

Prevalence of Obesity is Rising Among Primary School Children in Dhaka City of Bangladesh

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Abstract

Background: The rising prevalence of childhood obesity poses a major public health challenge and needs to be addressed accordingly.

Aims and Objectives: To see the frequency of overweight and obesity in primary school children of Dhaka city and to analyze the impact of socioeconomic status and associated hypertension on the anthropometric indices.

Materials and Methods: Multistage random cluster sample of 504 children of 9-14 years (age: 11.31 ± 1.39 , $M \pm SD$; M/F: 256/248) was done. The obesity and overweight were considered using an updated body mass index (BMI) reference, waist circumference (WC), waist height ratio (WHtR) and waist hip ratio (WHR). Socioeconomic status, life style factors as well as blood pressure were considered as influencing factors.

Results: About 13.0% (64/504) were underweight, 63.5% (320/504) normal weight, and 12.9% (65/504) overweight and 10.9% (55/504) obese. Most of normal and overweight BMI status was from middle class (51.6% and 55.4% respectively). By WHtR about 55-70% children belonged to normal BMI status while 22.6% was obese. Systolic and diastolic hypertensions were found in 19.9% and 29.8% respectively. BMI correlated with age WHtR, WC, WHR, systolic and diastolic blood pressure as well as socioeconomic condition ($p < 0.001$ for all). WHtR, WC, WHR ($P < 0.001$ for all) were independent predictors for BMI.

Conclusions: Prevalence of obesity is on rise in Bangladeshi children. It is high time for the concerned authority and the stakeholders to initiate appropriate measures to combat this rising prevalence.

Keywords: Childhood obesity; Anthropometric Indices; Waist-height Ratio

Introduction

Childhood obesity poses a major public health challenge in both developed and developing countries by increasing the burden of chronic non-communicable diseases. It has reached epidemic proportions and is the most prevalent chronic condition affecting health of children and adolescents worldwide [1]. Though adult body mass index (BMI) thresholds of 25 and 30 kg/m² is considered for overweight and obesity respectively, there is little consensus as to the best way to operationalize this definition in children [2]. Children with BMI equal to or exceeding the age-gender-specific 95th percentile are defined obese. Those with BMI equal to or exceeding the 85th but below 95 percentiles are defined overweight and are at risk for obesity related co-morbidities [3].

The World Health Organization (WHO) estimated that the prevalence of children <5 years of age with a BMI more than 2 standard deviation (SD; equivalent to the 98th percentile) increased from 4.2% in 1990 to 6.7% in 2010 and is expected to reach 9.1% in 2020 [4]. These worldwide trends in very young children are dramatic and have raised debate as to whether we can and should diagnose obesity even during infancy [2]. According to the BMI cut-off values specific for Asia-pacific region, almost one fourth of the population of Pakistan is overweight and obese [5]. According to recent Indian data, prevalence of overweight among 14 – 17 year old urban children in 2006-2007 was 29% in private schools and 11.3% in government-funded schools [1].

Obesity has been studied extensively in many developed countries, but in Bangladesh studies and data related to obesity in children and adolescents are relatively scarce. A positive association between obesity with higher socio-economic status, lack of physical activity and urban residence has been reported. These findings are in accordance with studies from other developing countries which identified the similar risk factors [6]. The present study was carried out to explore childhood overweight and obesity in primary school children in Dhaka, the capital city of Bangladesh.

Methodology

Study Design

This cross sectional study encompassing 504 primary school children between 9 -14 years of age was carried out during June 2014 to Jan 2016, in 5 schools of Dhaka City Corporation (DCC) selected by multistage random sampling. Five zones of DCC were selected (Lalbagh, Tipu

Sultan Road, Shyamoli, Mirpur and Baridhara) and from each zone one ward was selected. Thereafter, from each ward one school was selected randomly. All students of class IV and class V of selected schools were recruited. The study team visited each school in a prefixed day when height, weight, waist circumference (WC), hip circumference along with blood pressure was measured and sociodemographic parameters were recorded in a semi-structured questionnaire. Age and sex specific normograms were used to categorize the BMI.

Statistical Analysis

Data from the study were analyzed using computer based SPSS Program (version 22.0). Results were presented as means (\pm SD) and frequencies and where necessary by using reference cut-off values. All categorical data were expressed as frequency or percentages unless mentioned otherwise. For non-parametric variables, Chi-square test was preferred. Pearson's or Spearman's correlations were used to see correlation among related variables.

Ethical Aspects

Study was done after prior approval by Institutional Review Board (IRB). All parents/legal guardians of the students included in this study were informed about the nature of the study and agreed to participate voluntarily in this study. Informed written assent from parents/legal guardians was obtained through the school authority.

Results

Mean age of the children was 11.3 \pm 1.39 (year, M \pm SD), 256 (50.8%) were boys and 248 (49.2%) were girls. Following categorization on socioeconomic strata, 161 (31.9%) were from low socioeconomic status, 262 (52.0%) were from middle and 81 (16.1%) were from high socioeconomic status (Table 1). Among the children, 12.9% (65/504) were overweight and 10.9% (55/504) were obese (Figure 1). It was observed that, 11.7% and 12.5% of the boys were overweight and obese respectively, frequencies of which were 14.1% and 9.3% in the girls (p <0.001; Figure 2). Abdominal obesity measured as waist circumference in both the boys and girls is shown in Figure 3. (Boys: 73.0% vs. 11.3% vs. 15.6%; Girls: 73.8% vs. 17.3% vs. 8.9%; normal vs. overweight vs. obese; p =0.02). Waist-height ratio (WHtR) was high in 22.6% children (21.5% boys vs. 23.8% girls; p =0.536; Figure 4). About 94% of the children had normal waist hip ratio (WHR) and only 6.2% were obese in this regard (9.4% boys vs. 2.8% girls; p =0.002; Figure 5).

Frequency of obesity was higher in children from high socioeconomic class, whereas frequency of underweight children was more in lower socioeconomic class (high vs. middle vs. low socioeconomic status: obese 22.2% vs. 11.8% vs. 3.7%; overweight 17.3% vs. 13.7% vs. 9.3%; normal BMI 55.5% vs. 63.0% vs. 68.3%; underweight 4.9% vs. 11.5% vs. 18.6%; $p < 0.001$; Table 2). Systolic blood pressure (SBP) was observed to be in hypertensive range in 19.6% children while diastolic blood pressure

(DBP) in 29.8%. In obese and overweight children, there was significantly higher frequency of both systolic and diastolic hypertension (Table 3).

BMI positively correlated with age ($r = 0.241$), WHtR ($r = 0.800$), WC ($r = 0.859$), WHR ($r = 0.233$), SBP ($r = 0.388$), DBP ($r = 0.282$) and socioeconomic condition ($r = 0.286$) with level of significance of $p < 0.001$ for all (Table 4).

Table 1: Demographic and Socio-Economic Characteristics of the participants (n=504).

Variables		Frequency	Percentage
Age (years; mean \pm SD)		11.31 \pm 1.39	
Sex	Boys	256	50.8
	Girls	248	49.2
Class	IV	207	41.1
	V	297	58.9
Socioeconomic Status			
Low socioeconomic		161	31.9
Middle socioeconomic		262	52
High socioeconomic		81	16.1

Socio-economic status was classified according to the gross monthly income of the family

High: > 40000 taka
 Middle: 15000-39000 taka
 Low: < 15000 taka

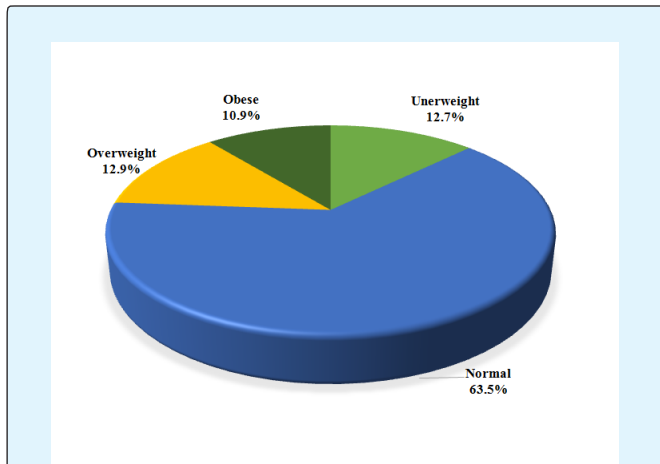


Figure 1: Body mass index (BMI) categories of children (n=504).

BMI calculated under reference cut-off value by Center for Disease Control (CDC)

Under weight : BMI <5th percentile
 Normal : BMI \geq 5th to < 85th percentile
 Overweight : BMI \geq 85th to < 95th percentile
 Obese : BMI \geq 95th percentile

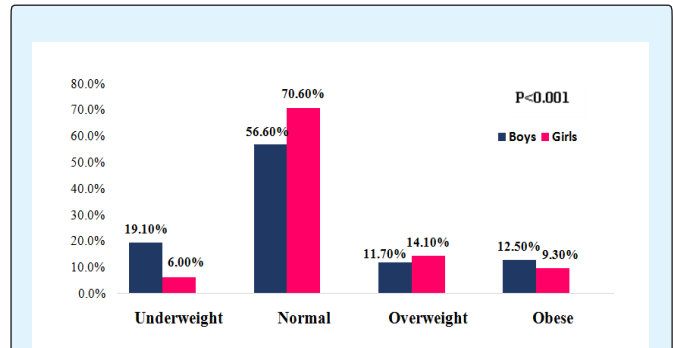


Figure 2: Body mass index (BMI) status: comparison of the boys (n=256) and girls (n=248).

BMI calculated under reference cut-off value by Center for Disease Control (CDC)

Under weight : BMI <5th percentile
 Normal : BMI \geq 5th to < 85th percentile
 Overweight : BMI \geq 85th to < 95th percentile
 Obese : BMI \geq 95th percentile

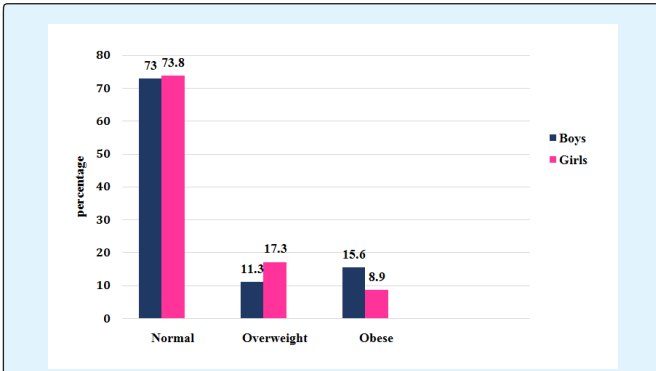


Figure 3: Waist circumference status of the Boys and Girls.

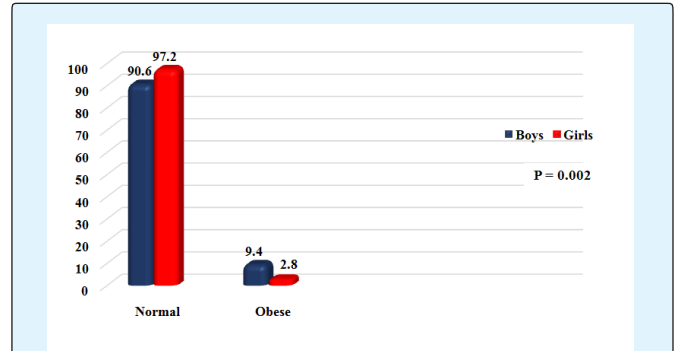


Figure 5: Waist hip ratio status of the boys and girls. Waist to Hip circumference ratio: Normal <90th percentile Obese ≥90th percentile

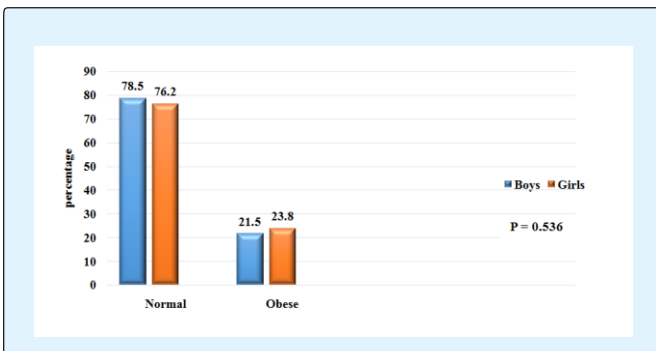


Figure 4: Waist height ratio status of the boys and girls. Waist height ratio: calculated by dividing the waist circumference in cm by height in cm Normal <0.50 Obese ≥0.50

Table 2: BMI status in various socioeconomic groups.

BMI Status	High	Middle	Low	Total
Underweight	4 (4.9)	30 (11.5)	30 (18.6)	64
Normal	45 (55.5)	165 (63.0)	110 (68.3)	320
Overweight	14 (17.3)	36 (13.7)	15 (9.3)	65
Obese	18 (22.2)	31 (11.8)	6 (3.7)	55
Total	81	262	161	

(Within parenthesis are percentages over column total) $\chi^2 = 30.304, p < 0.001$

BMI: body mass index
 BMI calculated under reference cut-off value by Center for Disease Control (CDC)
 Under weight : BMI <5th percentile
 Normal : BMI ≥5th to < 85th percentile
 Overweight : BMI ≥85th to < 95th percentile
 Obese : BMI ≥ 95th percentile

Table 3: Relationship of BMI with blood pressure.

BP status	Underweight	Normal	Overweight	Obese	total	χ^2, P
Systolic BP						62.178 <0.001
Normal	55 (85.9)	226 (70.6)	33 (50.8)	21 (38.2)	335 (66.5)	
Prehypertension	3 (4.7)	46 (14.4)	16 (24.6)	5 (9.1)	70 (13.4)	
Hypertension	6 (9.4)	48 (15.0)	10 (24.6)	29 (52.7)	99 (19.6)	
Total	64	320	65	55		
Diastolic BP						36.731 <0.001
Normal	50 (78.1)	196 (61.3)	32 (49.2)	16 (29.1)	294 (58.3)	
Prehypertension	3 (4.7)	41 (12.8)	6 (9.2)	10 (18.2)	60 (11.9)	
Hypertension	11 (17.2)	83 (25.9)	27 (41.5)	29 (52.7)	150 (29.8)	
Total	64	320	65	55		

(Within parenthesis are percentages over column total)

BP : Blood pressure
 Normal BP : SBP and DBP < 90th percentile
 Prehypertension : SBP or DBP ≥ 90th percentile to <95th percentile
 Hypertension : SBP or DBP ≥95th percentile

Table 4: Correlations between different variables with BMI.

Variables	r	p
BMI vs. age	0.241	<0.001
BMI vs. WHtR	0.800	<0.001
BMI vs. WC	0.859	<0.001
BMI vs. WHR	0.233	<0.001
BMI vs. SBP	0.388	<0.001
BMI vs. DBP	0.282	<0.001
BMI vs. socio-economic condition	0.286	<0.001

By Pearson's or Spearman's correlations (as applicable)
 BMI = Body mass index, WHtR = Waist-height-ratio, WC =Waist circumference, WHR = Waist-hip-ratio, SBP = Systolic blood pressure, DBP = Diastolic blood pressure.

Discussion

Childhood overweight and obesity has become a serious public health problem because of its strong association with adulthood obesity and the related adverse health consequences. Most likely it results from an interaction of nutritional, psychological, familial and physiological factors. The present study was undertaken to explore childhood overweight and obesity in primary school children in Dhaka city of Bangladesh.

The prevalence of overweight and obese children has been found to be 12.9% and 10.9% respectively by using CDC growth chart of BMI. International literature has portrayed developing countries as having a relatively low prevalence of obesity coexisting with a high prevalence of underweight. Similar observations were reflected by several other studies undertaken in ours and neighboring countries as well [5,7]. A study conducted by Sultana et al, in 2010 in Dhaka city reported a frequency of overweight and obesity 13.2% and 17.8% respectively among 6 -13 years school going children, while another study by Ferdousi, et al. in 2011 showed frequency of overweight 18.32% among 6-10 years children in urban community of Bangladesh [8,9].

BMI status was categorized in the context of different socioeconomic groups. As expected the frequency of obese and overweight were higher in high and middle socioeconomic class while the frequency of underweight was more in low and middle socioeconomic class, it was in keeping with other observations as well [10,11]. This finding is contrary to that in developed countries such as the UK where an association between social deprivation and childhood obesity was strong, especially in the girls. One possible explanation for this difference might be the influence of lifestyle factors such as diet, food

consumption patterns, and public services such as health care and transportation and physical activity. Richer people have better access to meat and other energy-dense foods than the poor. On the other hand, middle socioeconomic groups usually consume more vegetables and fruits, which are less energy dense.

While conducting the study we compared the relationship between SBP and DBP with the BMI of studied subjects. The frequency of both systolic and diastolic hypertension was highest in the obese group whereas the groups with normal or underweight BMI mostly were normotensive. The frequency of systolic prehypertension was highest in the overweight group on the contrary frequency of diastolic prehypertension was found to be higher in the obese group. The observed difference in the BP values between obese and non-obese group may be due to the differences in the BMI values, since high BMI correlates strongly with blood pressures levels of the child [11].

We analyzed the nutritional status of the studied subjects with other well recognized anthropometric markers like WC, WHR and WHtR. 15.6% of the boys and 8.9% of the girls were found to be centrally obese according to waist circumference. WC remains the simplest clinical measure of childhood central obesity. It has been proved a strong predictor of cardiovascular and metabolic disease risk in children [12]. It provides a better estimate of visceral adipose tissue than body mass index (BMI) and is significantly more efficient than BMI in predicting insulin resistance, blood pressure, and serum cholesterol and triglyceride levels [13].

The, WHtR in principle, is a good measure to represent WC in relation to another easily measurable body proportion so that distortions based on the body frame size in different populations are removed. It is being used increasingly to assess the risk of diseases related to central adiposity in adults and WHtR greater than 0.5 has been suggested as a value for indicating whether the upper body fat accumulation is excessive and poses a risk to health in adults [14,15]. Studies in children using WHtR have also shown that the ratio is superior in its ability to predict cardiovascular disease compared with BMI or percentage body fat [16]. Around 23% of the studied subjects were found to be obese with an almost equal frequency in both gender, these frequency rate was almost similar to the frequency of overweight and obese together on BMI category.

While applying WHR in categorization of nutritional status, 9.4% of the boys and 2.8% of the girls were found

to be obese, the rest being normal. WHR has been used to describe body fat distribution in adults; however, it is influenced by several other body factors and is a poor measure of body fat distribution and risk of related diseases in children [17]. When children were classified into different categories in the context of BMI and WC they correlated well with each other but poorly with that as categorized by WHR making it a less suitable tool for diagnosis of obesity in children.

In conclusion, we noticed a fairly high prevalence of obesity among school going children aged 9–14 years in Dhaka. Prevalence of obesity is on rise in Bangladeshi children, highlighting the possible role of change in the dietary pattern and physical activities with increase in income levels. Collective effort of parents and schools and stakeholders are required to institute early preventive measures to reduce March towards obesity and its future cardiometabolic complications.

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