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Association of hypertension with generalized and central obesity in rural adults: A cross-sectional study in Bangladesh

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Abstract

Background and aim: Obesity and hypertension are public health concerns. An increase in body weight is typically followed by an increase in blood pressure. This study aimed to investigate the association of general and central obesity with hypertension in Bangladeshi adults using WHO classification.

Methods: A Cross-sectional study of Bangladeshi adults (both males and females) aged (20-65 years). General obesity was determined by BMI in kg/m2. WHO classification for BMI for Asian population are underweight (BMI <18.5), normal (BMI 18.5-23.5), overweight (BMI 23.5-27.5) and obese (BMI >27.5). Central obesity was defined as a WC≥80 cm for females and ≥90 cm for males. Hypertension was defined by systolic blood pressure (SBP) ≥140mmHg and/or, diastolic blood pressure (DBP) ≥90mmHg and/ or, intake of anti-hypertensive drugs at the time of data collection. Prehypertension was defined as SBP 120–139mmHg; and/or DBP 80–89mmHg. Multinomial logistic regression analyses were performed to assess the association of general and central obesity with hypertension.

Results: In this study, the overall prevalence of hypertension in Bangladeshi males and females was 15.3% and 6.0% respectively. The males had a higher prevalence of general obesity (13.3%), central obesity (35.3%) and hypertension (15.3%) compared to the females (13.0, 28.5, and 6.0%, respectively). The odds of having hypertension for general and central obesity were 2.18 95% CI (1.12-4.23), 1.53 95% CI (0.94-2.5) while adjusted odds ratio (aOR) were 1.31 95% CI (0.76-2.27) and 1.67 95% CI 0.97-2.87 respectively.

Conclusion: Thus, not only general obesity but also central obesity should be used to assess obesity in Bangladeshi adults.

Keywords: Cardiometabolic risk; Cardiovascular disease; Adiposity; Epidemiological transition; Nutrition transition; Non-communicable diseases; Public health

1. Introduction

The silent killer; hypertension contributes to cardiovascular disease, stroke and premature mortality [1]. With time the prevalence of both obesity and hypertension is increasing speedily in the world and has been considered a public health concern. Obesity is generally measured using body mass index (BMI)[2], which has been proven to increase the risk of hypertension, coronary heart disease, stroke, diabetes and other non-communicable diseases [3]. However, BMI alone cannot provide complete information on body fat distribution, which is associated with metabolic risk. Moreover, BMI often fails to assess the cardiometabolic risk in adults with an excess of adiposity [4]. In this case, abdominal obesity which is measured based on waist circumference (WC) can provide useful information on visceral fat accumulation in

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the body [5]. Abdominal obesity is associated with an increased risk of type 2 diabetes, cardiovascular disease, metabolic syndrome and all-cause mortality [6]. On the other hand, hypertension is a major cause of morbidity and mortality. Increase in arterial pressure was shown to be associated with weight gain and it is estimated that 60-70% of adult's hypertension is related to adiposity. Hypertension is a significant risk factor for disability and death worldwide, affecting more than 1 billion people and causing approximately 9.4 million deaths every year [7]. In contrast to developed countries, the prevalence of hypertension is also increasing in developing countries with no improvement in awareness or control measures [8]. In Asia, especially the South Asian countries are facing a burden of hypertension and associated diseases [9]. Studies showed that obesity and hypertension are often occurred together and increased the risk of cardiovascular mortality [10]. It has been reported that both demographic, nutrition and socioeconomic transitions have contributed to the burden of obesity and hypertension in developing countries [11] and the epidemiological transition from infectious diseases to non-infectious diseases [12]. Bangladesh is a developing country in South Asia, with the rapid urbanization and industrialization in recent years, the prevalence of obesity and hypertension has increased remarkably in this country. Several early studies reported the prevalence of obesity and hypertension in Bangladeshi adults [13-15]; however, a number of them focused either obesity or hypertension or either male or female. Therefore, this study aims to assess the association of general and central obesity with hypertension in rural adults in both gender in Bangladesh.

2. Material and methods

2.1. Study subjects and study areas

The current study was a cross-sectional design conducted between January 2022 and April 2022. Data were collected on 400 participants (275 males and 125 females) from rural communities of Kushtia and Jhenaidah districts in Bangladesh. The subjects (aged 20-65 years) who were consented to participate included in the present study. The inclusion criteria were both genders, willingness to participate. We also set some exclusion criteria, for example, we did not collect data on participants who were pregnant or nursing mothers, and individuals who had hepatic disease, cardiac disease, renal disease and malignant disease.

2.2. Data collection

We followed a purposive sampling method in data collection. Data were collected on demographic and socioeconomic factors using a pre-structured questionnaire. The questionnaire was administered by trained interviewers at participant's convenient location. Anthropometric data namely Body mass index (BMI) and waist circumference (WC) were measured following standard procedures. We asked all the participants to avoid tea, coffee, beverages, eating, smoking and heavy physical work at least 20min before blood pressure (BP) measurement. The participants were also allowed for 5min rest before measuring BP two times at 5min intervals on the left arm in a comfortable sitting position using a digital BP machine (Omron M10, Tokyo, Japan). The study used the mean of two times blood pressure measurements.

2.3. General and central obesity categories

The study used World health Organization (WHO) classification for general and central obesity. General obesity was determined by BMI in kg/m2. WHO classification for BMI for Asian population are underweight (BMI <18.5), normal (BMI 18.5-23.5), overweight (BMI 23.5-27.5) and obese (BMI >27.5).

Central obesity was assessed by measuring waist circumference in the study. Central obesity was assessed by measuring waist circumference. In the study, the participant's waist circumference size was measured at a central point between the lower ribs and iliac crest [8]. Central obesity was defined as a WC≥80 cm for females and ≥90 cm for males [13]. Hypertension was defined by systolic blood pressure (SBP) ≥140mmHg and/or, diastolic blood pressure (DBP) ≥90mmHg and/ or, intake of anti-hypertensive drugs at the time of data collection. Prehypertension was defined as SBP 120–139mmHg; and/or DBP 80–89mmHg [14].

2.4. Statistical analysis

Continuous variables were described as mean (M) ± standard deviation (SD) while categorical variables as frequencies and percentages. The difference among hypertensive, pre-hypertensive and normotensive groups in this study was compared by one-way ANOVA. Multinomial logistic regression analysis was done to measure the odds ratio along with 95% confidence interval. Hypertension was examined as outcome variable along with BMI and central obesity as predictor variables. The significance level was set at $p<0.05$. All of the analyses were conducted in SPSS 21.0 (SPSS Inc., Chicago, IL).

3. Results

A total of 423 subjects aged 20-65 years old were examined. From those examined, 23 participants were excluded and the final analytical sample included 400 participants.

Table 1 represents the characteristics of the study subjects. Out of 400 participants, 68.8% were male and 31.3% were female. The mean age and BMI of the participants were 42.91 ± 8.95 years, 25.26 ± 3.83 kg/m2 respectively.The mean WC for male and female were 90.37 ± 9.21 and 94.28 ± 10.61 respectively. The mean SBP and DBP were 121.62±9.83 mmHg and 80.92 ± 6.97 mmHg, respectively.

3.1. Body mass index and waist circumference data

Table 2 and 3 summarize BMI and WC data by gender and age group. The prevalence of general obesity in male and female was 13.3% and 13.0% respectively while the prevalence of central obesity was 35.3% and 28.5% respectively. Both general and central obesity prevalence was significantly higher in males (13.3% and 35.5% respectively) than the females (13.0% and 28.5% respectively).

The prevalence of general and central obesity in young adults (20-39 years) was 10.3% and 23.0% respectively while in middle adults (40-59 years) it was 15.8% and 38.8 % respectively and in older adults (60-99 years) 0.3% and 2.0% respectively. In both general and central obesity, prevalence was higher in middle-aged adults (15.8% and 38.8% respectively) than the other two age groups.

3.2. Blood pressure data

According to table 2, the prevalence of pre-hypertension and hypertension was 37.0 and 15.3% in males and 17.8 and 6.0% in females respectively. The overall prevalence of normotensive, pre-hypertension and hypertension was 24.0, 54.8 and 21.3% respectively. However, males were more hypertensive (15.3%) than females (6.0%).

Middle-age group participants were significantly more pre-hypertensive (28.5%) as well as hypertensive (15.8%) than other groups. The comparison among hypertensive, pre-hypertensive and normotensive groups was listed in Table 4. There were significant differences for all characteristics inspected among the three groups. The hypertensive group was significantly older in age; higher in BMI, SBP and DBP, compared to pre-hypertensive and normotensive groups. In case of WC, in all three BP groups the mean was higher in female than male (*p <0.05.)*

Table 1 Characteristics of the study subjects in rural adults

Measure	
Gender (%)	
Male	68.8%
Female	31.3%
Age (years)	42.19 ± 8.95
BMI (kg/m2)	25.26 ± 3.83
WC (cm)	
Male	90.37 ± 9.21
Female	94.28 ± 10.61
SBP (mmHg)	121.62±9.83
DBP (mmHg)	80.92 ± 6.97

Data are presented as mean ± standard deviation (SD) for the continuous variables and percentages for the categorical variable.

Table 2 Characteristics of the study subjects in rural adults by gender

Gender	Body mass index						Waist circumference			Blood pressure		
	Under-weight (%)	Normal (%)	Over weight (%)	Obese (%)	*P* - value	Normal (%)	Obesity (%)	*P* - value	Normo-tensive (%)	Pre-hypertensive(%)	Hyper-tensive (%)	*P*– value
Male	1.8	25.8	28.0	13.3	0.000	33.5	35.3	0.000	16.5	37.0	15.3	0.779
Female	0.5	5.3	12.5	13.0		2.8	28.5		7.5	17.8	6.0	
Total	2.3%	31.0%	40.5%	26.3%		36.3%	63.8%		24.0%	54.8%	21.3%	

Data are presented as percentages for the categorical variables. P-values are obtained from the chi-square test.

Table 3 Characteristics of the study subjects in rural adult by age groups

Age groups	Body mass index					Waist circumference			Blood pressure			
	Underweight (%)	Normal (%)	Overweight (%)	Obese (%)	*P*-value	Normal (%)	Obesity (%)	*P*-value	Normotensive (%)	Pre-hyper-tensive (%)	Hypertensive (%)	*P*-value
Young adults	1.8	11.8	16.0	10.3	0.113	16.8	23.0	0.138	10.8	24.5	4.5	0.002
Middle-aged adults	0.5	17.5	23.5	15.8		18.5	38.8		13.0	28.5	15.8	
Older adults	0.0	1.8	1.0	0.3		1.0	2.0		0.3	1.8	1.0	
Total (%)	2.3	31.0	40.5	26.3		36.3	63.8		24.0	54.8	21.3	

Data are presented as percentages for the categorical variables. P-values are obtained from the chi-square test.

Table 4 Characteristics comparison among hypertensive, pre-hypertensive and normotensive groups

	Hypertensive		Pre-hypertensive		Normotensive		*P* value
	M	SD	M	SD	M	SD	
Age (year)	47.24	8.42	42.08	8.95	40.97	8.22	0.000
BMI (kg/m^2)	25.25	3.52	25.30	4.02	24.28	3.42	0.002
WC (cm)							
Male	92.67	10.08	90.66	8.62	87.58	9.10	0.004
Female	96.62	8.50	94.66	8.50	91.53	8.58	0.196
SBP (mmHg)	133.47	8.12	121.94	5.31	110.41	5.50	0.000
DBP (mmHg)	90.76	4.53	80.49	2.77	73.17	4.53	0.000

Data are presented as mean ±SD for the continuous variables. P-values are obtained from one-way ANOVA for continuous variables.

In multinomial regression model, the odds for general obese people to get hypertension were about 2.18 times higher compared to people with normal BMI and the odds for central obese people were 1.53 times higher compared to people without central obesity**.** Moreover, older adults have 3.19 times higher risk of having hypertension than young adults.

Table 5 Regression analysis

Variables	Hypertension	
	OR (95% CI)	**aOR (95% CI)**
Age group (years)		
Young adults	--	--
Middle-aged adults	3.07 (0.36-25.7)	3.11 (0.37-26.15)
Older adults	3.19 (0.38-26.62)	3.21 (0.38-26.84)
General obesity (BMI)		
Normal	--	--
Overweight	1.16 (0.62-2.15)	0.90 (0.49-1.67)
Obese	2.18 (1.12-4.23)	1.31 (0.76-2.27)
Central obesity (WC)		
Normal	--	--
Obese	1.53 (0.94-2.5)	1.67 (0.97-2.87)

a Adjusted odds ratio, OR odds ratio, CI Confidence interval. Adjusted by gender.

4. Discussion

Tis study reports on the prevalence of both general and central obesity and hypertension in rural adults in two districts of Bangladesh. In this cross-sectional study, the overall prevalence of general obesity, central obesity and hypertension was 63.8, 26.9 and 21.1%, respectively. In our study, a higher prevalence of general and central obesity was found in males than in females which were different from studies performed in South India [16] and China [17]. In Bangladesh, a limited number of studies have been conducted to estimate the prevalence of general obesity and central obesity in the general population. A previous study conducted in the Dhaka region of Bangladesh also reported a high prevalence of general obesity (26.2%) and abdominal obesity (39.8%) and this rate was higher in women [18]. A few more studies that used a different anthropometric cut-of value, reported a variation in the range of general and abdominal obesity prevalence in the Bangladeshi population [19]. In our survey, the prevalence rate of central obesity was more than two fold higher than general obesity which indicates that an important portion of the study subjects was not identified as obese only based on their BMI levels. Therefore, a specific BMI cut-of level for both sexes may not be enough to estimate general obesity. Considering sex, age and ethnic-specific BMI cut-of levels might be more appropriate for defining general obesity.

In the current study, we found a higher prevalence of hypertension in males (15.3%) than females (6.0%) although the difference was not significant. Some early studies in Bangladesh also reported hypertension prevalence in the country but a wide variation has been found between the studies. A systematic review and meta-analysis reported the prevalence of hypertension as 13.5% in the Bangladeshi population [20]. Another study in the country indicated a higher prevalence of hypertension (26.4%), with a higher percentage in women than in men [21].

The odds for generally obese people to develop hypertension were 2.18 times higher compared to people with normal BMI and the odds for centrally obese people were 1.53 times higher, as compared to people without abdominal obesity. The result in this study showed that having central obesity will also give a risk to get hypertension. The association and odds of hypertension is consistent with several previous studies, one previous study stated in detail that for every additional 1 cm in waist circumference, the odds for hypertension is 1.04 times higher [22]. Therefore, both BMI and waist circumference should be examined to assess hypertension. This is consistent with a previous study that suggests using not only BMI but also WC as significant predictors of hypertension in the population [23]. Both general and central obesity assessment are important to improve the evaluation of potential health risks and to provide accurate prognosis by estimating fat distributions. Additionally, previous research found that each fat depots such as lower body, upper body and visceral have unique characteristics related to the metabolism of fatty acid [18]. For people at risk who tend to store their excess weight abdominally, determination of waist circumference will help to improve the treatment [15]. Therefore, in assessing patients with health risks associated with obesity, measuring waist circumference as a

complement of simple BMI measurement is necessary. In general, Asian people are likely to have a higher percentage of total body fat and central adiposity compared to Caucasian people. Another research conducted on a population in Pakistan found out that a quarter of the study population was classified as overweight or obese using the Asian cut-offs [9]. The use of a lower BMI classification may provide reliable estimation and optimal identification of obesity-related disease risks in Asian populations [25[.

One limitation of this study is it is cross-sectional study that gives only a one-time measurement for classifying the BMI and WC score from the participants. Therefore, it is difficult to state a direct causal inference. Further longitudinal studies are needed to assess the effect size of general and central obesity on hypertension.

5. Conclusion

Our study found that both general and central obesity cut-off values should be used in adults for properly defining health status which would be appeared as precise predictor variable in context of association with hypertension.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that no conflict of interest exists.

Statement of ethical approval

The present research work does not contain any studies performed on animal/humans subjects by the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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