkar@gmail.com. ORCID:https://orcid.org/ 0000-0000-7988-1952.*

**For correspondence*

Introduction

Type 2 diabetes mellitus is a metabolic disorder that features high blood sugar levels due to either deficiency in insulin production or its action or both.[1] It has developed as one of the significant global public health issues due to its increasing incidence rate and longstanding complications[1] according to the IDF Diabetes Atlas (11th edition), the incidence of adult patients suffering from diabetes was about 589 million in 2024, which is expected to increase to 853 million cases by 2050.[1] Additionally, an estimated 488 million adults have impaired fasting glucose and 635 million have impaired glucose tolerance worldwide.[2]

Prediabetes is a serious condition where blood sugar levels are higher than normal but not yet high enough to be diagnosed as type 2 diabetes. It is also known as intermediate hyperglycemia. Studies reveal that both impaired fasting glucose and impaired glucose tolerance are highly associated with type-2 diabetes and cardiovascular disease. Thus, it is essential to diagnose prediabetes because treatment will prevent progression into other diseases.[3]

There are significant transitions in terms of epidemiology and lifestyles occurring in Bangladesh, which lead to the higher occurrence of Noncommunicable Disease (NCD) such as diabetes and its associated prediabetic conditions.[4] South Asians are predisposed to glucose deregulation because of genetic disposition and physical inactivity, especially when there is central obesity.[5] Several prediabetic risk factors have already been identified in the past, specifically older age, being a male, higher BMI, hypertension and less physical activity. Unfortunately, much research concerning prediabetes in Bangladesh is limited since previous literature tends to focus more on diabetes.[6] However, most of these studies have primarily focused on diabetes rather than prediabetes, thereby limiting understanding of early disease stages and opportunities for prevention.[6]

Despite the growing recognition of prediabetes as a major public health concern, several gaps remain in the existing literature. First, there is limited faculty-based evidence from diabetes centers, where high-risk individuals are more likely to be identified and managed. Second, inconsistencies in diagnostic criteria whether based on fasting plasma glucose, oral glucose tolerance test, or HbA1c can lead to variation in reported prevalence and associated risk factors. According to recent global analyses, prediabetes defined using fasting plasma glucose levels of 6.1-6.9 mmol/L (WHO criteria) remains a widely accepted and comparable standard across studies.[7] Recent evidence indicates that patient awareness of diabetes is critically low: nationally, only around 31% of individuals with the condition knew they had it, with 28% receiving treatment and 26.5% achieving control.[8] In rural settings, knowledge about key aspects of the disease including symptoms, risk factors, complications and prevention is notably inadequate.[9]

In spite of an increased incidence of T2DM in Bangladesh, there is limited information from the disadvantaged locations like coastal area. The Barishal region, with its own set of environmental exposures, lifestyle and access to healthcare facilities, is one of the vulnerable regions. Until now, only a handful of studies have attempted to explore the prevalence and determinants of T2DM among patients visiting the diabetes centers in this region. The role of sociodemographic, behavioral and clinical factors contributing to the epidemiology of type 2 diabetes in this region has also not been explored. Therefore this study aimed to assess the prevalence of both diabetes and prediabetes and to identify

their associated sociodemographic and biochemical risk factors among individuals attending selected four diabetes centers in coastal Bangladesh.

Methods

Study design and sampling method

A descriptive cross-sectional study was conducted during June 2024 and June 2025 in four selected diabetic centers in Barishal region viz. Barishal Diabetic Center (BDC), Patuakhali Diabetic Center (PDC), Bakerganj Diabetic Center (BkDC) and Dumki Diabetic Center (DDC). Stratified sampling was applied by categorizing centers into district (BDC and PDC) and upazilla (BkDC and DDC) strata. Total 432 adult subjects (aged ≥ 18 years, 263 female and 169 male) who agreed to participate voluntarily, were selected as study participants. Inclusion criteria considered people of both genders aged ≥ 18 years and older. Exclusion criteria comprised individuals with gestational diabetes, patients with severe illness and those unwilling to provide informed consent.

Sample size calculation

The sample size was calculated by using the following formula: Minimum sample size

$n= z^2 \times p \times (1- p)/e^2$

Here, the following features were considered: (i) since there is no any comparable research of four diabetes centers in central coastal region in Bangladesh, a 50% predicted prevalence was selected (p = 0.5) with (ii) 95% level of confidence (Z = 1.96) and (iii) 5% margin of error (e = 0.05). Thus, a minimum required sample of 384 participants was calculated. Additionally, an optimal sample size of 432 was estimated by considering a 10% non-response rate. In order to enhance the external validity and generalizability of the study, we targeted the inclusion of more participants than the sample size calculated.[10] Participants were selected through random sampling while the variation in the number of participants (154 from Barishal, 106 from Patuakhali, 87 from Bakerganj and 85 from Dumki) among centers reflected differences in patient volume and attendance rates.

Data collection procedure and tools

Data were collected through face-to-face interviews using pre-tested, structured, close-ended questionnaire and clinical measurements. Anthropometric measurements, including height and weight were obtained using standard procedures and body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Glycosylated hemoglobin (HbA1c) levels and blood pressure (BP) were measured and recorded following standardized protocols outlined in the World Health Organization STEP wise approach to non-communicable disease factor surveillance.[11] A BMI cut-off value of ≥ 23 kg/m^2 was used to define overweight, as recommended by the World Health Organization for Asian populations.[12] Blood pressure was measured for all participants using a sphygmomanometer in accordance with the guidelines of the American Heart Association.[13] Oral Glucose Tolerance Test (OGTT) was measured using the glucose oxidase-peroxidase (GOD-POD) method. Total cholesterol and triglycerides were determined by enzymatic colorimetric methods using an automated chemistry analyzer (DIRUI CS-T240, China).[14,15,-16]

Variable and measures

The dependent variables in the study were diabetes mellitus and prediabetes, which were defined based on the level of fasting blood glucose, The independent variables in the study included sociodemographic factors (age, sex, education level, occupation, place of residence), behavioral factors (smoking), family history of diabetes and biochemical

factors (BMI, blood pressure, total cholesterol and triglyceride level).

Ethical considerations

The study was conducted in accordance with the World Medical Association Declaration of Helsinki 2001 and the study protocol and ethics files were scrutinized and approved by the Institutional Ethical Committee (IEC) of Patuakhali Science and Technology University, Bangladesh (ethical approval reference number: PSTU/IEC/2022/84). The informed written consent and self-nominated involvement were taken from all of the participants. Stricter privacy and confidentiality of their own data were ensured.

Data screening and statistical analysis

Data screening involved examining all completed questionnaires immediately after data collection and again before data analysis. This ensured completeness and consistency of data. Microsoft Excel was used for data entry and analysis. 'R' studio (version 4.5.1) was used for data analysis. Descriptive statistics were used to analyze the data. Frequencies and percentages were used to summarize the data. Bivariate and multivariable logistic regression analysis were done to check for associated factors. Odds ratio with 95% confidence intervals was used to show the findings. A p-value of less than 0.05 was considered significant.

Results

The socio-demographic information of the 432 participants included in the study are presented in the Table I. Most of the participants were females (61%), while 39% were males.

About 50% of the participants were in the age range 31-50 years, 48% above 51 years, while 2% were below 30 years. The educational level of the participants showed that almost half of the participants had primary level of education (45%), followed by 19% having no formal education and 16% having completed graduation. The place of residence showed that most of the participants were from Barishal (35%), followed by Patuakhali (25%), Bakerganj (20%) and Dumki (20%). The occupational level showed that most of the participants were housewives (51%), followed by employed people (20%) and businessmen (16%). Most of the participants had no family history of diabetes (72%), while 28% had a positive family history. Most of the participants were non-smokers (89%), while 11% were smokers.

The prevalence of diabetes mellitus (DM) and prediabetes in relation to socio-demographic factors of 432 participants is presented in Table II. The prevalence of DM was higher in females (41.9%) than in males, as was prediabetes (4.9%). The highest prevalence of DM was observed in the 31-50 years (33.3%) and > 51 years (33.6%) age groups, whereas prediabetes was higher in the 31-50 years age group (4.9%). The highest prevalence of DM was observed in the primary education (34.0%) group, whereas prediabetes was higher in the graduate group (2.8%).

The highest prevalence of DM was observed in the Barishal center (26.9%), whereas prediabetes was higher in the Dumki center (2.3%). The highest prevalence of both DM (35.4%) and prediabetes (3.2%) was observed in the housewife group. The highest prevalence of DM (46.1%) and prediabetes (5.8%) was observed in the non-diabetes family history group. The highest proportion in both DM (68.9%) and prediabetes (7.4%) was observed in with non-smoker category.

Data in Table III revealed that biochemical parameters had shown notable association between diabetes and prediabetes respondants in elevated total cholesterol had markedly

higher prevalence of diabetes compared to those with normal cholesterol levels. Among individuals with high total cholesterol, 21.5% had diabetes, whereas only 47.5% cases were observed among those with normal cholesterol levels. Prediabetes was also slightly higher among participants with elevated cholesterol.

Triglyceride levels showed a strong association with diabetes status. A substantially higher proportion of participants with elevated triglycerides were 59.03% diabetic compared to those with 9.9% normal triglyceride levels. Prediabetes was also more frequent among participants with higher triglyceride levels. Regarding blood pressure, both systolic and diastolic hypertension were associated with a higher prevalence of diabetes. Among hypertensive individuals, 12.5% had diabetes based on systolic blood pressure, compared to 56.5% among non-hypertensive individuals. Similarly, diastolic hypertension showed higher proportions of diabetes 13.7% compared to non-hypertensive participants 55.3%.

Body mass index (BMI) demonstrated an association with diabetes. Participants classified as overweight or obese had a considerable proportion of diabetes 28.0% compared to those with normal weight 41.0%. Prediabetes was also slightly more prevalent among overweight and obese individuals. An elevated total cholesterol, high triglyceride levels, hypertension, and increased BMI were observed more frequently among participants with diabetes and prediabetes, indicating their potential role as important risk factors. The overall prevalence of impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) was 25.7% and 29.4% respectively. Both IFG and IGT were slightly higher among females (27.0% and 30.0%) compared to males (23.7% and 28.4%); however, the differences were not statistically significant ($p > 0.05$) (Table IV).

In table V, bivariate analysis revealed significant associations with diabetes, family history of diabetes, systolic blood pressure, total cholesterol, triglyceride levels, and body mass index (BMI). These variables were subsequently included in the multivariable logistic regression model.

Results revealed that a family history of diabetes had significantly higher odds ratios of developing diabetes compared to those without such history (AOR = 3.54, 95% CI: 1.92-6.79, $p < 0.001$). Smoking history was not significantly associated with diabetes in either crude or adjusted analysis. Participants with systolic hypertension had higher odds of diabetes (COR = 1.90, 95% CI: 1.01-3.55); however, this associations was not statistically significant after adjustment (AOR = 2.00, 95% CI: 0.94-4.52). In case of diastolic blood pressure no significant associated was found with diabetes.

Body mass index showed a significant association with diabetes where overweight and obese participants had lower odds of diabetes compared to normal-weight individuals (AOR = 0.45, 95% CI: 0.27-0.73, $p = 0.001$). Total cholesterol demonstrated a strong and significant association with diabetes. Participants with elevated total cholesterol had more than eight times higher odds of diabetes compared to those with normal levels (AOR = 8.16, 95% CI: 3.89-20.03, $p < 0.001$). Elevated triglyceride levels were strongly associated with diabetes, showing that an increased triglyceride had approximately nine times higher odds of diabetes compared to those with normal levels (AOR = 8.74, 95% CI: 5.41-14.36, $p < 0.001$).

In the adjusted regression model, most of the socio-demographic (sex, place of residence,

occupation and family history of diabetes) and clinical (SBP and DBP) variables had no significantly associated with prediabetic condition (Table VI). Sex had no significant association with prediabetes (AOR = 1.86, 95% CI: 0.52-6.74, p = 0.337). Age >51 years had lower odds of prediabetes compared to those aged 31-50 years (AOR = 0.94, 95% CI: 0.90-0.98, p = 0.008).

A significant association of education with prediabetes indicated that the primary education (AOR = 0.15, 95% CI: 0.04-0.50, p = 0.003) and the secondary education (AOR = 0.14, 95% CI: 0.02-0.65, p = 0.024) had significantly lower odds of prediabetes compared to those with graduation level. Body mass index (BMI) initially showed a significant association in crude analysis (COR = 2.92, 95% CI: 1.40-6.08), but this association disappeared when adjusted odd ratio was calculated (AOR = 1.14, 95% CI: 0.49-2.68, p = 0.762). In respect of smoking history, a significant association was observed with prediabetes where in smokers had lower odds compared to non-smokers (AOR = 0.14, 95% CI: 0.02-0.70, p = 0.030).

Table I: Socio-demographic characteristics of the study participants

Variables	Category	Frequency (n%)
Sex	Male	169(39)
	Female	263(61)
Age	<30 Yrs	9(2)
	31 - 50 Yrs	218(50)
	>51 Yrs	205(48)
Education	None	82(19)
	Primary	194(45)
	Secondary	46(11)
	Higher secondary	39(9)
	Graduation	71(16)
Address	Barishal	154(35)
	Patuakhali	106(25)
	Bakerganj	87(20)
	Dumki	85(20)
Occupation	Employed	86(20)
	Businessman	69(16)
	Housewives	222(51)
	Others(Retired/Laborer/Farmer/unemployed)	55(13)
Family history of diabetes	With family history	120(28)
	No family history	312(72)
Smoking history	Non smoker	384(89)
	Smoker	48(11)

Table II: Prevalence of diabetes and prediabetic condition by socio-demographic characteristics of the study participants (n = 432)

Variables	Category	DM		Prediabetes	
		No (%)	Yes (%)	No (%)	Yes(%)
Sex	Male	52(12.0)	117(27.0)	39(9.0)	13(3.0)
	Female	82(18.9)	181(41.9)	61(14.1)	21(4.9)
Age	<30 Yrs	0	9 (2.1)	0	0
	31 - 50 Yrs	74(17.1)	144(33.3)	53(12.3)	21(4.9)
	>51 Yrs	60(13.9)	145(33.6)	47(10.9)	13(3.0)
Education	None	38(8.8)	44(10.2)	31(7.2)	7(1.6)
	Primary	47(10.9)	147(34.0)	40(9.3)	7(1.6)
	Secondary	8(1.6)	38(8.8)	6(1.4)	2(0.5)
	Higher secondary	13(3.0)	26(6.0)	7(1.6)	6(1.4)
	Graduation	28(6.5)	43(10.0)	16(3.7)	12(2.8)
Address	Barishal	38(8.8)	116(26.9)	29(6.7)	9(2.1)
	Patuakhali	32(7.4)	74(17.1)	26(6.0)	6(1.4)
	Bakergonj	22(5.1)	65(15.0)	13(3.0)	9(2.1)
	Dumki	42(9.7)	43(10.0)	32(7.4)	10(2.3)
Occupation	Employed	28(6.5)	58(13.4)	21(4.9)	7(1.6)
	Businessman	24(5.5)	45(10.4)	18(4.2)	6(1.4)
	Housewives	69(15.9)	153(35.4)	55(12.7)	14(3.2)
	Others Retired/Laborer/Farmer/unemployed	13(3.0)	42(9.7)	6(1.4)	7(1.6)
Family history of diabetes	With family history	21(4.9)	99(22.9)	12(2.8)	9(2.1)
	No family history	113(26.2)	199(46.1)	88(20.4)	25(5.8)
Smoking history	Non-smoker	117(27.1)	267(61.8)	85(19.7)	32(7.4)
	Smoker	17(3.9)	31(7.1)	15(3.5)	2(0.4)

Table III: Prevalence of diabetes and prediabetic condition related to biochemical and anthropometric measurements of study participants (n = 432)

Variables	Category	DM		Prediabetes	
		No (%)	Yes (%)	No (%)	Yes (%)
Total- cholesterol	<200mg/dl	127 (29.4)	205(47.5)	98(22.7)	29(6.7)
	≥200mg/dl	7(1.6)	93(21.5)	2(0.5)	5(1.2)
Triglyceride	<150mg/dl	82(18.9)	43(9.9)	70(16.2)	12(2.8)
	≥150mg/dl	52(12)	255(59.03)	30(6.9)	22(5.1)
SBP	Hypertensive	14(3.2)	54(12.5)	7(1.6)	7(1.6)
	Non-hypertensive	120(27.8)	244(56.5)	93(21.5)	27(6.25)
DBP	Hypertensive	22(5.1)	59(13.7)	11(2.5)	11(2.5)
	Non-hypertensive	112(25.9)	239(55.3)	89(20.6)	23(5.3)
BMI	Normal weight	54(12.5)	177(41.0)	22(5.1)	16(3.7)
	Overweight & Obese	80(18.5)	121(28.0)	44(10.2)	18(4.1)

SBP= Systolic blood pressure, DBP= Diastolic blood pressure, BMI= Body mass index, % = Percentage

Table IV: Prevalence of T2DM impaired fasting glucose and impaired glucose tolerance according to WHO criteria.

Sex	Total (n)	IFG (%)	IGT (%)
Female	263	71 (27.0%)	79 (30.0%)
Male	169	40 (23.7%)	48 (28.4%)
Total	432	111 (25.7%)	127 (29.4%)

Table V: Bivariate and multivariable analysis of factors associated with diabetes among study participants (n = 432)

Variables	Category	Diabetes		COR (95%CI)	AOR (95%CI)	p value
		DM (n)	No DM(n)			
FHDM	Yes	99	21	2.68 (1.58–4.52)	3.54 (1.92–6.79)	<0.001
	No	199	113	1 (Ref)	1	
Smoking history	Non smoker	267	117	1 (Ref)	1	0.51
	Smoker	31	17	0.80 (0.43–1.50)	0.74 (0.30 – 1.82)	
SBP	Hypertensive	54	14	1.90 (1.01–3.55)	2.00 (0.94–4.52)	0.043
	Non –hypertensive	244	120	1 (Ref)	1	
DBP	Hypertensive	59	22	1.26 (0.73–2.15)	0.98 (0.50–1.97)	0.405
	Non –hypertensive	239	112	1 (Ref)	1	
BMI	Normal weight	177	54	1 (Ref)	1	
	Overweight & Obese	121	80	0.46 (0.30–0.70)	0.45 (0.27–0.73)	<0.001
TC	<200mg/dl	205	127	1	1	<0.001
	≥200mg/dl	93	7	8.23 (3.70–18.31)	8.16(3.89 – 20.03)	
TG	<150mg/dl	43	82	1	1	<0.001
	≥150mg/dl	255	52	9.35 (5.82 – 15.03)	8.74 (5.41 – 14.36)	

Notes: $p < 0.05$, statistically significant association

Abbreviations: AOR = Adjusted odd ratio; CI = Confidence interval; COR = Crude odd ratio; FHDM = Family history of diabetes mellitus; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; BMI = Body mass index; TC = Total cholesterol; TG = Triglyceride; Results are expressed as number (n).

Table VI: Factors associated with prediabetes among study participants (n = 432)

Variables	Category	Prediabetes No (%)	Yes (%)	COR(95%CI)	AOR(95%CI)	p value
Sex	Male	39(9.0)	13(3.0)	1.03(0.46-2.30)	1.86(0.52 – 6.74)	
	Female (Ref)	61(14.1)	21(4.9)	1	1	0.337
Age	<30 Yrs	0	0			
	31 - 50 Yrs (Ref)	53(12.3)	21(4.9)	1	1	0.34
	>51 Yrs	47(10.9)	13(3.0)	0.70(0.32-1.52)	0.94(0.90 – 0.98)	0.008
Education	None	31(7.2)	7(1.6)	0.46(0.16-1.21)	0.51(0.11 – 2.30)	0.383
	Primary	40(9.3)	7(1.6)	0.18(0.07-0.48)	0.15(0.04 – 0.50)	0.003
	Secondary	6(1.4)	2(0.5)	0.22(0.03-0.87)	0.14(0.02 – 0.65)	0.024
	Higher secondary	7(1.6)	6(1.4)	0.89(0.29-2.53)	0.64 (0.18– 2.08)	0.466
	Graduation (Ref)	16(3.7)	12(2.8)	1	1	
Address	Barishal	29(6.7)	9(2.1)	2.23(0.74-6.74)	0.40 (0.12– 1.28)	0.124
	Patuakhali	26(6.0)	6(1.4)	0.74(0.23-2.38)	0.45 (0.12– 1.56)	0.213
	Bakergonj (Ref)	13(3.0)	9(2.1)	1	1	
	Dumki	32(7.4)	10(2.3)	1.01(0.36-2.82)	1.14 (0.36– 3.59)	0.824
Occupation	Employed	21(4.9)	7(1.6)	1.00(0.29-3.42)	0.48 ((0.12– .82)	0.275
	Businessman (Ref)	18(4.2)	6(1.4)	1	1	
	Housewives	55(12.7)	14(3.2)	0.76(0.29-2.01)	0.66 (0.17– 2.85)	0.57
	Others (Retired/Laborer/Farmer/unemployed)	6(1.4)	7(1.6)	3.50(0.96-12.71)	3.39 (0.67 18.03)	0.143
Family history of diabetes	With family history	12(2.8)	9(2.1)	2.64(0.99-7.02)	0.69 (0.24 1.83)	0.05
	No family history (Ref)	88(20.4)	25(5.8)	1	1	
SBP	Hypertensive	7(1.6)	7(1.6)	3.44(1.13-10.46)	.06(0.31-3.39)	0.926
	Non –hypertensive (Ref)	93(21.5)	27(6.25)	1	1	
DBP	Hypertensive	11(2.5)	11(2.5)	3.87(1.49-10.07)	1.97(0.64-5.81)	0.227
	Non –hypertensive (Ref)	89(20.6)	23(5.3)	1	1	
BMI	Normal weight(Ref)	22(5.1)	16(3.7)	1	1	
	Overweight & Obese	44(10.2)	18(4.1)	2.92(1.40-6.08)	1.14(0.49-2.68)	0.762
Smoking history	Non-smoker (Ref)	85(19.7)	32(7.4)	1	1	
	Smoker	15(3.5)	2(0.4)	0.35(0.07-1.64)	0.14(0.02 – 0.70)	0.030

Notes: $p < 0.05$, statistically significant association, Abbreviations: AOR = Adjusted odd ratio; CI = Confidence interval; COR = Crude odd ratio; FHDM = Family history of diabetes mellitus; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; BMI = Body mass index; TC = Total cholesterol; TG = Triglyceride; Results are expressed as number (n).

Discussion

This study aimed to assess the prevalence and determinants of diabetes and prediabetes among participants visiting four diabetes centers in coastal Bangladesh. Findings demonstrated a high prevalence rate of diabetes and prediabetes and its strong association with various socio-demographic, biochemical and anthropometric factors among the study populations. These outcomes might encompass the regional inherent risk factors like poverty, lack of healthcare facilities, nutritional imbalance, climate related stress and lack of knowledge about chronic diseases. General progression of these factors is becoming a major public health issue in the coastal areas of Bangladesh. In this study, the prevalence of diabetes among the centers where graded as BDC>PDC>BkDC>DDC, while the prediabetes status was graded as DDC>BDC & BkDC>PDC. Our findings are consisted with previous discoveries that a high burden of diabetes are driven by poverty, limited health care access, imbalanced diet, knowledge gap and vulnerable environment in the coastal region,[17]

In our study, prevalence of DM and prediabetes were higher in female than male which comply with the previous findings that age-standardized prevalence of diabetes and pre-diabetes among women were higher compared to men[18]. In addition, the presence of some risk factors, including dyslipidemia, obesity and hypertension, as well as a family history of diabetes among the diabetic subjects were found to be aggregated with cardiovascular and renal risks. These findings are comparable to the reports that participants with known family history of diabetes had higher risk than those with negative or unknown history[19]. Participants with high total cholesterol had more than eight times higher odds of diabetes, while those with elevated triglycerides also demonstrated a similarly increased risk. Previous studies have identified that dyslipidemia was a major risk factor for type 2 diabetes due to its role in insulin resistance and metabolic dusfunction.[20,21]

Multivariate regression analysis indicated significant associations between diabetes and linked independent variables. Age was significantly associated with diabetes and prediabetes, indicating that the risk increases with advancing age. Global evidence suggests that aging is an important non-modifiable risk factor for diabetes due to progressive β-cell dysfunction and increased insulin resistance.[22] On the other hand, factor associated with increased prevalence of having diabetes were increasing age, obesity, hypertension, being in the highest wealth quintile and living in Dhaka division.[18] We found that a family history of diabetes was another significant determinant where a positive family history showed more than threefold increased odds of diabetes. This finding aligns with earlier research highlighting the combined influence of genetic predisposition and shared lifestyle factors in the development of diabetes[19]. In this study, elevated total cholesterol and triglyceride levels were found to be strong independent predictors of diabetes. Systolic blood pressure showed a significant association in crude analysis but lost significance after adjustment, suggesting the presence of confounding factors. Diastolic blood pressure and smoking were not significantly associated with diabetes in this study.

Regarding prediabetes, fewer independent variables had significant associations. Particularly, age and education were significantly related to prediabetes, where older individuals showed lower odds, possibly due to progression from borderline condition to diabetes over time. Education appeared to have a protective effect, which may reflect better awareness and healthier lifestyle practices among more educated individuals. An unexpected finding was the inverse association between smoking and prediabetes. This result is not consistent with existing literature and may be due to the small number of smokers in the sample or residual confounding. Therefore, this finding should be interpreted with caution. Interestingly, body mass index (BMI) showed an inverse association with diabetes in the adjusted regression model, where overweight and obese individuals had lower odds of diabetes. This unexpected observation may be influenced by residual confounding, reverse causality and disease related weight loss or difference in lifestyle and treatment pattern among the diabetes participants.

Conclusion

This study has shown a high prevalence of diabetes and prediabetes conditions among the subjects visiting the selected four diabetes centers. Family history, high total cholesterol and high triglycerides were found to be significantly associated with diabetes. Limited associations were found with prediabetes, where age, education and smoking status were significant factors. Since this is a diabetes center specific investigation, further studies with household-based larger sample size and also longitudinal observations could be done before comprehensive recommendation on T2 DM in the disadvantaged coastal population of Bangladesh.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Disclaimer

The authors are solely responsible for the content and writing of this article.

References

1. International Diabetes Federation. IDF Diabetes Atlas. 11th ed. Brussels: IDF; 2024.pp18-25.
2. International Diabetes Federation. Global diabetes data and estimates 2024 (Diabetes atlas). Pp18-31.
3. International Diabetes Federation. Intermediate hyperglycaemia (IFG & IGT) definitions and risks (NCBI). IDF Diabetes Atlas. 10th ed. Brussels: IDF; 2021-15
4. Sujon H, Rahman MM, Haque MA, Banu S, Ananta TT, Sarker MHR. Prevalence and Associated Factors of Prediabetes and Diabetes in Rural and Peri-Urban Bangladesh: A Community-Based Cross-Sectional Study. Cureus. 2025 Jul 1; 17(7):e87090. doi: 10.7759/cureus.87090. PMID: 40747186; PMCID: PMC12311873.
5. Akhtar S, Nasir JA, Sarwar A, Nasr N, Javed A, Majeed R, Salam MA, Billah

B. Prevalence of diabetes and pre-diabetes in Bangladesh: a systematic review and meta-analysis. BMJ Open. 2020 Sep 9;10(9):e036086. doi: 10.1136/bmjopen-2019-036086. PMID: 32907898; PMCID: PMC7482481.

6. Rahman MA, Halder HR, Kundu S, Sultana F, Islam SMS. Trends in the prevalence and associated factors of prediabetes and diabetes in Bangladesh: Evidence from population-based cross-sectional surveys. Diabetes Res Clin Pract. 2022 Aug;190:109873. doi: 10.1016/j.diabres.2022.109873. Epub 2022 Apr 15. PMID: 35436546.
7. Rooney MR, et al. Global and regional prediabetes prevalence updates (2024).(PMC). Diabetes Care.2025Sep9:48(11):e142-e144.doi:10-2337/dc25-1640
8. Baig M, Gazzaz ZJ, Atta HM, Mostafa MM, Jameel T, Murad MA et al. Patient Safety Attitudes Among Saudi Medical Students and Interns: Insights for Improving Medical Education. AdvMedEducPract.2024;15:1349-1360. doi.org/10.2147/AMEP.S503055
9. Kiberenge MW, Ndegwa ZM, Njenga EW, Muchemi EW. Knowledge, attitude and practices related to diabetes among community members in four provinces in Kenya: a cross-sectional study. Pan Afr Med J. 2010;7:2. Epub 2010 Oct 6. PMID: 21918691; PMCID: PMC3172632.
10. Tabák AG, Herder C, Rathmann W, Brunner EJ, Kivimäki M. Prediabetes: a high-risk state for diabetes development. Lancet. 2012; 379(9833):2279–90.
11. Kaur S, Kaur M, Kumar R. Health promotion intervention to prevent risk factors of chronic diseases: Protocol for a cluster randomized controlled trial among adolescents in school settings of Chandigarh (India). PLoS One. 2022Feb17; 17(2):e0263584. doi.org 10.1371/journal.pone.0263584. PMID: 35176046; PMCID: PMC8853575.
12. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004 Jan 10; 363(9403):157-63. [PubMed] [Reference list]
13. Perloff D, Grim C, Flack J, Frohlich ED, Hill M, McDonald M, Morgenstern BZ, Human blood pressure determination by sphygmomanometry. Circulation1993; 88(2460–70). doi.org 10.1161/01.CIR.88.5.2460
14. Trinder P. Determination of glucose in blood using glucose oxidase method. Ann Clin Biochem. 1969.
15. Corso G, Papagni F, Gelzo M, et al. Development and validation of an enzymatic method for total cholesterol analysis. J Clin Lab Anal. 2015; 30(5):517–523.
16. Centers for Disease Control and Prevention (CDC). Laboratory method for triglycerides and cholesterol measurement. 2020;1161/01.CIR.88.5.2460
17. Huda FA, Mahmood HR, Hossain AT, Khan J. Analysis of health needs and health system response in the coastal districts of Bangladesh. London: Foreign, Commonwealth & Development Office (FCDO); 2020. Pp13.
18. Hossain M.B., Khan M.N., Oldroyd J.C., Rana J., Magliago D.J., & Chowdhury E.K. Prevalence of, and risk factors for, diabetes and prediabetes in Bangladesh: Evidence

from the national survey using a multilevel Poisson regression model with a robust variance. PLOS. Glob Public Health. 2022: 2(6): e0000461. June, No 1-16. http://doi.org/10.1371/journal.pgph.0000461

19. Sayeed MA, Rahman ASH, Hazrat AM, Rahman MM, Begum T, Khanam PA and Banu A. Diabetes in a Disaster Prone Coastal Population of Bangladesh. J Diabetes Metab Disord Control. 2016: 3(5): 00081.Doi: 10.15406/jdmdc.2016.03.00081
20. Rahman MA, Halder HR, Kundu S, et al. Trends in prevalence and associated factors of diabetes and prediabetes in Bangladesh. Diabetes Res Clin Pract. 2022; 190:109873.
21. Saquib N, Saquib J, Ahmed T, Khanam MA, Cullen MR. Cardiovascular diseases and type 2 diabetes in Bangladesh. Int J Epidemiol. 2012; 41(1):201–11.
22. Sujon H, Rahman MM, Haque MA, et al. Prevalence and associated factors of prediabetes and diabetes in rural and peri-urban Bangladesh. Cureus. 2025; 17 (7):e87090