Original Article

Prevalence of cardiovascular disease and its associated factors among middle-aged type-2 diabetic subjects: a cross-sectional study in selected hospitals in Bangladesh

Rajib Mondal[1,2]^, Rani Baroi Ritu[2]^, Palash Chandra Banik[2,3]^

[1]Department of Public Health, Hamdard University Bangladesh (HUB), Gazaria, Munshiganj, Bangladesh; [2]Department of Public Health and Research, Center for Noncommunicable diseases Prevention Control Rehabilitation & Research (CeNoR), Dhaka, Bangladesh; [3]Department of Noncommunicable Diseases, Bangladesh University of Health Sciences (BUHS), Dhaka, Bangladesh

Contributions: (I) Conception and design: R Mondal, PC Banik; (II) Administrative support: PC Banik; (III) Provision of study materials or patients: R Mondal, PC Banik; (IV) Collection and assembly of data: R Mondal, RB Ritu; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Dr. Rajib Mondal. Lecturer, Department of Public Health, Hamdard University Bangladesh (HUB), Hamdard City of Science, Education & Culture, Gazaria, Munshiganj-1510, Bangladesh. Email: rajibmondaluday@gmail.com.

Background: Cardiovascular disease (CVD) is a leading cause of mortality globally, including Bangladesh. CVD prevalence is higher in patients with diabetes. However, considering the relatively early age of onset of the disease, the information in middle-aged diabetic subjects is quite limited globally, and unknown in Bangladesh. And, type-2 diabetes mellitus (T2DM) is a major public health concern in this country. We aimed at investigating the prevalence of CVD and its associated factors among middle-aged T2DM subjects in selected areas of Bangladesh.

Methods: In this cross-sectional study conducted in purposively selected two district-level diabetic hospitals, a total of 356 men and women T2DM subjects aged 40–60 years were recruited conveniently those who visited the outpatient departments (OPDs). The outcomes were the self-reported prevalence of CVD and its associated factors. Respondent's self-reported responses were recorded for socio-demographics, behavioral risk factors, diabetes and known CVD event(s) through interview, and height, weight and blood pressure (BP) were derived from personal diabetic record books. Descriptive and inferential (univariable and multivariable binary logistic regression analyses to see the associations) statistics were used.

Results: Men and women were almost equal (48.9% *vs.* 51.1%). Among all [mean ± standard deviation (SD) age 51.0±6.9 years], 8.1% reported to have a history of CVD among them. CVD was relatively higher in the respondents with age 50 years and above (10.0%), education at primary level and below (10.5%), diabetes for ≥5 years (10.6%), and practicing added salt (10.5%). In multivariable binary logistic regression analysis, the odds [OR (95% CI); P] of CVD was found to be significantly higher only in the respondents with higher systolic BP [1.04 (1.00–1.08); 0.042].

Conclusions: The prevalence of self-reported CVD among our study population was noticeable. Systolic BP might be the most powerful independent contributing factor for CVD.

Keywords: Associated factors; Bangladesh; cardiovascular disease (CVD); diabetic subjects; prevalence

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^ ORCID: Rajib Mondal, 0000-0001-9371-8131; Rani Baroi Ritu, 0000-0003-0080-7042; Palash Chandra Banik, 0000-0003-2395-9049.

Introduction

Cardiovascular disease (CVD), a group of disorders of the heart and blood vessels like coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions, is the leading cause of death globally with an estimated annual figure of around 17.9 million, according to World Health Organization (WHO) (1). Type-2 diabetes mellitus (T2DM) is a crucial metabolic factor for developing different kinds of CVDs (1,2). Approximately, one-third (32.2%) of the people with T2DM are affected by some sort of CVDs, mainly from coronary heart disease (21.2%) followed by heart failure (14.9%), angina (14.6%), myocardial infarction (10.0%) and stroke (7.6%). These CVDs also cause approximately half of all deaths among them (3). Moreover, developing and also dying from CVD is twice as high in T2DM subjects than the nondiabetic ones, according to the American Heart Association (2). The most significant risk factors for CVD in diabetic subjects include higher age, smoking, inadequate level of physical activity, obesity, high blood pressure (BP), dyslipidemia (imbalance of high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglyceride) and poorly controlled blood sugar (2,3). However, there is a substantial gap for the relevant information from the less developed regions including the Asian subcontinent (3). The CVD burden is much higher in low- and middle-income countries compared to the developed ones because of less access to effective and equitable health care facilities, including early diagnosis and treatment for the CVD risk factors (1).

Highlight box

Key findings

- The prevalence of self-reported cardiovascular disease (CVD) was 8.1% in diabetic patients.
- The adjusted odds of CVD was significantly higher in those with higher systolic blood pressure [odds ratio 1.04 (95% CI: 1.00–1.08), P=0.042].

What is known and what is new?

- CVD is highly prevalent in patients with diabetes.
- However, the information in middle-aged diabetic patients is quite limited globally, and unknown in Bangladesh.

What is the implication, and what should change now?

- This study provides a cross-section of CVD situations among the middle-aged diabetic population in Bangladesh, while the prevalence is quite higher considering relatively an early age of onset of the disease.

Therefore, exploring the CVD burden in these areas especially in different high-risk populations like T2DM is highly important.

In Bangladesh, as a developing country in the South Asian region with a highly dense population of over 165 million (4), the prevalence of CVD was reported to be 4.5–5.0% (5,6). Moreover, a large number of people in this country are affected by diabetes, reporting almost one in every ten of the adults (9.7%) (7). However, the highly important information regarding the prevalence and associated factors of CVD among T2DM subjects more specifically in the middle-aged group is still unknown in this country, based on the available online published data. We aimed at investigating the self-reported prevalence of CVD and its associated socio-demographic, behavioral, and metabolic factors among the middle-aged T2DM subjects attending two selected district-level diabetic care hospitals in Bangladesh to insight the CVD burden among the population. We present the following article in accordance with the STROBE reporting checklist (available at https://jxym.amegroups.com/article/view/10.21037/jxym-22-36/rc).

Methods

Study design, setting, population, and sampling

In this cross-sectional study conducted in 2017, a total of 356 registered T2DM subjects aged 40–60 years were recruited using a convenient sampling method among those who attended outpatient departments (OPDs) of the purposively selected Alhaz Asmat Ali Khan Diabetic Hospital, Pirojpur, and Dinajpur Diabetic Hospital, Dinajpur. The number of samples in this study satisfied the minimum required sample size (using $n = z^2pq/d^2$ formula) taking into account the 32.2% prevalence of CVD among diabetic subjects found in a systematic review (3). Pirojpur and Dinajpur districts are located in the southern and northern parts of Bangladesh, respectively. The hospitals are affiliated with the Diabetic Association of Bangladesh (BADAS), a leading tertiary care organization in national and regional contexts for prevention, management and control, and rehabilitation of the diabetic subjects. The hospitals are situated in the urban area of the respective districts, and the diabetic subjects from surrounding urban and rural areas attend there to seek diabetic care. Along with regular diabetic care, in these hospitals, the physicians also advise them for undergoing routine screening for the vital diabetes-related complications such as CVD, nephropathy, neuropathy, and retinopathy.

Outcomes and measures

The primary outcome was the prevalence of CVD based on the self-reported history of any form of coronary heart diseases and cerebrovascular diseases (such as stroke) among the T2DM subjects diagnosed previously by any qualified physician. And, the secondary outcomes were the associated socio-demographic, behavioral, and metabolic factors for CVD.

Data collection instrument and technique

The questionnaire included socio-demographics (sex, age, and education), duration of T2DM, behavioral factors (currently smoking and alcohol consumption, added salt intake during meal, and fruit and vegetables intake), metabolic factors [body mass index (BMI) and systolic and diastolic BPs], and the CVD history. In face-to-face interviews, the respondents were asked about their socio-demographics, duration of T2DM, behavioral factors and CVD history, and the self-reported information were recorded. Fruit and vegetables intake behavior was assessed using relevant show cards (derived from WHO STEPS Survey) (8) for better understanding of dietary practice. Respondent's height, recent body weight, and on-spot systolic and diastolic BP-related information were derived from respondent's personal diabetic record book, which was provided by the BADAS. Measuring and recording the weight and BP are the parts of routine physical measurements of every patient visiting these hospitals. BMI was calculated through dividing the body weight (in kg) by the square of the height (in meter), as per the WHO guidelines.

Quality control

The investigators ensured the quality control process from beginning to the ending of the whole thesis work. A pre-tested questionnaire was used for data collection. All the standard methods were followed strictly. A group of well-trained data collectors collected the data along with the principal investigator. The principal investigator monitored the whole data collection process.

Statistical analysis

SPSS software (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY, USA: IBM Corp.) was used for data processing and statistical analyses. Descriptive statistics were used to describe the socio-demographics, behavioral and metabolic factors, duration of T2DM, and CVD history-related information, and presented as frequency, percentage, mean, standard deviation (SD). Both univariable and multivariable binary logistic regression analyses were used to see the association of CVD with the socio-demographic, behavioral and metabolic factors, as these are the important factors for developing CVD especially in patients with T2DM. We used a multivariable binary logistic regression model adjusted for the factors found as potential confounders or effect modifiers (considering if $P<0.08$) in the univariable binary logistic regression analyses to compute the adjusted odds ratio [95% confidence intervals (CI); P value]. While, two-sided $P<0.05$ was considered as the final statistical significance in multivariable binary logistic regression analysis.

Ethical statements

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and the Bangladesh Medical and Research Council (BMRC). Ethical clearance for the study protocol was taken from the Ethical Review Committee (ERC) of Bangladesh University of Health Sciences (Identification No. BUHS/BIO/EA/17/82). Both verbal and written informed consents were taken. The details can be found in another paper (9).

Results

Socio-demographics, behavioral and metabolic factors

Of all (mean ± SD age 51.0±6.9 years), 205 (58%) respondents were from northern district Dinajpur, and remaining were from the southern district Pirojpur (not shown in table). Men and women were in almost equal proportion (48.9% *vs.* 51.1%). Majority of them studied up to the primary school level (53.4%). Their mean ± SD duration of diabetes was 7.0±4.4 years. Overall, 14.3% were smokers and nearly half (45.5%) of them were used to add extra salt during the meal. Their fruit and vegetables intake behavior seemed low, wherein the systolic and diastolic BPs seemed high. Detailed behavioral and metabolic factors are illustrated in *Table 1*.

Self-reported CVD and associated factors

Overall, 8.1% (n=29) of our respondents reported to have

Table 1 Participant characteristics and related unadjusted odds ratio of cardiovascular disease (n=356)

Variables	Overall, n (%)	CVD		Unadjusted odds ratio of CVD, OR (95% CI); P value
		No, n (%)	Yes, n (%)	
Socio-demographic factors				
Sex				
Men	174 (48.9)	162 (93.1)	12 (6.9)	Reference
Women	182 (51.1)	165 (90.7)	17 (9.3)	1.39 (0.64–3.00); 0.40
Age, years (mean ± SD)	51.0±6.9	50.8±7.0	53.7±5.4	1.07 (1.01–1.14); 0.03
Below 50	127 (35.7)	121 (95. 3)	6 (4.7)	Reference
50 and above	229 (64.3)	206 (90.0)	23 (10.0)	2.25 (0.89–5.66); 0.09
Level of education				
Up to primary	190 (53.4)	170 (89.5)	20 (10.5)	Reference
Above primary	166 (46.6)	157 (94.6)	9 (5.4)	0.49 (0.22–1.10); 0.08
Duration of diabetes mellitus				
<5 years	140 (39.3)	134 (95.7)	6 (4.3)	Reference
≥5 years	216 (60.7)	193 (89.4)	23 (10.6)	2.66 (1.06–6.71); 0.04
Behavioral factors				
Current smoking				
No	305 (85.7)	278 (91.1)	27 (8.9)	Reference
Yes	51 (14.3)	49 (96.1)	2 (3.9)	0.42 (0.10–1.82); 0.25
Current alcohol consumption				
No	341 (95.8)	313 (91.8)	28 (8.2)	Reference
Yes	15 (4.2)	14 (93.3)	1 (6.7)	0.80 (0.10–6.30); 0.83
Added salt intake during meal				
No	194 (54.5)	182 (93.8)	12 (6.2)	Reference
Yes	162 (45.5)	145 (89.5)	17 (10.5)	1.78 (0.82–3.84); 0.14
Fruit and vegetable intake (mean ± SD)	3.6±1.0	3.7±1.0	3.1±1.2	0.62 (0.44–0.90); 0.01
Metabolic factors				
Body mass index (mean ± SD)	24.1±4.1	24.2±4.1	22.6±3.9	0.88 (0.78–0.99); 0.04
Systolic blood pressure, mmHg (mean ± SD)	128±13	127±11	137±21	1.05 (1.03–1.08); <0.01
Diastolic blood pressure, mmHg (mean ± SD)	83±7	82±7	86±10	1.07 (1.02–1.12); <0.01

Univariable (unadjusted) binary logistic regression analysis was done. The dependent variable was the presence of cardiovascular diseases with two categories '0= no' and '1= yes'; the primary level of education consists 5 schooling years; fruit and vegetable intake behavior was measured in servings in a day. CVD, cardiovascular disease; OR, odds ratio; CI, confidence interval; SD, standard deviation.

Table 2 Adjusted odds ratio of cardiovascular disease by socio-demographic, behavioral, and metabolic factors (n=356)

Independent variables	Presence of cardiovascular disease		
	Odds ratio	95% CI	P value
Sex			
Men		Reference	
Women	1.18	0.51–2.68	0.70
Age	1.04	0.97–1.12	0.23
Duration of diabetes mellitus			
<5 years		Reference	
≥5 years	1.77	0.65–4.77	0.26
Fruit and vegetable intake	0.74	0.50–1.10	0.13
Body mass index	0.91	0.81–1.03	0.14
Systolic blood pressure	1.04	1.00–1.08	0.04
Diastolic blood pressure	1.00	0.93–1.08	0.95

Multivariable (adjusted for all factors presented in this table) binary logistic regression analysis was done. The dependent variable was the presence of cardiovascular diseases with two categories '0= no' and '1= yes'; fruit and vegetable intake behavior was measured in servings in a day. CI, confidence interval.

a history of CVD among them (not shown in table). The proportion of CVD has been found relatively higher in the respondents with age 50 years and above (10.0% *vs.* 4.7%), education at primary level and below (10.5% *vs.* 5.4%), diabetes for ≥5 years (10.6% *vs.* 4.3%), and practicing added salt (10.5% *vs.* 6.2%) compared to their counterparts (*Table 1*).

In univariable binary logistic regression analyses, the odds [OR (95% CI); P] of CVD was found to be significantly higher in the respondents with higher age [1.07 (1.01–1.14); 0.03], diabetes for ≥5 years [2.66 (1.06–6.71); 0.04] compared to <5 years, lower fruit and vegetables intake [0.62 (0.44–0.90); 0.01], lower BMI [0.88 (0.78–0.99); 0.04], and higher systolic [1.05 (1.03–1.08); <0.01] and diastolic [1.07 (1.02–1.12); <0.01] BPs (*Table 1*). However, in multivariable binary logistic regression analysis adjusted for the potential effect modifiers (age, duration of diabetes, fruit and vegetables intake, BMI, and systolic and diastolic BPs), the odds [OR (95% CI); P] of CVD was found to be significantly higher only in the respondents with higher systolic BP [1.04 (1.00–1.08); 0.042], indicating the most powerful independent associated factor of CVD among the subjects (*Table 2*).

Discussion

Significance of the study

Along with the soaring scenario of T2DM population in Bangladesh, it is essential to explore the burden of its associated chronic complications, especially the CVDs in order to reduce the morbidity and premature mortality. This current study provides a cross-section of CVD situations among the middle-aged T2DM population residing in two selected areas in Bangladesh. This sort of highly important information considering CVD relatively in an early age of life of the T2DM population is still uncovered in this country as well as the globe. We suggest, the T2DM subjects with higher systolic BP should undergo routine CVD screening along with maintaining a controlled BP for preventing CVD.

Comparing findings with other studies

We found a bit higher prevalence of CVD when compared to the general population of the country (around 5%) (5,6), which was pre-assumed and clearly justifiable that our diabetic affected population may relatively have a higher burden of the disease. However, our prevalence was very negligible than the global prevalence of overall CVDs among the T2DM population (32.2%) (3). Data from a recently published meta-analysis on the prevalence of CVDs in the T2DM population in the nearest neighboring country, India, revealed a much higher statistic (21.1%) (10). Similarly, Iran, a country of the Middle-East region, also reported a far higher prevalence (37.4%) among its T2DM subjects, evidence from a systematic review and meta-analysis (11). The possible reasons behind this comparatively less prevalence of CVD in our findings may be due to the relatively younger age group (reflecting the middle-aged adults) in our study population who provided self-reported data, also there may be potential geographical variational factors compared to these mentioned studies (3,10,11).

We report higher age, lower fruit and vegetables intake behavior, duration of diabetes for 5 years and above, and higher systolic and diastolic BPs are significantly associated with CVD among our study population. Among these, the systolic BP seemed to be the most powerful independent

associated factor. Nearly similar to our study findings, a study evaluating the predictors of cardiovascular events (disease and/or deaths) in a contemporary population with impaired glucose tolerance reported older age as one of the potential predictors (12). Unlike the Bangladeshi study among the general population (6), we found lower BMI was associated with CVD among our T2DM population. The possible reason for this contradictory finding might be due to the unexplained weight loss scenario in chronic diabetic condition or the prior CVD that caused the weight loss.

Limitations and strengths

Nonrandomized selection of the study areas, hospitals, and also the study samples (especially a middle-aged group) may reflect a potential methodological drawback in light of the particular population generalizability. This is because of an uncertainty to reach out to all the registered diabetic subjects in OPD settings during the data collection period, hence it was not convenient to randomize the samples. The self-reported CVD prevalence may reflect an underestimation of the condition, and again, we didn't assess the date of CVD diagnosis whether it was developed before the diagnosis of diabetes. Analyses with only 29 CVD events may not have enough power to report the associated factors. Also, the size of the samples was not large enough to be representative for district-wise subgroup analyses.

Despite these technical issues, perhaps this is the first-ever study in Bangladesh that explored the prevalence and associated risk factors of CVD among diabetic subjects, especially in the middle-aged (40–60 years) representative individuals. Findings of this study will enrich the existing literature in the relevant field, most importantly as a baseline prevalence of CVD among the diabetic population. Our findings will help the policymakers to insight the CVD situation among them, and also to design preventive interventions in primary care practice targeting to reduce the disease burden in early age and premature CVD deaths.

Conclusions

The prevalence of self-reported CVD was noticeable among the selected middle-aged T2DM population in Bangladesh, considering the relatively early age of the disease. The higher systolic BP was significantly associated with CVD history, suggesting the most powerful independent contributing factor for the disease.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jxym.amegroups.com/article/view/10.21037/jxym-22-36/rc

Data Sharing Statement: Available at https://jxym.amegroups.com/article/view/10.21037/jxym-22-36/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jxym.amegroups.com/article/view/10.21037/jxym-22-36/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and the Bangladesh Medical and Research Council (BMRC). Ethical clearance for the study protocol was taken from the Ethical Review Committee (ERC) of Bangladesh University of Health Sciences (Identification No. BUHS/BIO/EA/17/82). Both verbal and written informed consents were taken.

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