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Original Article

Prevalence of overweight, obesity and abdominal obesity in Bangladeshi university students: A cross-sectional study

Mohammad Zamsad [a, 1], Sujan Banik [a, *, 1], Lopa Ghosh [b]

[a] Department of Pharmacy, Noakhali Science and Technology University, Noakhali, 3814, Bangladesh
[b] Department of Medicine, Ibrahim Medical College, Dhaka, Bangladesh

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ABSTRACT

Aim: A sustained economic growth in Bangladesh leading to nutrition transition with negative impact on health followed to sedentary lifestyle, and obesity. Therefore, the study objective was to examine the prevalence of overweight, obesity and abdominal obesity among Bangladeshi university students.
Materials and methods: This cross-sectional study in Bangladeshi university students was conducted in December 2016 to April 2017. Randomly selected participants, aged 18–25 years were analyzed from three specific universities as per gender variation. The height and waist-circumference were measured using measuring tape and weight by personal weight scale.
Results: Total samples 500, 64.6% (n = 323) were males, 34.5% (n = 117) were females and mean age (standard deviation) was 21.76 (1.86) years. The prevalence of overweight and obesity (14.86% vs. 11.86%) were significantly 1.29-fold higher in males than females (OR: 1.29, 95%CI: 0.75–2.25, $p < 0.001$). Mean waist-circumference was significantly ($p < 0.001$) higher in males than females, but the waist-to height ratio (WHtR) was higher in females than in males ($p < 0.001$).
Conclusion: We conclude that the prevalence of overweight and obesity is significantly higher in male students than female university students of Bangladesh because of girls were so much concerned their physical appearance and wish a slim body than boys. However, future study and public health efforts are necessary to address complications of obesity problem and to promote active lifestyles.
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1. Introduction

In recent years, obesity has become a pandemic health issues across the developed and developing countries and considered as fifth leading cause of mortality at worldwide ([1]). Since 1980s, the prevalence of obesity has increased dramatically throughout the global level [2] and an estimation according to World Health Organization (WHO) in 2014, at least 600 million adults worldwide were obese [3]. Obesity is considered as serious problem because it has linked with wide range of health complications like hypertension, insulin insensitivity, diabetes mellitus, cardiovascular disease, and different types of cancers [4] and well-recognized to associate co-morbidities [4–6]. Body mass index (BMI) is a proxy measure of body fat based on weight (kg) and height (m) squared and the value of BMI 18.5–24.9 kg/m^2 is categorized as normal weight. An increase value of BMI for each 5 kg/m^2 results in around a 30% higher mortality rate [7]. Roughly, an estimated report by WHO annually 3.4 million adults die due to overweight or obesity in worldwide [8].

Bangladesh is a developing nation of South Asia, is experiencing economic transition and rapid shifts in demographics [9]. The population is expected to increase from 165 million in 2017 to 218 million in 2050 [10]. The rapidly increasing pattern of population has been linked with hasty urbanization and a changing pattern of diseases from communicable to noncommunicable [10,11]. In 1982 to 2005, the mortality rates due to chronic disease in rural Bangladesh overall from 646 to 670 per 100,000 people [12] and which was increased to 68% by 2006 [13]. In this part, it can be explained due to changes in lifestyle behaviors and nutritional status. Previous studies showed that the prevalence of overweight and obesity in Dhaka city (aged 3–18 years) was estimated between 23.6% and 17.9% respectively [14] as well as in Noakhali city (aged 6–16 years) was reported between 15.5% and 23.1% [15].

Abbreviations: BMI, Body mass index; WC, Waist circumference; WHtR, Waist-to height ratio; WHO, World Health Organization.

* Corresponding author.
E-mail address: pharmasujan@yahoo.com (S. Banik).
[1] Equal contributor.

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Furthermore, a high prevalent of overweight and obesity has been found in younger urban children with higher family income, which may further increase the prevalence obesity in the adult population over succeeding years [16]. A most recent study of 5496 Bangladesh adults aged between 35 and 70 years, showed that about 18.9% were overweight and 4.6% were obese [17].

To our knowledge, the prevalence of overweight and obesity in Bangladeshi university students has not been examined. The purpose of this study was to determine the prevalence of overweight, obesity, and abdominal obesity by age and sex in representative samples of Bangladeshi students from three public universities.

2. Materials and methods

This community-based, cross-sectional study was conducted in three university of Bangladesh namely Noakhali Science and Technology University, Comilla University and Chittagong University from December 2016 to April 2017. A total of 500 students of under graduate and graduate program, aged 18–25 years (323 males and 177 females) were participated in the study by convenience sampling. All the participants willingly joined in this study and provided written informed consent. The sampling method was a stratified multistage sampling based on selected university of Bangladesh. This study protocol was approved by the Institutional Ethical Committee of Noakhali Science and Technology University, Bangladesh.

Detailed information regarding sociodemographic information including name, sex, age, area, height, weight and waist circumference (WC) were collected from each study subject. The questionnaire was administered by well-trained personnel. Height and WC were measured in centimeters using a measuring tape. Weight was measured in kg using a calibrated electronic personal scale. Measurements were done with minimal clothing and without shoes. Body mass index (BMI) was calculated as kg/m^2, and the following groups were categorized based on BMI value: underweight ($<$18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2) and obese ($\geq$30.0 kg/m^2) (Sultana et al., 2016). Waist-to height ratio (WHtR) was calculated as a ratio of WC in cm by height in cm. The normal cutoff values for WC: men $\leq$89 cm and women $\leq$79 cm; and WHtR of $\geq$0.50 defined abdominal obesity [18].

Descriptive statistical analysis was performed by using IBM SPSS (version 20 for Windows; Armonk, NY: IBM Corp) and a p value $<$ 0.05 was considered as the level of significance. Mann-Whitney *U* test was done to determine the significance between two groups, since the data were not normally distributed. The odds ratio (OR) and 95% confidence interval (CI) was assessed by binomial logistic regression.

3. Results

Our study comprised of 500 samples, 323 (64.6%) males and 117 (35.4%) females, aged 18–25 years. Age class frequencies were unequal: 5.2% (n = 26) aged 18 years, 8.4% (n = 42) aged 19 years, 13.2% (n = 66) aged 20 years, 17.4% (n = 87) aged 21 years, 14% (n = 70) aged 22 years, 22.6% (n = 113) aged 23 years, 14.8% (n = 74) aged 24 years and 4.4% (n = 22) aged 25 years. Overall, almost 82.4% (n = 412) had a normal weight and only 13.8% (n = 69) were overweight and obese. The mean (SD) age for the males was 21.99 (1.63) years; 21.33 (2.15) years for the females and 21.76 (1.86) years for the whole samples. Mean BMI values for the males and females were 22.26 (2.62) vs. 21.84 (2.70) kg/m^2. For the entire sample, males showed significantly ($p < 0.05$) higher values for age, weight, height, BMI, and WC but not for WHtR (Table 1).

Table 2 shows the association and distribution of BMI categories and resembling odd ratios (ORs) by gender. The study data revealed that the overweight and obesity in males was higher than in females (14.86% vs. 11.86%). Males were about 1.29-fold higher risk of being overweight and obesity compared to females (OR = 1.29, 95% CI = 0.75–2.25). The presented data reflect that prevalence of overweight in males was higher than females (14.55% vs. 11.30%), and males had a 1.33 times more likely to be overweight compared to females (OR = 1.33, 95% CI = 0.76–2.33). However, females had markedly higher prevalence of underweight (3.95% vs. 3.72) and normal weight (84.18% vs. 81.42%) in compared to males.

Table 1
Descriptive characteristics of study sample (n = 500).

Parameter	Male (n = 323)	Female (n = 177)	Total (n = 500)	*P value*
Age (year)	21.99 ± 1.63*	21.33 ± 2.15	21.76 ± 1.86	0.002
Weight (kg)	63.87 ± 6.76*	51.93 ± 5.62	59.64 ± 8.56	0.000
Height (m)	1.70 ± 0.06*	1.54 ± 0.43	1.64 ± 0.09	0.000
BMI (kg/m^2)	22.26 ± 2.62*	21.84 ± 2.70	22.11 ± 2.66	0.036
WC (cm)	81.25 ± 4.85*	78.60 ± 5.02	80.31 ± 5.07	0.000
WHtR	0.48 ± 0.03	0.51 ± 0.04*	0.49 ± 0.04	0.000

Results are expressed as mean ± SD. P value was determined by Mann-Whitney *U* test. BMI, body mass index; WC, waist circumference; WHtR, waist-height rat**io.**

Table 3 presents the prevalence of underweight, overweight and obesity at different ages in Bangladeshi students. Of these male participants, the prevalence of underweight, overweight and obesity were found as 3.7%, 14.5% and 0.3%, respectively, while those were 3.9%, 11.3% and 0.6% for female participants, respectively.

4. Discussion

A report by WHO in 2014, confirmed that globally the prevalence of overweight and obesity affected more than 1.9 billion adults aged 18 years or older, where 39% of adults were overweight and 13% were obese [3]. To our knowledge, the first study to report the prevalence of overweight and obesity among a sample of university students in Bangladesh, and that the odds of being overweight and obese were higher among men, compared with women. Conversely, the odds of being underweight was slighter lower among men, compared with women. Although the prevalence of overweight and obesity in our sample are lower than the prevalence in developed nations, the findings suggest interventions are warranted, particularly for men, to prevent an increase in the prevalence of overweight and obesity as Bangladesh continues through economic transition. Bangladesh's economic transitioning will expose the population to Westernized lifestyles, including processed foods, increased mechanization of tasks and population shifts from rural areas to cities [19]. Similarly previous studies showed the prevalence of students overweight and obesity is increasing worldwide in both developed and developing countries due to life-style modifications, changes to poor diet value, physical inactivity, skipping healthy breakfast that is very common to university students, a high intake of carbonated soft beverage, and also very tendency to eating outside the home [20,21]. Another vital cause in Bangladesh, the problem of overweight is being emerging at a time when under nutrition is still a significant problem [22]. Rahman in his systemic review stated that socioeconomic stratification is also another factor behind the greater prevalence of obesity and overweight in Bangladesh [23]. Higher prevalence of obesity and overweight were shown in urban children and adolescents compared to rural backgrounds which undoubtedly suggest lifestyle and socio-economic differences in two different locations. In accordance with this study, similar studies from North America, Great Britain and South-Western Europe reported high

Table 2
Association and distribution of BMI categories by gender.

Parameter	Male n (%)	Female n (%)	OR (95% CI)
Underweight (males vs. females)	12 (3.72)	7 (3.95)	0.97 (0.37–2.52)[b]
Normal weight	263 (81.42)	149 (84.18)	1
Overweight (males vs. females)	47 (14.55)	20 (11.30)	1.33 (0.76–2.33)[a]
Obese (males vs. females)	1 (0.31)	1 (0.56)	0.56 (0.04–9.12)
Overweight + Obese (males vs. females)	48 (14.86)	21 (11.86)	1.29 (0.75–2.25)[a]

Percentages were determined within each gender. Binomial logistic regression for OR: Odd ratio; 95% Cl: 95% confidence interval. The reference category is the normal weight group.
Underweight: BMI <18 kg/m^2, normal weight: BMI 18–24.9 kg/m^2, overweight: BMI 25–29.9 kg/m^2, obese: BMI >30 kg/m^2.
[a] Significant at $P < 0.001$.
[b] Significant at $P < 0.01$.

Table 3
Underweight, overweight and obesity prevalence at different ages in Bangladeshi university students.

Age (years)	Male			Female		
	Underweight	Overweight	Obesity	Underweight	Overweight	Obesity
18	1	0	0	1	3	0
19	0	5	0	1	2	0
20	2	6	0	0	6	0
21	3	11	0	0	0	1
22	2	11	1	2	0	0
23	3	5	0	1	5	0
24	1	5	0	1	2	0
25	0	4	0	1	2	0
Total	12 (3.7%)	47 (14.5%)	1 (0.3%)	7 (3.9%)	20 (11.3%)	1 (0.6%)

prevalence of overweight and obesity 19.3%, 25.1% and 18.8% respectively [24]. The concluded data in the present study was slightly different from previously published studies [16,25,26]. Firstly, the data of this study is more recent and different than the previous report. Second, our study subjects came from three major university in Bangladesh where most changes in lifestyle are happening while sample of the previous study came from both urban and rural parts. Finally, our study included students from 18 to 25 years of age while the earlier studies presented the prevalence data for 13–14 age grouped. The current study also revealed data in age differences between males and females. According to age difference the highest overweight and obesity for male and female in 23 years university students and lowest in 18 years university students. Although in other groups BMI value were in normal group but that was to be predictor of overweight/obesity for the later life.

There are some limitations of this study. Firstly, the participants of this study was come from different public university in Bangladesh located in urban centers whereas inclusion of other areas could have expected in different outcomes. Secondly, our sample was a convenience sample of university students, so our findings are not generalizable to Bangladesh adult's age 18–25 years. Lastly, we did not collect any information on the students' weight-related behavior so we are unable to examine lifestyle factors that may be associated with overweight and obesity in young Bangladeshi adults.

5. Conclusion

In finale, overweight and obesity is being a problem among Bangladeshi University students as the study found a moderate prevalence of overweight and obesity among participants. According to age difference the highest overweight and obesity for male and female in 25 years university students and lowest in 19 years university students. However, Universities need to promote healthy environments as proposed by the WHO Global Strategy on diet, physical activity and health. Student themselves should be engaged in this process since they also need to be involved in promoting and living healthy lives.

Authors' contributions

SB designed the study and prepared the manuscript as principal investigator, MZ collected and interpreted the data, and LG revised the manuscript. All the authors read and accepted the final manuscript.

Compliance with Ethical Standards

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Declaration of competing interests

The authors declare that they have no competing interests.

Consent for publication

Have consent to publish.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dsx.2018.11.015.

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