

# Prevalence of Overweight Among the Adolescent School Girls in Dhaka City

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## ABSTRACT

A cross-sectional study was carried out to investigate the prevalence of overweight among adolescent school girls in Dhaka City and examine the relationship of various socio-economic factors with overweight. A total of 130 girls aged 12 to 16 years of three girls high schools were selected by random sampling. Height and weight were measured to calculate body mass index (BMI). Dietary intake was estimated using 24 hour recall method. The usual pattern of food intake was examined using a 7-day food frequency questionnaire. Prevalence of overweight was denoted by BMI above 85<sup>th</sup> percentile. In this study 33.1% of the participants were overweight and the rest were found to be normal. Participants were divided into two groups-normal weight participants with a BMI between 5<sup>th</sup> and 85<sup>th</sup> percentile and overweight participants with a BMI above 85<sup>th</sup> percentile of WHO/NCHS reference values. Mean intake of energy and all nutrients, except vitamin C were found significantly higher in overweight girls compared to normal weight girls. Overwhelming majority (95%) of the overweight girls consumed fast foods, soft drinks (44%) and fruit juice (21%) more than 3 times/week. Consumption of these foods by overweight girls was significantly higher than that of normal weight girls. Significant positive relationship was found among overweight and monthly family income, educational level of the parents and consumption of fast-food, soft drinks, fruit juice and energy intake but inverse relationship was found between overweight and participant's family size.

**Key words:** Adolescent, Overweight, BMI, Energy, Nutrients

## INTRODUCTION

Adolescence is a period of transition between childhood and Adulthood<sup>1</sup>. It is a critical stage of life when growth is accelerated, and major physical and sexual development takes place<sup>2</sup>. During adolescence hormonal changes accelerate growth in height, growth is faster than at any other time in the individual's postnatal life except the first year. It is the time when more than 20% total growth in stature and up to 45% of adult bone mass are achieved, and weight gain during the period contribute about 50% to adult weight<sup>3</sup>. Adolescents comprise 20% of the world's total population. Of these, 84%

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are in the developing world<sup>4</sup>. In Bangladesh, total female adolescent population aged (10-19 years) was 1,29,98,000 (near 13 million), constituting about 21.86% of the total population<sup>5</sup>. Although underweight and stunting are fairly common among adolescents in the developing countries<sup>6</sup>, only recently there is growing evidence that the prevalence of overweight and obesity in children and adolescents has also been increasing in these countries and especially in urban population<sup>7</sup>. Adolescent obesity is known to increase the risk of obesity in adulthood, which in turn, is associated with some important chronic disease like hypertension, respiratory disease, several orthopedic disorder, diabetes and psychological disorder<sup>8</sup>. Adolescent nutrition did not receive adequate attention in our country, and only recently few studies have been carried out in adolescent girls<sup>9,10</sup>. Studies of both under nutrition and over nutrition have significant clinical and public health implication for developing health promotin strategies to prevent chronic disease in adulthood. Such studies in developing countries require a change of focus from under nutrition and food insecurity to assessing trends in overweight and obesity<sup>11</sup>. This study was designed to investigate the prevalence of overweight and dietary pattern of adolescent school girls in Dhaka City.

## **Materials and Methods**

### **Study Population Identification and Selection**

The study group comprised 130 girls aged 11-16 years, who were student of class vii-x in 3 different high schools in Dhaka City. The participants were randomly selected who were attending classes regularly and voluntarily agreed to participate in the study.

### **Questionnaire Development and Data Collection**

A standard questionnaire was developed to obtain relevant information on the socioeconomic conditions, anthropometry, 24 hour dietary intake and food habits of some selected foods. The questionnaire was pre-tested and modified on the basis of test results for study. The purpose of the study was explained to each school administration and permission was obtained to carry out the study on their premises. A consent form was given to each selected student to obtain written consent of their parents to participate in the study. The study was conducted during March to May, 2004.

### **Socio-economic Information**

The part of the questionnaire that was designed to obtain socioeconomic information such as participant's parent's education, monthly family income, occupation, family size, oil consumption per month etc was sent home with each of the selected participant and her parents were requested to give the information asked for. All of them were able to obtain socio economic data from their parents.

### **Anthropometric Measurement**

After receiving the signed consent form and questionnaire completed for the socioeconomic information, a data for visiting each school was fixed to collect

anthropometric data and dietary information. These data and information were collected from 130 adolescent girls. A digital bathroom scale was used to record body weight of the participants. This scale was tested every day with known weight before use. Body weight was measured barefooted to the nearest 0.1 kg with school uniform on. The school uniform was weighted later (average weight was 0.5 kg) and the weight was subtracted from the body weight of the participants. A wooden height scale was used to record height of the participants. BMI was computed by dividing body weight in kg by height in meter square. Weight-for-age (ponderal growth), height-for-age (liner growth) and BMI-for age (body proportion) of the participants were calculated and compared with the National Center for Health Statistics (NCHS) and World Health Organization (WHO) reference standard. The cutoff points below 5<sup>th</sup> percentile and above 80<sup>th</sup> percentile of the NCHS reference population median values for weight-for-age were used to identify minimum weight and maximum weight respectively<sup>12</sup>. Stunting was identified as height-for-age below 3<sup>rd</sup> percentile of the NCHS reference population median values<sup>12</sup>. Both weight-for-age and height-for-age measures were compared with reference values using 6 month age brackets. Thin, normal body proportion and over weight were identified as BMI-for-age below 5<sup>th</sup> percentile, between 5<sup>th</sup> and 85<sup>th</sup> percentile and above 85<sup>th</sup> percentile, using 12 month age brackets, of the NCHS reference population median value<sup>1</sup>.

### Dietary assessment

Dietary intake of the participant was assessed using 24 hour recall method and details of all foods and drinks consumed by the participants were recorded. Various standard utensils such as measuring cups, spoons, glasses, plates and models of different foods, were used. The participants were shown these utensils to get nearest possible approximation of the serving sizes of the cooked food they consumed. Intake of snacks and meals outside from home was also recorded; from this information serving weight (wt) of different food items were calculated. Equivalent raw food weight was calculated by using a conversion table for Bangladeshi foods formulated in INFS<sup>13</sup>. A program package based on the Bangladeshi and Indian food consumption tables developed at the INFS<sup>14</sup> was used to calculate energy and nutrients intake of the each participants. Information about the habitual dietary pattern of the participants was obtained using a 7 day food frequency questionnaire. Percentage distribution of food frequencies was also calculated.

### Statistical analysis

Analysis of anthropometric data by mean, standard deviation (SD), frequency distribution was done. Various relations were obtained by calculating socioeconomic data. Mean, standard deviation (SD) and 95% confidence interval (CI) were calculated. Mean and the differences between groups were assessed using one way analysis of variance (ANOVA). The raw data record in questionnaire was coded first. The coded data were entered into the computer in base program. Then the data were again

transferred to SPSS program. Finally required analysis was done by simple cross tabulation.

## Results

Table 1 shows the age and socioeconomic characteristic of the participants. The mean age of the participants was 14 years. The largest group of the girls was 14 years old, with 33.9% of the total. The 12-year old girls comprised the smallest (3.8%) age group. Majority (41.5%) of the participants came from families with income between Tk. 6,000-29,999/month. About 33% participants had monthly family income of Tk. 30,000/- and above, rest 25.4% of the girls came from families with monthly income below Tk. 6,000. None of the father and only 3.9% of the mother was illiterate; over 65% fathers of the participants and 43% mothers were graduates. About 52% of the participants came from medium size families, 40.8% were from small families and rest (7.7%) belonged to large families.

**Table 1. Age and socio economic characteristics of the participants**

Variables	Number	Percent (%)
Age (Year)		
12	5	3.8
13	27	20.8
14	44	33.9
15	37	28.5
16	17	13.0
Family Income (Tk. month)		
6,000	33	25.4
6,000-29,999	54	41.5
≥ 30,000	43	33.1
Father's education		
Primary	4	3.3
Secondary	38	31.1
Graduate and above	80	65.6
Mother's education		
Illiterate	5	3.9
Primary	25	19.4
Secondary	43	33.3
Graduate and above	56	43.4
Famili size		
Small (≤ 4 members)	53	40.8
Medium (5-7 members)	67	51.5
Large (≥ 8 members)	10	7.7

Table 2 shows that the mean (SD) height of the participants was 152 (12) cm which ranged from 143.1 to 156.8 cm with a median 153.2 cm. Mean height increased significantly ( $p=0.00$ ) with age. Overall 21.5% of the participants were stunted (according to height-for-age below 3<sup>rd</sup> percentile). Highest (40%) number of the girls of 12 years age group was stunted.

The mean body weight of the participants by age group is shown in Table 3. Mean (SD) body weight was 50.2 (12.5) kg which ranged from 36.9 to 61.4 kg (median 54 kg) and increased significantly ( $P=0.00$ ) with age. Some 20% of participants had maximum body weight (above 80<sup>th</sup> percentile) and 8.5% had minimum body weight (below 5<sup>th</sup> percentile), according to ponderal growth (weight-for-age)

**Table 2 Achievements in linear growth by age $\xi$**

Age (Year)	Number of participants	Height (cm)		Achievement in linear growth
		Mean	SD	Stunted*
12	5	143.1	11.8	40.0 (2)
13	27	150.1	6.4	22.0 (6)
14	44	153.2	5.8	18.2 (8)
15	37	150.9	19.7	24.3 (9)
16	17	156.8	6.0	17.6 (3)
Total	130	152.0	12.0	21.5 (28)

\*Below 3<sup>rd</sup> percentile

$\xi$  Reference data are based on WHO/NCHS<sup>12</sup>

Figures in parentheses indicate the number of participants

**Table 3 Achievement in ponderal growth by age $\xi$**

Age (Year)	Number of Participants	Weight (kg)		Achievement in ponderal growth	
		Mean	SD	Minimum weight (%)	Maximum weight (%)
12	5	36.9	11.2	20.0 (1)	20.0 (1)
13	27	46.6	8.1	0.0	11.1 (3)
14	44	54.0	13.1	4.5 (2)	27.3 (12)
15	37	51.9	10.1	13.5 (5)	10.8 (4)
16	17	61.4	13.9	17.6 (3)	35.3 (6)
Total	130	50.2	12.5	8.5 (11)	20.0 (26)

\*Below 5<sup>th</sup> percentile

+Above 80<sup>th</sup> percentile

$\xi$  Reference data are based on WHO/NCHS<sup>12</sup>

Figures in parentheses indicate the number of participants

Table 4 shows body mass index (BMI) and achievement in body proportion and prevalence of overweight by age. BMI ranged from 17.7 to 24.8 kg/m<sup>2</sup> (median 22.8 kg/m<sup>2</sup>). Mean BMI of the participants was 21.6 (4.3) kg/m<sup>2</sup> and it increased significantly ( $P=0.00$ ) with age. In 12 years age group, all the participants were normal in body proportion. On the contrary, in 16 years age group majority (52.9%) of the participants were overweight and 47.1% were normal. This table also shows that majority (66.9%) of the participants were normal in body proportion, (between 5<sup>th</sup> and 85<sup>th</sup> percentile), none was thin (below 5<sup>th</sup> percentile), and prevalence of overweight (above > 85<sup>th</sup> percentile) was 33.1% according to body proportion.

**Table 4 Body mass index (BMI) and achievement in body proportion and prevalence of overweight by age<sup>1</sup>**

Age (Year)	Number of participants	Body mass index (Kg/m <sup>2</sup> )		Achievement in body proportion		
		Mean	SD	Thin* (%)	Normal <sup>s</sup> (%)	Over weight <sup>†</sup> (%)
12	5	17.7	2.6	0.0	100 (5)	0.0
13	27	20.7	2.8	0.0	81.5 (22)	18.5 (5)
14	44	22.8	4.7	0.0	59.1 (26)	40.9 (18)
16	37	22.0	3.9	0.0	67.6 (26)	29.7 (11)
16	17	24.8	4.7	0.0	47.1 (8)	52.9 (9)
Total	130	21.6	4.3	0.0	66.9 (87)	33.1 (43)

\*Below 5<sup>th</sup> percentile

<sup>s</sup> Between 5<sup>th</sup> and 85<sup>th</sup> percentile

<sup>†</sup> Above 85<sup>th</sup> percentile

¶ Reference data are based on WHO/NCHS<sup>12</sup>

Figure in parenthesis indicates the number of participants

Table 5 shows a good percent of normal weight (59.8%) and overweight (65.1%) participants consumed egg 1-3 times/week. About 38% of normal weight and 18.6% of overweight participants did not drink milk at all in the week preceding the interview. It was observed that consumption frequencies of meat, fast food, fruit juice and soft drinks by overweight girls were significantly ( $P=0.00$ ) higher than normal weight girls. About two third of the participants of both groups took pulses more than 3 times/week. Near about equal percent of normal weight and overweight participants consumed pulses 1-3 times/week. Consumption pattern of GLV shows that only 9.3% of overweight girls and 27.6% of normal weight participants consumed it > 3 times/week. About one third of the participants ate fruit 1-3 times/week. Some 50.6% and 44.2% of normal weight and overweight girls took fish more than 3 times/week. But 50.6% and 48.8% of normal weight and overweight girls consumed sweets 1-3 times/week respectively.

**Table 5 Consumption frequencies of selected food items, by body weight status of the participants**

Food Items	Normal weight (n=87) Consumption (times/week)			Overweight (n=4.3) Consumption (times/week)			P-value
	0	1-3	>3	0	1-3	>3	
	Egg	18.4	59.8	21.8	7.0	65.1	
Milk	37.9	26.4	35.6	18.6	34.9	46.5	0.08
Meat	11.5	54.0	34.5	2.3	37.2	60.5	0.01
Fish	9.2	40.2	50.6	4.7	51.2	44.2	0.40
Pulses	11.5	24.1	64.4	4.7	27.9	67.4	0.43
GFV†	13.8	58.6	27.6	9.3	81.4	9.3	0.02
Fruit	21.8	43.7	34.5	9.3	37.2	53.5	0.06
Sweets	41.4	50.6	8.0	34.9	48.8	16.3	0.34
Fast food	16.1	17.2	66.7	0.0	4.7	95.3	0.00
Fruit juice	57.5	27.6	14.9	27.9	51.2	20.9	0.00
Soft drinks	33.3	42.5	24.1	14.0	41.9	44.2	0.02
Ice-cream	39.1	44.8	16.1	20.9	55.8	23.3	0.11

“Chi-square test

†Green leafy vegetables

Table 6 shows mean intake of energy and all nutrients except vitamin C and vitamin A by overweight girls was significantly higher ( $P=0.00$ ) than the intake of normal weight girls.

**Table 6 Energy and nutrients intake, by body weight status of the participants**

Nutrients	Normal weight (n=87)	Overweight (n=43)	P value**
	Intake	Intake	
	Mean (95%CI)†	Mean (95%CI)†	
Energy (kcal)	1650 (1592-1708)	2366 (2270-2461)	0.00
Protein (g)	43.8 (41.5-46.9)	73.0 (68.7-77.4)	0.00
Fat (g)	47.0 (44.5-49.5)	68.3 (63.4-73.1)	0.00
CHO (g)	250(240-260)	316(300-332)	0.00
Iron (mg)	11.6(10.2-13.1)	16.4(13.7-19.1)	0.00
Calcium (mg)	330(288-372)	506(415-596)	0.00
Vitamin A (RE) <sup>s</sup>	751(601-901)	996(778-1213)	0.06
Thiamin (mg)	0.9(0.8-0.9)	1.2(1.1-1.2)	0.00
Riboflavin (mg)	0.6(0.5-0.6)	0.9(0.8-1.0)	0.00
Vitamin C (mg)	33.8(28.1-39.6)	42.7(34.0-51.5)	0.08

\*\*One way ANOVA

sRetinol equivalent

†Confidence interval

\*Carbohydrate

**Table 7 Relationship between socioeconomic factors and body mass index of the participants**

Variables	n	BMI (Kg/m <sup>2</sup> ) Mean (95%CI)	P value*
Family Income (Tk./month)			
< 6,000	33	19.3(18.4-20.1)	
6,000-29,999	54	22.4(21.2-23.6)	0.00
≥ 30,000	43	24.1(22.8-25.4)	
Father's education			
Primary	4	17.4(16.3-18.4)	
Secondary	38	20.1(19.1-21.1)	0.00
Graduation and above	80	23.5(22.5-24.5)	
Mother's education			
Illiterate	5	20.2(16.7-23.7)	
Primary	25	20.1(18.6-21.7)	
Secondary	43	21.8(20.6-23.0)	0.00
Graduation and above	56	23.5(22.3-24.8)	
Family size			
Small (≤ 4 members)	53	23.4(22.2-24.7)	
Medium (5-7 members)	67	21.4(20.4-22.4)	0.01
Large (≥ 8 members)	10	20.6(18.2-23.0)	

\*One way ANOVA

†Confidence interval

Table 7 reveals the relationship between socioeconomic factors and BMI. BMI was significantly ( $P=0.00$ ) higher in the girls from high income (Tk.  $\geq 30,000$ /month) and high educated (graduate and above) 4 families compared with those of the girls from other income and education groups. Participants from small families ( $\leq 4$  members) had higher BMI than the participants of large families ( $\geq 8$  members) and it was statistically significant ( $P=0.00$ ).

## Discussion

The present study reports the prevalence of overweight and dietary intake among the adolescent schoolgirls of Dhaka City. Height may be considered as the most representative characteristics of overall growth and development<sup>15</sup>. In this study, the mean height of the girls was 152 cm (Table 2) and it was 4.6% higher than the mean height of the urban girls of Bangladesh reported in the National Nutrition Survey<sup>16</sup>. This difference may be due to the fact that the National Nutrition Survey included urban girls of all socioeconomic strata but in the present study majority of the participants came from well to do families. However, the mean height (152cm) of the participants of present study was lower than the NCHS reference values<sup>17</sup>.

Mean body weight (50.2kg) of the girls (Table 3) was found to be higher than the average weight of the adolescent girls of Bangladesh<sup>18</sup>. A number of studies in other



countries have reported high prevalence of overweight in the adolescent population<sup>19,20</sup> using BMI criterion. In India, 5.5% and 27.7% of adolescent girls from affluent family in Delhi were obese and overweight respectively<sup>21</sup>. This high rate of overweight was almost similar with findings of the present study (Table 4). The present study shows a relatively high prevalence of overweight (33.1%) among the school girls judged by using BMI ( $\text{kg/m}^2$ ). It should be noted here; under this system (using BMI cutoff values, above 85<sup>th</sup> percentile), some girls may have a higher body weight due to stunting rather than as a result of excess adiposity<sup>22</sup>. About 22% of the participants of this study were stunted using height-for-age below 3<sup>rd</sup> percentile of NCHS reference value. It was hypothesized that in a population with high rate of stunting, there may be increased risk of overweight related chronic disorder in adulthood<sup>23</sup>. The high rates of overweight documented in this population group might have significant public health implications in near future as recent evidence linking adolescent obesity and increased risks for health in adult life<sup>8,23</sup>. If this hypothesis is correct, Bangladesh will face a large public health challenge as children who are stunted become overweight<sup>22</sup>.

It was reported that aberrant food habit is one of the factors for adolescent obesity<sup>24</sup>. It has been noted in several studies of the world<sup>25-28</sup> that excessive consumption of fast foods, fruit juice and soft drinks are linked with rapid increase in overweight population among adolescent boys and girls. Similar trend of consumption by the overweight girls was also observed in the present study. The food habit of the overweight girls resembles westernized food habit as represented by fast food, high sugar, fruit juice and soft drinks. Higher consumption of these kinds of food are responsible for obesity and overweight, as reported in many studies<sup>29,30</sup>. It indicates that diets of the adolescent in Bangladesh are heading in the wrong direction<sup>31</sup>.

Many studies show urban environment reduces physical activity and the change in the life style also increases the probability of the population being overweight<sup>32</sup>. Now-a-day, the physical activity shows a decreased trend in adolescent group. This situation is also applicable especially to affluent adolescent of the developing countries like Bangladesh. Most of the schools in Dhaka City have no physical exercise program due to the absence of play ground. As a result, energy expenditure is lower than energy intake. The increase in the prevalence of overweight is a result of a positive shift in energy balance in which energy intake from food exceed energy expenditure in physical activity. Probably all the above factors are associated with overweight found in urban adolescent girls of the study.

This study shows a high prevalence of overweight among urban adolescent school girls. There were also cases of under weight and stunting which pose a public health problem in the country in general. These findings thus indicate a double burden of nutritional problems in this segment of the population. A large scale survey is necessary to develop the appropriate health and nutrition program that may address both underweight and overweight problems simultaneously.

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