

Outcomes of Diabetes in Bangladeshi Patients with Hypertension: Prevalence and Complication Profile

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DOI: <https://doi.org/10.36347/sjams.2024.v12i12.039>

| Received: 20.11.2024 | Accepted: 25.12.2024 | Published: 31.12.2024

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Abstract

Original Research Article

Background: Diabetes mellitus and hypertension are two of the most prevalent non-communicable diseases that often coexist, amplifying the risk of cardiovascular, renal, and other systemic complications. Despite their high prevalence in Bangladesh, limited data exist on the clinical outcomes of diabetic hypertensive patients in this population. **Aim of the study:** To evaluate the prevalence of diabetes and its associated complications among hypertensive patients in Bangladesh and identify significant predictors of diabetes in this high-risk group. **Methods:** This cross-sectional observational study was conducted among 145 hypertensive adults aged ≥ 30 years attending the outpatient Department of Medicine, Jashore Medical College, Jashore, Bangladesh. Sociodemographic data, clinical characteristics, and biochemical parameters were collected using structured questionnaires and medical records. Diabetes was diagnosed using American Diabetes Association (ADA) 2024 criteria. Complications were assessed clinically and through relevant investigations. Statistical analysis was performed using SPSS version 26.0, with logistic regression applied to determine independent predictors of diabetes. **Result:** Among hypertensive patients, 66.2% were diabetic, 13.8% pre-diabetic, and 20% non-diabetic. Overweight (64.8%), male gender (60%), and smoking (66.9%) were highly prevalent. Cardiovascular disease (34.4%), peripheral neuropathy (30.2%), and retinopathy (27.1%) were the most common complications, while 65.6% of diabetics had at least one complication. Poor glycemic control ($HbA1c \geq 9\%$) was significantly associated with higher complication rates ($p < 0.001$). Independent predictors of diabetes included age > 50 years (AOR 2.32, $p = 0.027$), overweight (AOR 3.08, $p = 0.008$), smoking (AOR 2.85, $p = 0.013$), and positive family history of diabetes (AOR 5.01, $p = 0.047$). **Conclusion:** Diabetes is highly prevalent among hypertensive patients in Bangladesh, with a considerable burden of complications. Older age, overweight, smoking, and family history significantly increase diabetes risk. Integrated screening, lifestyle modification, and early intervention programs are essential to reduce the morbidity associated with this dual disease burden.

Keywords: Diabetes mellitus, Hypertension, Complications, Predictors, Glycemic control.

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INTRODUCTION

Diabetes mellitus (DM) and hypertension (HTN) are among the most common chronic non-communicable diseases (NCDs) worldwide, often coexisting and exerting synergistic adverse effects on health [1]. The International Diabetes Federation (IDF) estimated that 537 million adults aged 20–79 years were living with diabetes in 2021 [2]. Meanwhile, according to the World Health Organization (WHO), approximately 1.3 billion people globally suffer from

hypertension, with nearly half of them unaware of their condition [3]. Both disorders are responsible for a significant proportion of global morbidity, disability, and premature death, accounting for more than 19 million deaths annually when combined with cardiovascular and renal diseases [4]. The coexistence of diabetes and hypertension is particularly detrimental. Patients with type 2 diabetes who also have hypertension face a two- to four-fold higher risk of developing cardiovascular disease, chronic kidney disease, and stroke compared to

Citation: Md. Jahangir Hossain, Debasish Dutta, Goutam Kumar Ghosh, Md Tosdikur Rahman Khan, Shoriful Islam, Md. Edrish Ali Akand, Seema Saha. Outcomes of Diabetes in Bangladeshi Patients with Hypertension: Prevalence and Complication Profile. Sch J App Med Sci, 2024 Dec 12(12): 1935-1941.

those with either condition alone [5]. The pathophysiological interplay between these two diseases involves complex mechanisms, including insulin resistance, endothelial dysfunction, renin–angiotensin–aldosterone system activation, oxidative stress, and chronic low-grade inflammation [6-8]. These shared pathways lead to target organ damage, affecting the heart, kidneys, retina, and peripheral nerves. The simultaneous presence of both conditions accelerates the onset of microvascular complications (retinopathy, nephropathy, neuropathy) and macrovascular complications (coronary artery disease, cerebrovascular disease, peripheral vascular disease), worsening patient outcomes and increasing healthcare costs [9]. In low- and middle-income countries (LMICs) like Bangladesh, the dual burden of diabetes and hypertension has become a growing public health crisis. Rapid urbanization, changing dietary patterns, increased consumption of processed foods, physical inactivity, stress, and rising obesity rates have contributed to this escalating epidemic [10,11]. Complications arising from diabetes and hypertension represent a major cause of hospital admissions and mortality in Bangladesh. Diabetic nephropathy is now one of the leading causes of end-stage renal disease (ESRD), while hypertensive heart disease and stroke are among the top causes of death [12]. Patients who have both diabetes and hypertension are more likely to experience serious health problems, including heart disease, eye damage, and kidney impairment, compared to diabetics with normal blood pressure. The risk and severity of these complications are further increased when blood sugar and blood pressure are poorly controlled. In addition, limited access to healthcare services, low awareness about the conditions, and irregular medical follow-ups contribute significantly to worsening outcomes in this population, making effective management and regular monitoring essential [13]. Although diabetes and hypertension have often been studied separately, little is known about their coexistence and combined complications in Bangladeshi patients. Understanding this relationship and the associated comorbidities is crucial for early detection, optimized treatment, targeted community interventions, patient education, and more effective resource allocation to reduce the national disease burden. Therefore, the present study aims to evaluate the outcomes of diabetes in Bangladeshi patients with hypertension, focusing on the prevalence, clinical characteristics, and associated complication profiles.

METHODOLOGY & MATERIALS

This was a cross-sectional observational study conducted among patients attending the outpatient Department of Medicine, Jashore Medical College, Jashore, Bangladesh. The study was carried out over a period of 12 months, from July 2023 to December 2024. A total of 145 adult patients (aged ≥ 30 years) diagnosed with hypertension were enrolled consecutively using a purposive sampling method. Ethical approval for the

study was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants prior to inclusion.

Inclusion Criteria:

- Adult patients aged ≥ 30 years.
- Diagnosed cases of primary (essential) hypertension for at least 1 year.

Exclusion Criteria:

- Individuals with known malignancy, chronic liver disease, or severe renal failure.
- Patients with gestational diabetes mellitus.
- Individuals on medications that could significantly alter glucose metabolism.

Data Collection

Data were collected through face-to-face interviews and review of medical records using a structured questionnaire. The questionnaire captured information on sociodemographic factors (age, sex, education, occupation, and economic status), lifestyle habits (smoking, physical activity, and dietary pattern), anthropometric parameters, family history of diabetes, and clinical data.

Blood pressure was measured using a standard mercury sphygmomanometer after the patient had rested for at least five minutes in a sitting position. Hypertension staging was classified according to the American College of Cardiology/American Heart Association (ACC/AHA) 2017 guidelines. Body Mass Index (BMI) was calculated as weight (kg)/height (m²) and categorized according to WHO criteria for the Asian population.

Biochemical Analysis

Fasting blood glucose (FBG), postprandial blood glucose (PPBG), and glycated hemoglobin (HbA1c) levels were measured after an overnight fast of at least 8 hours. Diabetes mellitus was defined according to the American Diabetes Association (ADA) 2024 criteria (FBG ≥ 7.0 mmol/L, PPBG ≥ 11.1 mmol/L, or HbA1c $\geq 6.5\%$). HbA1c levels were used to categorize glycemic control as:

- Good control: HbA1c $< 7\%$
- Moderate control: HbA1c 7–8.9%
- Poor control: HbA1c $\geq 9\%$

Assessment of Complications

Diabetic complications were identified based on clinical and laboratory assessments documented in the patients' medical records:

- Retinopathy: Confirmed by fundoscopic examination performed by an ophthalmologist.
- Nephropathy: Based on presence of microalbuminuria or elevated serum creatinine.
- Peripheral neuropathy: Assessed by clinical symptoms and monofilament testing.

- Cardiovascular disease: Documented history of ischemic heart disease or ECG findings.
- Cerebrovascular events: History of stroke confirmed by imaging reports.
- Peripheral vascular disease: Based on clinical findings of intermittent claudication or Doppler evidence of arterial insufficiency.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean $\pm$ standard deviation (SD), and categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test as appropriate. Binary logistic regression analysis was performed to determine predictors of diabetes among hypertensive patients, with results presented as adjusted odds ratios (OR) and 95% confidence intervals (CI). A *p*-value <0.05 was considered statistically significant.

RESULT

The majority were aged 41–50 years (32.41%), followed closely by 51–60 years (30.34%), while 25.52% were over 60 years and 11.72% were 30–40 years old. Male participants predominated, accounting for 60% of the study population. Regarding education, 53.79% were literate, whereas 46.21% were illiterate. Occupationally, most patients were engaged in business (40.69%), followed by service holders (31.72%), and

27.59% were unemployed. 69.7% reported middle-class economic status (Table 1). Overweight patients were the largest group (64.83%), while 33.10% had normal BMI and 2.07% were underweight. Two-thirds of patients (66.90%) were smokers. Sedentary lifestyle was uncommon (4.14%). Most patients consumed rice three times daily (67.59%). Family history of diabetes was present in only 5.52% of participants (Table 2). Stage 1 hypertension was observed in 51.72% of patients, stage 2 in 38.62%, and stage 3 in 9.66% (Figure 1). A significant proportion (66.21%) were diabetic (FBS ≥ 126 mg/dL or HbA1c $\geq 6.5\%$), 13.79% were pre-diabetic (FBS 110–125 mg/dL), and 20% were non-diabetic (Figure 2). Table 3 demonstrated that cardiovascular disease was the most common complication (34.38%), after peripheral neuropathy (30.21%), retinopathy (27.08%), nephropathy (20.83%), cerebrovascular events (12.50%), and peripheral vascular disease (11.46%). Overall, 65.63% of diabetic patients had at least one complication. Patients with poor glycemic control (HbA1c $\geq 9\%$) had the highest rate of complications (74.07%), compared to 43.90% in the moderate control group (HbA1c 7–8.9%) and 21.43% in the good control group (HbA1c $<7\%$) ($p < 0.001$) (Table 4). Age >50 years (adjusted OR 2.32, $p=0.027$), overweight (BMI ≥ 25 kg/m²) (adjusted OR 3.08, $p=0.008$), smoking (adjusted OR 2.85, $p=0.013$), and positive family history of diabetes (adjusted OR 5.01, $p=0.047$) were significant predictors. Male gender, sedentary lifestyle, and higher economic status were not statistically significant (Table 5).

Table 1: Demographic characteristics of the study population (n=145)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
30-40	17	11.72
41-50	47	32.41
51-60	44	30.34
>60	37	25.52
Gender		
Male	87	60.00
Female	58	40.00
Education		
Illiterate	67	46.21
Literate	78	53.79
Occupation		
Business	59	40.69
Service holder	46	31.72
Unemployed	40	27.59
Economic status		
Lower class	31	21.38
Middle class	101	69.66
Upper class	13	8.97

Table 2: Baseline characteristics of the study population (n=145)

Variables	Frequency (n)	Percentage (%)
Body mass index (BMI)		
Normal	48	33.10
Underweight	3	2.07
Over weight	94	64.83
Smoking		
Smoker	97	66.90
Non- smoker	48	33.10
Sedentary lifestyle		
No	139	95.86
Yes	6	4.14
Rice eating habit		
3 times a day	98	67.59
2 times a day	45	31.03
One time a day	2	1.38
Family history of diabetes		
No	137	94.48
Yes	8	5.52

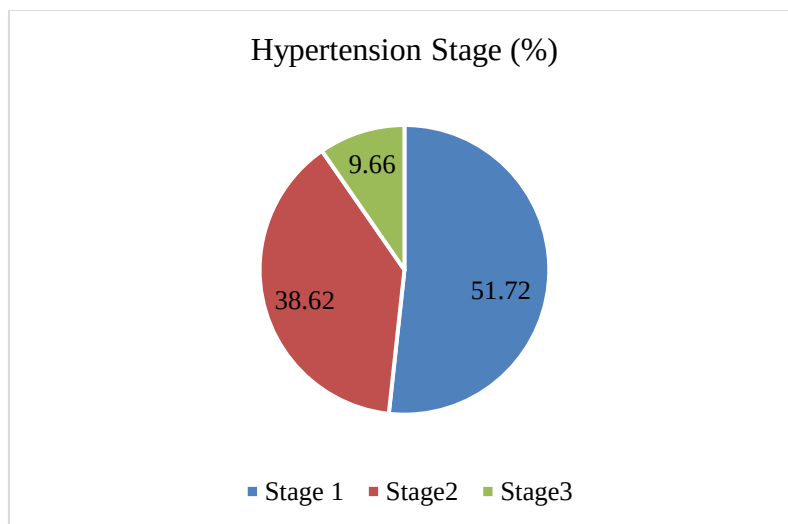
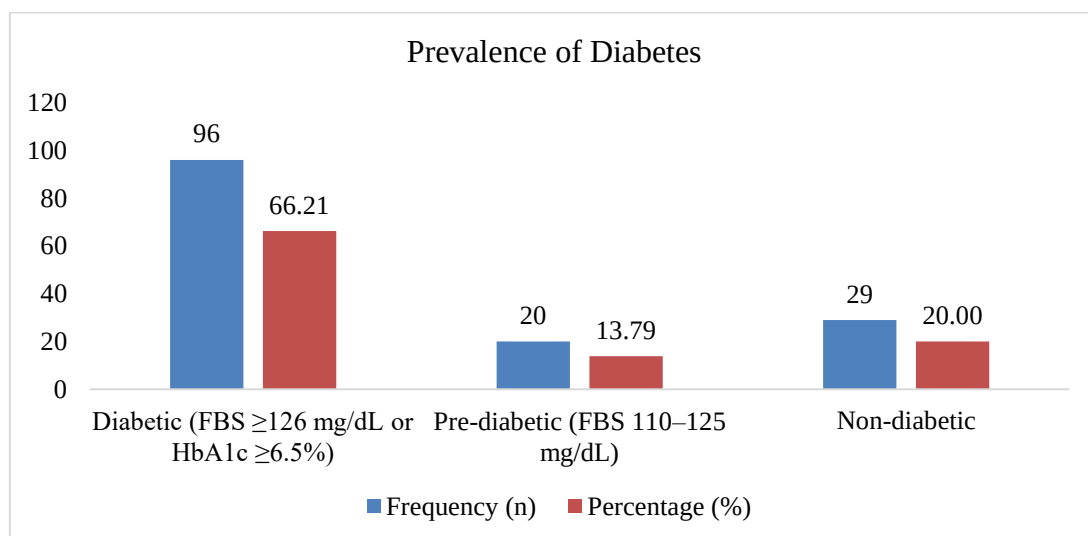
**Figure 1: Hypertension stage among study population (n=145)****Figure 2: Prevalence of diabetes among hypertensive patients (n=145)**

Table 3: Distribution of diabetic complications among hypertensive patients with diabetes (n=96)

Complication	Frequency (n)	Percentage (%)
Retinopathy	26	27.08
Nephropathy	20	20.83
Peripheral neuropathy	29	30.21
Cardiovascular disease	33	34.38
Cerebrovascular event (stroke)	12	12.50
Peripheral vascular disease	11	11.46
At least one complication	63	65.63

Table 4: Association between glycemic control and presence of complications (n=96)

HbA1c Category	Total n n (%)	Complications Present n (%)	P-value
Good control	28 (29.17)	6 (21.43)	<0.001
Moderate	41 (42.71)	18 (43.90)	
Poor control	27 (28.13)	20 (74.07)	

Table 5: Logistic regression analysis for predictors of diabetes among hypertensive patients

Variables	β Coefficient	Adjusted OR (95% CI)	P-value
Age >50 years	0.842	2.32 (1.10 – 4.89)	0.027
Male gender	0.511	1.67 (0.83 – 3.37)	0.15
Overweight (BMI $\geq$ 25 kg/m ²)	1.126	3.08 (1.34 – 7.09)	0.008
Smoking habit (Yes)	1.048	2.85 (1.25 – 6.48)	0.013
Sedentary lifestyle (Yes)	0.596	1.82 (0.27 – 12.19)	0.538
Family history of diabetes (Yes)	1.612	5.01 (1.02 – 24.63)	0.047
Middle/upper economic status	0.438	1.55 (0.67 – 3.58)	0.305

DISCUSSION

Diabetes mellitus and hypertension frequently coexist, posing a significant public health challenge in Bangladesh. The combined presence of these conditions greatly increases the risk of cardiovascular, renal, and other metabolic complications. Understanding their prevalence and associated outcomes is essential for effective disease management and prevention strategies. This study aimed to evaluate the prevalence and complication profile of diabetes among hypertensive patients in a Bangladeshi population. The largest age groups were 41–50 years (32.4%) and 51–60 years (30.3%) in our study. Population analyses of BDHS and other datasets found peak diabetes prevalence in middle-older age groups (Mean $\pm$ SD 52.79 $\pm$ 12.99 years) and show a clear age gradient for both diabetes and hypertension [14]. Men comprised 60.0% of the sample, which is consistent with the study of Haque et al [15]. Most participants identified as middle class (69.7%) and about half were illiterate in the present study. Our mix observation including many middle-class patients but a large illiterate subgroup, is consistent with the epidemiologic transition and with studies showing socioeconomic gradients in both prevalence and awareness [16]. In our study, a large share of participants worked in business (40.7%) or were service holders (31.7%). Occupational class is often a marker for urban residence, dietary patterns and activity levels that contribute to both hypertension and diabetes [14]. In this study, 64.83% of participants were overweight, which was higher than the findings of a similar study conducted

in Kuwait [17] and nearly double the proportion of those with normal weight (33.10%). The high prevalence of overweight individuals may be attributed to lifestyle changes, unhealthy dietary patterns, and reduced physical activity among the participants. The proportion of underweight individuals was minimal (2.07%), likely reflecting increased health awareness and improved economic conditions. Smokers constituted 66.90% of the study population, nearly twice the proportion of non-smokers (33.10%). This high prevalence may be linked to early initiation influenced by peer groups and the easy availability of cigarettes. Smoking is known to contribute to microvascular complications in diabetes and may also play a role in the development of type 2 diabetes [18]. There was low proportion (4.1%) of sedentary lifestyle in our study which is inconsistent with other study [19]. This discrepancy likely reflects our simpler self-reported measure, possible social desirability bias, and the inclusion of participants whose work or daily activities provide some physical movement. High frequency of rice intake (three times daily in 67.60%) aligns with the study of Haque et al [15]. We found that only 5.5% of participants reported a family history of diabetes. More than half of patients were categorized as Stage 1 hypertension. Haque et al also observed similar findings [15]. Notably, two-thirds of the patients (66.2%) met the study criteria for diabetes (FBS $\geq$ 126 mg/dL or HbA1c $\geq$ 6.5%), with another 13.8% classified as pre-diabetic and 20.0% non-diabetic. Pre-diabetes proportion was less than the Nigerian (25%) study [20]. The high diabetes prevalence among our hypertensive patients may result from shared risk factors (age, overweight,

unhealthy diet, and smoking), the common pathophysiology of insulin resistance and hypertension, and selection of high-risk individuals in tertiary care. In our hypertensive-diabetic subgroup, a high burden of complications was evident: 65.63% had at least one, with cardiovascular disease (34.4%), peripheral neuropathy (30.2%) and retinopathy (27.1%) predominating. Moreover, poorer glycaemic control was strongly associated with complications: only 21.4% of those with “good” HbA1c had complications versus 74.1% of the “poor” control group ($p < 0.001$). These figures align with Bangladeshi hospital-based studies, where nephropathy (42.5%) and retinopathy (37.8%) were the most frequent complications [21]. That study also found poor glycaemic control and hypertension as significant risk factors for complications. Our findings reinforce the well-recognized link between hyperglycaemia and micro/macrovacular damage, and suggest that in hypertensive populations the complication burden may be especially high. Overweight, older age, smoking and positive family history emerged as independent predictors of diabetes in our hypertensive cohort (adjusted ORs: overweight 3.08, age >50 y 2.32, smoking 2.85, family history 5.01). Previous study showed active smoking increases risk of incident T2D [22]. For a given BMI, South Asians have greater central adiposity and insulin resistance, which helps explain why overweight (even at modest BMI) strongly predicts diabetes in our sample [23]. Bangladeshi analyses similarly identify age, higher BMI and family history as consistent diabetes risk factors [24].

Limitations of the study:

- Self-reported data on lifestyle factors such as diet, smoking, and physical activity may be subject to recall and social desirability bias.
- Some complications were assessed using medical records and not uniform diagnostic testing, which may have led to underestimation or misclassification.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that diabetes is remarkably common among Bangladeshi patients with hypertension, and most affected individuals suffer from at least one microvascular or macrovascular complication. Poor glycemic control substantially increases complication rates. Age above 50 years, overweight status, smoking, and positive family history emerged as key determinants of diabetes among hypertensive individuals. These findings highlight the need for early screening, patient education, and comprehensive management strategies integrating lifestyle modification and pharmacologic control to prevent complications. Nationwide population-based studies are warranted to confirm these results and guide policy-level interventions.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

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