PREVALENCE OF METABOLIC SYNDROME IN THREE URBAN COMMUNITIES OF DHAKA CITY

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Abstract

Bangladeshis are prone to develop type 2 diabetes mellitus (T2DM), hypertension (sHTN and dHTN) and atherosclerotic heart diseases, observed more predominantly in the urban population. Though metabolic syndrome (MetS) is a related disorder, there are few studies in this regard. The prevalence of obesity, T2DM and MetS in three urban communities of Bangladesh were addressed in this study. Nine hundred non-slum urban households in three Dhaka City Wards were randomly selected. One member (age ≥ 25y) from each household was invited for investigation with an overnight fast. Socio-demographic information as well as height, weight, waist-girth, hip-girth and blood pressure were measured. Fasting plasma glucose (FPG), total cholesterol (chol), triglycerides (TG) and high-density lipoproteins-c (HDL) were estimated. A total of 705 (m / f = 239 / 466) subjects volunteered for the study. The mean value with 95% confidence interval (CI) of age was 42.4 (40.9 – 43.1) years for men and 37.8 (36.8 – 38.7) for women. The mean (CI) body mass index (BMI) was 21.0 (20.6 – 21.5) and 22.6 (22.2 – 22.9) and waist hip ratio (WHR) was 0.84 (0.83 – 0.84) and 0.82 (0.81 – 0.83), respectively for men and women. The mean (CI) FPG (fasting plasma glucose) was 5.5 (5.2 – 5.7) for men and 5.2 (5.0 – 5.4) for women. The prevalence of obesity (BMI ≥ 25.0) was 21%, T2DM (FPG ≥ 6.1 mmol/l) was 22.2%, triglyceridemia (TG ≥ 150mg/dl) was 45.1% and low HDL-c (HDL < 40mg/dl) was 43.8%. The crude prevalence of MetS varied based on different cluster combinations, being the lowest (0.3%) recommended by WHO cluster (FPG + BMI + SBP/DBP) and the highest (8.7%) by International Diabetes Federation (IDF) cluster (waist + FPG + HDL). The MetS was found higher in male than female by NCEP criteria and higher in female than male by IDF criteria. The study revealed an increased prevalence of obesity, T2DM and MetS in the urban communities. It also revealed that T2DM and MetS are moderately common and of growing healthcare burden in the rapidly growing urban population. Additionally, the study observed the wide ranging prevalence rates of MetS in the same study population indicating the need to establish a consistent and useful MetS-cluster depending on population characteristics.

Ibrahim Med. Coll. J. 2008; 2(2): 44-48

Key Words: Metabolic syndrome, urban, diabetes, hypertension, dyslipidemia

Introduction

The prevalence of obesity, type 2 diabetes mellitus (T2DM), hypertension (HTN) and coronary heart disease (CHD) are on the increase globally.[1,2] The increasing trend is predominant in the South East Asian Region (SEAR) as observed in India and Bangladesh.[2-7] The population of this region is affected by both communicable (CD) and non-communicable diseases (NCDs). The morbidity and

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mortality pattern has changed from CDs in the past to NCDs at present though both are health burdens. Metabolic syndrome (MetS) has been found to be associated with atherosclerotic morbidity and mortality and it is also postulated that Bangladeshis and Indians are more likely to develop MetS.[6-8] There have been very few studies on MetS except one on rural natives[9] and the other on migrant Bangladeshis.[10] The prevalence of MetS in a rural community was found to be low (<3%). This present study addresses the prevalence of obesity and MetS in urban communities of Dhaka City and to determine the association of MetS with obesity indices, blood pressure, plasma glucose, TG and HDl-c.

Subjects and Methods

The study was conducted from October 2004 to February 2005. Three City Corporation Wards (CCW) of Dhaka City were purposively selected. Each CCW has its own household (HH) number. Three hundred HHs were randomly selected from each CCW. Thus, in 3 CCWs 900 HHs were selected for this study. One member who attained the age of 25 years was enlisted from each HH as an eligible participant. The enlisted member was then informed about the objectives and procedural details of the study. Informed consent was taken and invited to volunteer for the study. The willing participant was advised to attend a nearby site in the next morning with an overnight (~12h) fast for investigation. The investigation included interviewing (education, occupation, income and clinical history), anthropometry (height, weight, waist- and hip-circumference), systolic and diastolic blood pressure (SBP & DBP) and biochemical tests like fasting plasma glucose (FPG), total cholesterol (Chol), triglycerides (TG) and high-density lipoprotein-cholesterol (HDL-c).

Measurements of height, weight, waist- and hip-girth were taken with light clothes but without shoes. The weighing tools were calibrated daily by known standard weight. For height, the subject stood in erect posture vertically touching occiput, back, hip and heels on the wall gazing horizontally in front keeping tragus and lateral orbital margin in the same horizontal plane. Waist girth was measured by placing a plastic tape horizontally midway between 12th rib and iliac crest on the mid-axillary line. Similarly, hip was measured taking extreme end posteriorly and symphysis pubis anteriorly. Blood pressure was taken after 10 min rest using a standard cuff for adults fitted with mercury sphygmomanometer. Mean of two measurements was accepted. Five ml venous blood was taken with disposable syringe after cleaning antecubital fossa with 70% alcohol. FPG, Chol, TG and HDL-c were estimated by an auto-analyzer, Screen Master-3000 (Italy).

Statistical analysis

The prevalence rates of diabetes, hypertension, obesity and metabolic syndrome were given in percentages. The characteristics were shown in mean with 95% confidence interval (CI) separately for men and women. Simultaneously, unpaired *t-test* was used to show comparison of characteristics between male and female subjects. The associations between MetS and risk variables like social class, sex, physical activities were determined by Chi-sq test. SPSS 11.5 was used for all statistical analysis. The level of significance was accepted at 0.05 level.

Results

Of the enlisted 900 subjects, 705 (m / f = 239 / 466) subjects responded. Thus the response rate was 78%. The female participants outnumbered their male counterparts (m / f=34 / 66%). The participants from the higher social class were 23% and 73% from the lower and middle class. Of the participants, 16% were illiterate.

The *characteristics* of both male and female participants are shown in table 1. The mean value of each characteristic with 95% confidence interval (CI) is given separately for either sex. The comparisons between sexes are also shown. The mean values (95% CI) for age, height, weight, WHR and TG were significantly higher in male than female; whereas BMI, HDL-c and LDL-c were significantly higher in female than male subjects. Fasting plasma glucose and blood pressure did not differ.

Nutrition – The crude prevalence of obesity was 20.9% [table 2]. The women were significantly more obese than men (26.4 v. 10.1%, p = 0.001). It

Table-1: *Comparison of characteristics between male and female participants*

Characteristics	Men (n=237)		Women (n=462)		P¶
	Mean	95% CI*	Mean	95% CI	
Age (y)	42.4	40.9–43.1	37.8	36.8–38.7	*<0.001*
Height (cm)	163	162–164	150	149–151	*<0.001*
Weight (kg)	56.3	55.1–57.6	51.4	50.5–52.4	*<0.001*
Body mass index	21.0	20.6–21.5	22.6	22.2– 22.9	*<0.001*
Waist (cm)	75.4	74.3–76.6	76.9	75.9–77.9	*ns*
Hip (cm)	90	89–91	93	92–94	*<0.001*
Waist-to-hip ratio	0.84	0.83–0.85	0.82	0.81–0.83	*.023*
Systolic blood pressure (mmHg)	118	115–120	114	112–116	*ns*
Diastolic blood pressure (mmHg)	77	75–78	75	74–76	*ns*
Fasting plasma glucose (mmol/l)	5.5	5.2–5.7	5.2	5.0– 5.4	*ns*
Total cholesterol (mg/dl)	181	174–187	186	182–190	*ns*
Triglycerides (mg/dl)	173	159–186	152	144–160	*.005*
High-density lipoproteins chol (mg/dl)	39.2	38.4–40.0	40.2	39.6–40.8	*.048*
Low-density lipoproteins chol (mg/dl)	107	101–113	115	111–119	*.021*

* CI- confidence interval; ¶p – after unpaired t-test.

may be noted that thinness (BMI < 18.5) was found in 17.7% of all participants. Compared with the female the male subjects had a significantly higher prevalence of thinness (24.5 v. 14.5%, p < 0.001).

Table-2: *Prevalence of obesity impaired glucose tolerance, diabetes, hypertension and dyslipidemia in urban population*

Metabolic abnormalities and related disorders	All	Men	Women	P*
Obesity (BMI ≥ 25.0)	20.9	10.1	26.4	0.001
IFG [Impaired fasting glucose (FBG 5.6 – 6.0 mmol/l)]	9.3	9.3	9.3	ns
T2DM (FBG ≥ 6.1 mmol/l)	21.1	27.1	18.0	0.02
sHTN (SBP ≥ 135 mmHg)	14.7	15.9	14.1	ns
dHTN (BP ≥ 85 mmHg)	22.2	27.5	19.5	0.011
Hypercholesterolemia (total chol ≥ 200mg/dl)	36.3	34.3	37.4	ns
Hypertriglyceridemia (TG>=150mg/dl)	45.1	51.0	42.1	0.02
Low HDL (HDL=40 mg/dl)	43.8	45.2	43.1	Ns

* p after chi-sq test, men vs. women. All figures in the table are given in percentage.

Table-3: *The prevalence of metabolic syndrome according to different diagnostic criteria*

Diagnostic criteria	Men n=239(%)	Women n=466(%)	All n=705(%)
WHO (FBG ≥6.1+2 factors)			
FBG + WHR (M/F:>0.9/0.85)+TG (≥150)	7 (2.9)	20 (4.3)	27 (3.8)
FBG + WHR+ SBP / DBP	4 (1.7)	10 (2.1)	14 (2.0)
FBG + BMI (>30)+ SBP / DBP (≥140/90)	0	2 (0.4)	2 (0.3)
FBG + BMI + WHR	0	4 (0.9)	4 (0.6)
FBG + SBP / DBP + HDL (M/F: <35/39)	2 (0.8)	6 (1.3)	8 (1.1)
NCEP ATPIII (any combination of 3 factors)			
Waist (M/F: ≥102 /88)+SBP/ DBP (≥130/85) + FBG (≥6.1)	0	2 (0.4)	2 (0.3)
Waist+SBP/DBP+TG (≥150)	0	20 (4.3)	20 (2.8)
Waist + SBP / DBP + HDL (M/F: <40/50)	0	18 (3.9)	18 (2.6)
FBG + SBP / DBP + HDL	25 (10.5)	9 (1.9)	34 (4.8)
FBG + SBP / DBP + TG	14 (5.9)	13 (2.8)	27 (3.8)
IDF [waist (M / F: ≥90 / 80) + 2 factors]			
Waist + SBP/DBP (≥130/85)+TG (≥150)	2 (0.8)	35 (7.5)	37 (5.2)
Waist + SBP / DBP (≥130/85) + FBG (≥5.6)	4 (1.7)	25 (5.4)	29 (4.1)
Waist + SBP / DBP (≥130/85)+HDL (M/F: <40/50)	3 (1.3)	50 (10.7)	53 (7.5)
Waist + FBG + HDL	3 (1.3)	58 (12.4)	61 (8.7)

Diabetes – The prevalence of IFG was 9.1% and T2DM was 21.1%. Compared with the female, the male subjects had significantly higher prevalence of T2DM (p=0.02) and triglyceridemia (p=0.01).

Metabolic syndrome (MetS) – The prevalence of MetS differed according to different combination of clusters proposed by different bodies [table 3]. Thus, the crude prevalence of combined sexes ranged from 0.3% to 8.7%. The lowest prevalence was observed when cluster encompassed BMI >30 or waist-girth >=102 cm for men and >= 88 cm for women, or WHR (m / f = >0.9 / 0.85). Hypertriglyceridemia (TG>150 mg/dl) was found in 45.1% and low HDL-c was found in 43.8% of the participants.

The prevalence of MetS (WHO criteria) was significantly higher among the higher social class than among the lower and middle social class (8.0 v. 1.8%, p<0.001). It was also higher among those with sedentary habits than among those with regular physical activity (4.3 v. 1.1%, p<0.02). There was no significant difference of prevalence between male

and female participants. As regards physical activity there was no difference between those with and without brisk walking of less than 15 min; and also between those with and without leisurely walking of less than 30 min.

Discussion

The overall response was 78%. Almost all enlisted female subjects took part in the investigation. In contrast, only 51% of the males volunteered despite all efforts for increasing their response. This was on weakness of the study. Otherwise, the study could include different social class of non-slum dwellers. The participants were found to be cooperative in all steps of the investigation. This study was the first of its kind conducted in an urban population of Bangladesh and it could investigate all cluster-components needed for the three diagnostic criteria proposed by WHO, NCEP-ATPIII (National cholesterol education program adult treatment panel III) and IDF.

The study revealed that the prevalence of obesity (BMI > 25) almost equals the prevalence of thinness (20.9 v. 17.7%). This indicates that both extremes of nutritional problems coexist in the heterogeneous urban dwellers. Interestingly, obesity was more prevalent among women and thinness among men. It is not clear why the females are more obese than males. This may be due to an occupational hazard as more than 80% of the female participants were housewives. Culturally and traditionally housewives are confined to the house and have less opportunity for outdoor walking or exercise. Their lifestyle may contribute to obesity. On the other hand, the thinness (BMI < 18.5) was more prevalent among the male participants of the low and middle social class. Obviously, this may be attributed to their nutritional deficiency with respect to their energy requirement.

The observed prevalence of T2DM (22.1%) is much higher than that observed (11.2%) in 2002-03.[3] This higher prevalence may be due to real increase or may be for not including the slum communities. The present study has been conducted exclusively in the non-slum population but the previous study[3] included both slum and non-slum communities. Those two communities showed significant difference in the prevalence of T2DM (7.4 v. 13.4, $p < 0.001$).

As already mentioned, the prevalence of MetS varied (0.3 to 8.7%) depending on the different diagnostic criteria. The variation of prevalence rates were also reported by several studies.[10-12] Considering the prevalence of MetS found in Greece[13] and in African Americans[14] Bangladeshis had a lower prevalence. Hoang *et al.*[12] rightly pointed out that the East Asians have a lower prevalence than that of Caucasians.

For comparison of the different diagnostic criteria, this study agrees with Soto González *et al.*[11] that IDF criteria identified higher prevalence of MetS than did WHO and NCEP criteria. It is difficult to predict at this moment whether a higher rate of detection of MetS in this population is important. It may be speculated that a higher detection may be worthy because the greater number of subjects are undertaken for modifying the risk factors to which they are already exposed, which in turn helps preventing cardiovascular morbidity or mortality.

Though general obesity and central obesity was not very marked (table-1), the level of TG was very high and HDL-c was very low in the study population. This was also observed by Zaman *et al*.[9] This indicates that dyslipidemia is one of the important components that should be addressed while measuring the risk factors.

Conclusions

The study revealed that both extremes of nutritional disorders – obesity and thinness are almost equally prevalent in the urban community. The prevalence of obesity and metabolic syndrome were significantly higher in the higher social class and among those with less physical activity. The prevalence of diabetes was found to be on the increase. Dyslipidemia (high TG and low HDL) was found to be an important component for addressing MetS. A prospective cohort study may be undertaken to establish a meaningful cluster of MetS components.

Acknowledgement

We are grateful to BIRDEM authority for providing the logistics and the laboratory facilities. We are thankful to the social leaders of Azimpur, New Market and Mughda for their active cooperation. We are indebted to the local volunteers and participants who helped us in every step of the investigation.

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