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Research article

Prevalence of risk factors for hypertension: A cross-sectional study in an urban area of Bangladesh

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ABSTRACT

Background: Hypertension is a major risk factor for several cardiovascular diseases (CVD). The prevalence of hypertension is increasing in Bangladesh, especially in urban areas. The objective of this study was to estimate the prevalence of hypertension and its risk factors in an urban area of Bangladesh.

Methods: We conducted a cross-sectional survey involving participants aged ≥25 years in an urban area in Dhaka between June-December 2012, using multi-stage random sampling. Data on socioeconomic status, tobacco use, physical activity, diet, extra-salt use, family history of hypertension, CVD, anthropometric measurements and blood pressure were collected using modified WHO-STEPS protocol. Hypertension and pre-hypertension were defined according to JNC-7. Multiple logistic regressions models were used to identify risk factors associated with hypertension.

Results: The overall age-adjusted prevalence hypertension and pre-hypertension among 730 participants was 23.7% and 19%, respectively, which was higher among males compared to females (23.6% vs 21.71% and 21.7% vs 17.0%, respectively). Bivariate analysis showed significant relationship of hypertension with age, BMI, no physical activity, tobacco use, extra salt intake and family history of stroke/cardiovascular disease. In the multivariate model, factors significantly associated with hypertension were older age (OR 19.18, 95% CI 13.58–28.11), smoking (OR 3.47, 95% CI 2.85–5.19), extra salt intake (OR 1.13, 95% CI 1.04–2.21), and high waist circumference (OR 3.41, 95% CI 2.81–5.29).

Conclusions: The prevalence of hypertension and pre-hypertension was high among our study participants. Population-based intervention programs and policies for increased awareness about the risk factors, and life-style modification are essential for prevention of hypertension.

Keywords: prevalence, risk factors, hypertension, cardiovascular diseases, Bangladesh

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INTRODUCTION

Hypertension is the leading risk factor for death and disability globally and disproportionately impacts low-and middle-income countries (LMICs), where more than two-thirds of people with hypertension live.[1] In 2010, an estimated 9.4 million deaths and 162 million years of life were lost due to hypertension.[1,2] Hypertension is the major cause for more than half of the cardiovascular diseases (CVD), stroke and heart failure and is a leading risk factor for fetal and maternal deaths in pregnancy, dementia and renal failure.[3–5] The prevalence of hypertension is increasing globally and is predicted to affect more than 500 million people by 2025.[6,7]

Hypertension is a significant public health challenge and has a major impact on healthcare costs, contributing to around 10% of total healthcare spending globally.[8,9] Hypertension imposes a serious economic burden on individuals, households, healthcare systems and the entire nation as a whole.[10] Previous studies have reported that investments in prevention are cost-saving[11,12] and investments in treatment and control are cost-effective if targeted to the higher risk groups.[13,14] In most developing countries, including Bangladesh, hypertension often remains undiagnosed and untreated and, even when treated, a large proportion still have uncontrolled blood pressure (BP).[15,16] Despite effective therapies and lifestyle interventions, adequate control of hypertension remains a challenge.[17] Lifestyle measures for lowering BP can potentially reduce requirements for anti-hypertensive medications, prevent development of hypertension and its complications and are important for controlling other CVD risk factors, illustrating the importance of a multifactorial approach for reducing hypertension.[17]

In recent years, hypertension and CVDs have increased in South-East Asia including Bangladesh as a result of rapid urbanization, increased life expectancy, unhealthy diet, and lifestyle changes.[17,18] The Bangladesh non-communicable diseases (NCD) risk factor survey in 2010 estimated the prevalence of hypertension among adults between 16–20%.[19] Also, the Bangladesh health, nutrition and demographic survey in 2011 reported the prevalence of hypertension among adults 34%.[20] Furthermore, a meta-analysis of studies between 1995 and 2010 found the pooled prevalence of hypertension to be 13.7%, with an increasing trend and higher rate in urban versus rural areas (22.2% vs 14.3%, respectively).[21] Most of these studies reported only the prevalence and risk factors of hypertension, but did not perform any statistical analysis of the predictors of hypertension.
A proper assessment of the risk factors for hypertension among urban population in Bangladesh is important to develop strategies and policies for effective prevention and control. This study aimed to determine the prevalence of risk factors for hypertension in an urban area in Dhaka, Bangladesh.

METHODS

Study design and area

We used a multi-stage random sample procedure to select a representative sample of residents of Dhaka city. In the first stage, we randomly selected one zone (zone-5) out of ten zones in Dhaka city corporation. Out of six wards of the zone-5, we randomly selected one ward (ward-29 Mohammadpur central), which consisted of 2215 holdings or houses, for our study. This Ward is similar to other Wards under Dhaka city corporation in terms of number of holdings, population density, and male female ratio. Mostly middle-class people live in this area. However, the average literacy rate of 56.2% is higher than some other areas in Dhaka city and rest of Bangladesh (32.4%) according to reports of Bangladesh Bureau of Statistics 2008. Using a detailed area map we identified all holdings with the city corporation unique holding number. We used the holding numbers to randomly select 800 holdings for our study. From each holding we included one adult meeting the inclusion criteria. If the holding was an apartment complex with several households, we randomly selected one household.
Study investigators approached individuals who deemed to be eligible for the study. In the households, when there were multiple eligible participants, we randomly selected one participant. If there was no eligible participant in the selected household or the eligible participant declined to participate, we randomly selected another household in the same apartment complex or moved to the next holding number.

Study population

All participants from the selected household aged ≥ 25 years agreeing to provide written informed consent were eligible for the study. We excluded participants who had serious mental illness, other serious diseases and not willing to provide written informed consent.

Data collection

Data collection was conducted at the residence of the study participants between June and December 2012. The data collection team was made up of a research officer and two trained nurses experienced in community data collection. All study investigators and staff members successfully completed a training program that oriented them both to the aims of the study and to the specific tools and methodologies used. Two trained public health nurses performed anthropometric measurements. A research officer under the supervision of a medical officer performed interviews and blood pressure measurements. A structured-questionnaire was used to collect data through face-to-face interviews using modified WHO STEPS protocol.[22] The STEPS questionnaire was translated into Bengali and back translated as per WHO guidelines and used in other surveys.[23] It was pilot tested and standardized using trained interviewers. The survey took approximately 30–40 minutes per participant.

Demographic data including age, gender, education, occupation and income were collected. The interview included questions related to personal and family history of hypertension, CVD/stroke, smoking, diet and salt intake habits. Body weight, height, waist circumference (WC), hip circumference (HC) and blood pressure (BP) were measured on two occasions. Anthropometric measurements were performed with the participants wearing light clothing and no footwear. Body weight was measured to the nearest 0.1 kg using a digital weight scale (Seca 803, Germany), which was calibrated weekly by a member of the study team by using an object with known weight to ensure accuracy. Height was recorded to the nearest 0.1 cm in the standing position using a portable stadiometer. Waist circumference (WC) was measured by placing a plastic tape horizontally midway between 12th rib and iliac crest on the midaxillary line. Similarly, hip circumference (HC) was measured by taking the extreme end posteriorly and the symphysis pubis anteriorly.

Blood pressure (BP) measurements used a common protocol adapted from WHO Stepwise approach.[22] Automatic sphygmomanometers (OMRON, SEM 2, Omron Corporation, Japan) with appropriately sized cuffs were used. BP was measured twice, five minute apart, with participants in a sitting position after five minutes of rest, in one visit. A third measurement was performed if the difference between the first two was over 10 mmHg for systolic or diastolic BP. The average of the second and the third BP measurements were used for analyses. In addition, participants were advised to avoid smoking, taking coffee/tea, and performing any exercise for at least 30 minutes before measuring their BP. The digital BP machines were calibrated against a mercury sphygmomanometer every week by members of the research team.

Hypertension was defined as an average systolic BP $\geq$ 140 mmHg, and/or average diastolic BP $\geq$ 90 mmHg, and/or self-reported previous diagnosis of hypertension by a health professional, and/or self-reported current treatment for hypertension with antihypertensive medications in the previous 2 weeks.[24] Body mass index (BMI) was calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2) and defined as follows: Normal (18.8–24.9); Overweight (25–29.9) and Obese ($\geq$30). High waist circumference (WC) was defined as waist circumference over 80 cm in women and over 90 cm in men and high waist-hip ratio (WHR) was defined as WHR $\geq$0.90 for Male, $\geq$0.80 for Female. Physical activity was measured as: "Recommended" = at least 150 minutes per week of moderate exercise or 75 minutes per week of vigorous exercise (or a combination of moderate and vigorous activity); "Low" = $<$150 minutes per week of moderate or $<$75 minutes vigorous activity and "No physical activity" as per recommendations of American Heart Association recommendations for physical activity in adults. Extra salt was defined as at least one teaspoon full of salt everyday (2,300 mg sodium). Low vegetables intake and low fruits intake were defined as less than 5 servings (2.5 cups) of vegetables and 4 servings (2 cups) of fruits per day, respectively, as per WHO STEPS Guidelines.[22]

Data analysis

Data were transformed from hard copies to Microsoft Access with built in range and consistency checks. We customized the Microsoft Access forms to perform consistency and range check. We created several event procedures with VBA code that runs in response to various events happening in the forms, for example, any number below 25 or above 100 for age category will flag a message for checking the data. We also used these procedures to check for consistency or for setting up an automatic skip and fill system, etc during data entry to avoid mistakes in data entry.

Data were presented as frequency (n), percentage (%) and Mean ± Standard Deviation (± SD). We used t-test and chi-square tests to compare participants with hypertension and pre-hypertension. Bivariate and Multiple logistic regressions models were used to identify the associations between hypertension and its risk factors. The unadjusted bivariate model included the following co-variates: age, sex, education, marital and employment status, income, tobacco use, extra salt intake, physical activity, family history of hypertension, CVD and stroke. We considered all co-variates for developing the adjusted multivariate models and applied a backward selection procedure, in which non-significant variables were detected one by one until only the significant variables remain in the model. A *P*-value of <0.05 was considered to be significant. Data analysis was carried out using Stata 11 (Stata corporation, College Station, TX, USA).

Ethical considerations

All participants in the study were asked for their consent before collection of data and venous blood, and all had complete rights to withdraw from the study at any time without any threat or disadvantage. Any participants with high blood pressure or other disorders were referred to appropriate facilities for further investigation and treatment. This study protocol was approved by the Ethical Review Committee of Bangladesh Medical Research Council (BMRC), Dhaka, Bangladesh.

RESULTS

We screened 832 individuals, 746 agreed to participate, 16 participants did not complete the survey and were not included in the analysis. Subsequently, a total of 730 participants remained for analyses with a response rate of 89.6%.

Characteristics of the study participants: Of the 730 participants, 427 (58.4%) were females. The mean ± SD age of the participants was 43 ± 14 years, and 44.9% was aged 36–45 years. Almost half of our study participants were housewives (42%), completed higher secondary education or above studies (43.2%) and had a monthly average family income from 20001–50000 BDT or 258– 645 USD (48.2%). A great majority of the participants were non-tobacco users (61.6%), performed no physical activity (55.3%), had high waist circumference (79.9%) and WHR (84.2%), consumed extra salt (70.9%), reported low fruits intake (67.9%), and family history of hypertension (57.9%). The sociodemographic characteristics of the study participants were similar to urban population in Dhaka city.[25–27]

Prevalence of hypertension and pre-hypertension: The overall age-adjusted prevalence of hypertension was 23.7% and pre-hypertension was 19%. The prevalence of both hypertension and pre-hypertension was higher among males compared to females (23.6% vs 21.71% and 21.7% vs 17.0%, respectively, p value <0.001). About one-third of the participants with hypertension were in the age groups 36–45 years (32.7%) were housewives (34.1%). completed higher secondary or above level education (41.3%) and had average monthly family income ≥50000 BDT or 645.16 USD (40.2%). Participants with hypertension also had higher rates of smoking (41.1%), no physical activity (55.5%), obesity (45.3%), high waist circumference (85.4%) and WHR (89.0%), consumed extra salt (83.5%), less fruits (73.2%), family history of hypertension (64.6%) and family history of stroke/CVD (50.6%). Evidently, participants with pre-hypertension had similar findings (Table 1). In addition, a greater number of male participants were smokers (88%) while a higher number of women were smokeless tobacco users (83%). A greater proportion of females (56%) than males performed no physical activity. (1 USD = 77.5 BDT, 2014).

Risk factors associated with hypertension: Table 2 presents the results of binomial and multivariate logistic regression analysis to evaluate the risk factors associated with hypertension. In the binomial logistic model, factors significant associated with hypertension were age, BMI, no physical activity, tobacco use, extra salt intake and family history of stroke/cardiovascular disease. Female participants were more likely to be hypertensive compared to men (OR 1.21, 95% CI 0.53–2.71). Participants in the age group 66–74 years had significantly higher risk of developing hypertension compared to participants in the age group of 25–35 years (OR 26.22, 95% CI 12.58–52.11). Participants who had monthly higher family income were more at risk to develop hypertension than low or middle income group participants (OR 1.88, 95% CI 0.89–2.37). Smokers (OR 4.78, 95% CI 3.62–6.32) and users of smokeless tobacco (OR 3.62, 95% CI 2.74–4.78) were also at higher risks of developing hypertension compared to non-tobacco users. Extra salt intake (OR 1.46, 95% CI 1.18–2.72),

Table 1. Characteristics and risk factors among the study participants.

Variables n (%)	Total n = 730 (%)	HTN n = 164 (%)	Pre-HTN n = 139 (%)	p- value
Age groups (years)				
25–35	80 (11.0)	15 (9.1)	13 (9.4)	0.258
36–45	328 (44.9)	54 (32.7)	63 (45.6)	
46–55	202 (27.7)	49 (30.1)	33 (23.5)	
56–65	83 (11.4)	29 (17.7)	20 (14.1)	
≥66	37 (5.0)	17 (10.6)	10 (7.2)	
Sex				
Male	303 (41.6)	71 (43.3)	66 (47.5)	0.465
Female	427 (58.4)	93 (56.7)	73 (52.3)	
Occupation				
Service	103 (14.2)	24 (14.6)	16 (11.5)	0.053
Business	123 (16.9)	46 (27.8)	33 (24.0)	
House wife	307 (42.0)	56 (34.1)	56 (40.3)	
‡Labor	177 (24.2)	24 (14.8)	30 (21.6)	
‡‡Others	20 (2.7)	14 (8.7)	3 (2.4)	
Education				
Illiterate	88 (12.1)	21 (12.8)	15 (10.6)	0.071
Primary (grade 1–5)	103 (14.2)	40 (24.4)	28 (19.9)	
Secondary (grade 6–10)	223 (30.6)	35 (21.4)	31 (22.3)	
Higher secondary and above	315 (43.2)	68 (41.3)	65 (47.0)	
Monthly family income (BDT)				
Low (≤20000)	137 (18.8)	38 (23.4)	30 (21.6)	0.382
Middle (20001–50000)	352 (48.2)	60 (36.6)	61 (44.1)	
Higher (≥50001)	241 (33.0)	66 (40.2)	48 (34.5)	
Use of tobacco				
None	450 (61.6)	50 (30.7)	54 (39.1)	0.277
Smoker	171 (23.4)	67 (41.1)	47 (33.6)	
Smokeless tobacco (Gul, Jarda, etc)	109 (15.0)	47 (28.5)	38 (27.1)	
Physical activity				
Recommended (≥150 mins/week)	124 (16.9)	23 (14.2)	21 (15.1)	0.051
Low (<150mins/week)	203 (27.8)	50 (30.5)	47 (33.8)	
No physical activity	404 (55.3)	91 (55.5)	71 (50.8)	
BMI/obesity ($kg/m^{2)}$				
Normal (18.8–24.9)	169 (23.2)	28 (17.1)	21 (15.1)	0.743
Overweight (25–29.9)	266 (36.4)	62 (37.8)	55 (39.3)	
Obese (≥30)	295 (40.4)	74 (45.3)	63 (45.3)	
Waist circumference				
High (M: ≥ 90 cm, F: ≥ 80 cm)	583 (79.9)	140 (85.4)	121 (86.8)	0.672
Extra salt intake	518 (70.9)	137 (83.5)	108 (77.7)	0.198
Low fruits consumption	496 (67.9)	120 (73.2)	97 (69.8)	0.515
Low vegetables consumption	231 (31.6)	67 (40.8)	58 (41.7)	0.877
Waist hip ratio (M:0.9,F:0.85)	615 (84.2)	146 (89.0)	122 (87.8)	0.734
Family history of hypertension	423 (57.9)	106 (64.6)	89 (64.0)	0.913
Family history of stroke/CVD	298 (40.8)	83 (50.6)	66 (47.5)	0.587

‡Labor = All kinds of physical worker. ‡‡Others = Abroad, retired, unable to work.

low consumption of vegetables (OR 1.07, 95% CI 0.97–1.85) were also at higher risk to develop hypertension. participants who were obese with a body mass index (BMI) more than 29 were also at higher risk (OR 4.01, 95% CI 3.42–6.76) to develop hypertension compared to those with BMI lower than 29. Participants who had high waist circumference (OR 4.01, 95% CI 3.42–6.76) and family history of stroke/CVD (OR 1.23, 95% CI 1.02–2.79) also were at high risk of developing hypertension.

In the multivariate model, controlling for the selected co-variates mentioned in data analysis section, factors independently associated with hypertension were older age group 66–74 years (OR 19.18, 95% CI 13.58–28.11), smokers (OR 3.47, 95% CI 2.85–5.19), extra salt intake (OR 1.13, 95% CI 1.04–2.21), and those with high waist circumference (OR 3.41, 95% CI 2.81–5.29).

DISCUSSION

This study showed the overall age-adjusted prevalence of hypertension among adults aged ≥25 years in an urban area in Dhaka, Bangladesh was 23.7%. The various studies estimated a prevalence rate of hypertension in Bangladesh ranging from 16–34%.[20,21] However these differences are due to different study population, different cut-off marks in determining the level of hypertension and also differing age

Table 2. Results of logistic regression analysis to evaluate risk factors for HTN.

Variables	Binomial logistic model OR (95%CI)	Multivariate logistic model OR (95%CI)
Sex		
Male	1	1
Female	1.21 (0.53–2.71)	1.01 (0.49–2.14)
Age groups (years)		
25–35	1	1
36–45	1.70 (1.12–3.92)	1.07 (0.87–2.84)
46–55	4.53 (3.55–9.52)	3.89 (3.14–8.55)
56–65	16.31 (8.34–22.35)	12.41 (7.34–19.35)
≥66	26.22 (12.58–52.11)**	19.18 (13.58–28.11)**
Education		
Illiterate	1	1
Primary (grade 1–5)	1.12 (0.61–1.92)	1.01 (0.57–1.92)
Secondary (grade 6–10)	1.21 (0.92–2.77)	1.07 (0.71–2.33)
Higher education (grade >11)	1.23 (0.52–2.83)	1.12 (0.53–2.78)
Occupation		
Service	1	1
Business	1.63 (1.21–5.13)	1.44 (1.11–4.87)
House wife	2.64 (1.84–5.19)	1.54 (1.18–4.52)
‡Labor	3.14 (1.13–6.14)	2.97 (1.17–5.49)
‡‡Others	3.87 (2.14–11.17)	3.23 (2.12–9.59)
Monthly family income (BDT)		
Low (≤20000)	1	1
Middle (20001–50000)	1.59 (0.81–2.13)	1.28 (0.88–2.01)
Higher (≥50001)	1.88 (0.89–2.37)	1.29 (0.91–2.17)
Use of tobacco products		
None	1	1
Smoker	4.78 (3.62–6.32)**	3.47 (2.85–5.19)**
Smokeless tobacco	3.62 (2.74–4.78)**	3.61 (2.33–4.14)
Physical activity		
Recommended (≥150mins/week)	1	1
Low (≥150mins/week)	1.36 (0.59–6.13)	1.12 (0.51–5.81)
No physical activity	2.22 (1.29–3.41)**	2.01 (1.02–3.11)
Extra salt intake (>1 TSF)	1.46 (1.18–2.72)**	1.13 (1.04–2.21)**
Low consumption of fruits (<80gm)	1.18 (0.97–1.66)	0.99 (0.29–1.41)
Low consumption of vegetables (<400gm)	1.07 (0.97–1.85)	0.87 (0.41–1.33)
BMI/obesity (kg/m^2)		
Normal (18.8–24.9)	1	1
Overweight (25–29.9)	0.56 (0.41–0.71)	0.21 (0.17–0.97)
Obese (≥30)	2.48 (1.22–3.14)**	1.97 (1.21–2.54)
High waist circumference	4.01 (3.42–6.76)**	3.41 (2.81–5.29)**
Waist hip ratio (M:0.9,F:0.85)	2.62 (2.01–3.41)	2.09 (1.98–3.21)
Family history of hypertension	1.61 (1.21–2.47)	1.23 (1.07–2.39)
Family history of stroke/CVD	1.23 (1.02–2.79)**	1.03 (0.77–2.31)

**Variable is significantly associated at ≤ 0. 05; High waist circumference = (M: ≥ 90 cm,F: ≥ 80 cm);
Co-variate used in the multivariate model: age, sex, education, marital and employment status, income, tobacco use, extra salt intake, physical activity, family history of hypertension, CVD and stroke.

groups of the study population. Our results are similar to findings of the pooled analysis of prevalence of hypertension in urban areas of Bangladesh and results of a recent study where the prevalence of hypertension in another urban area was 23.6%.[21,26] A meta-analysis showed the pooled prevalence of hypertension in Bangladesh in 6430 adults was 13.5%.[19] Studies in India, reported the prevalence of hypertension ranging from 4.5–58.5%.[28–30] Another study in India showed that the prevalence of hypertension increased around 30 times in urban populations over 25 years, and by 10 times in rural populations over 36 years.[31]

In this study, older age group, smoking, taking extra salt, and high waist circumference were significant risk factors among urban population, which is similar to other studies in Bangladesh and India.[17,20,30] A recent study on prevalence of hypertension in rural and urban areas showed that in another urban area the prevalence of hypertension was higher among female than men.[26] Our analysis showed that participants with higher waist-hip circumference had significantly higher risks of hypertension. Previous studies in Bangladesh reported similar findings.[32,33]

Our results showed that the risk of developing hypertension was significantly higher among smokers and smokeless tobacco users. A previous study in Bangladesh found higher prevalence of smoking

and showed increased risk of coronary heart diseases (CHD) was approximately four fold in ever smokers [adjusted odds ratio (OR) 4.0, 95% CI 1.7–9.5] and that smokeless tobacco consumption was strongly associated with CHD after adjustment for smoking and other confounders.[34] These findings are similar to our results and those reported from INTERHEART study in 52 countries.[35]

Our results showed that participants who took extra salt had almost 1.5 times higher risks of hypertension. A recent study showed that in 2010, globally 1.65 million deaths occurred from cardiovascular causes that were attributed to excess sodium consumption above a reference level of 2.0 g per day.[36] A previous study in Bangladesh showed that salt consumption is deeply-rooted in the dietary beliefs, attitudes and a culturally-established taste for salt among the population.[37] There is a need to understand the behavioral concepts of salt consumption, develop culturally appropriate materials and create general awareness about the harmful effects of extra salt consumption in Bangladesh.

A analysis of the global burden of disease showed the potentially large impact that increasing fruit and vegetable intake could have in reducing many NCDs including hypertension and CVDs.[38] A greater proportion of our participants reported taking recommended vegetables but the fruits consumption was low which is in line with the Bangladesh NCD risk factor survey 2011. Low fruits and vegetables intake has been linked with increased risk of CVD and all-cause mortality.[39–41] A Bangladeshi study reported the recent change in food habits rich in animal protein pattern was positively associated with the prevalence of hypertension.[42]

Our study also showed a large proportion of participants in the pre-hypertensive group and 41.8% were young people aged between 25–45 years. Previous studies reported increasing prevalence of coronary artery disease among young population in Bangladesh and India.[17] The relationship between BP and risk of CVD events is continuous, consistent and independent of other risk factors and pre-hypertensive group have greater chance of progression to hypertension and other CVDs.[43,44] However, we did not find any study in Bangladesh on this group for comparison. Future longitudinal study involving regular check up of BP in young population is needed to understand the causal relationship between age-specific pre-hypertensive level of blood pressure and subsequent development of hypertension and CVD. The findings of high percentage of pre-hypertension, especially among young population is of clinical and public health importance.

Our study has several limitations that should be considered while interpreting the results. First, data were collected from an urban residential area in Dhaka city where most of the residents are middle-class working people, and not representative of the diverse group of people living in Dhaka, for example the slum population. Thus, the results of this study might not represent other parts of Bangladesh. Larger studies collecting population level data from both urban and rural areas might provide a better estimate of the prevalence and risk factors for hypertension in Bangladesh. Second, the inherent limitations in a cross-sectional study design in this study limits our ability for drawing causal inferences. Community based longitudinal studies will provide further exploration of the risk factors for hypertension. Third, in spite of our effort to maintain random selection in every stage of the sampling frame, our data was not true randomization as our participants were selected through convenience sampling. Fourth, data on physical activity and diet were collected using a structured questionnaire and therefore the accuracy of the reporting may be questioned. Fifth, we did not collect data on alcohol use even though this modifiable risk factor is strongly associated with elevated BP. Also, due to resources constraints we could not collect blood samples of the participants for further biochemical, molecular and genetic analysis. However, in a previous study we showed that hypertensive patients in Bangladesh have a close association with dyslipidemia.[45] Future advanced studies will provide better pathophysiology and genetics basis of hypertension in Bangladesh. Finally, we did not collect data on medication use and adherence, which could have provided better clinical information.

CONCLUSION

Our data shows a high prevalence of hypertension and pre-hypertension in an urban community in Bangladesh. A large number of our participants were young and need special attention to avoid early progression to hypertension and possibly other CVDs. Hypertension and majority of its risk factors are largely preventable through early screening, lifestyle modification and simple interventions. Policies targeting healthy life style promotion through awareness building and adopting necessary changes in the environment are priority needs for Bangladesh and other developing countries.

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Authors' contributions
AKM, KNC, SMSI made contributions in conception and design of the study. AKM and KNC contributed in acquisition and interpretation of data. AKM drafted the manuscript, MAK, SZM and SA reviewed the manuscript and provided intellectual contribution, and SMSI finalized it. All authors have read and approved the final version.

Conflicts of interest
The authors declare that they have no competing interests.

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