



## Adolescent Obesity: its correlates and associated morbidity

Sonali Sain,\* Prianka Mukhopadhyaya,<sup>1</sup> Tushar Kanti Saha,<sup>2</sup> Shamima Yasmin,<sup>3</sup> Amitava Chatterji<sup>4</sup>, Indira Dey<sup>5</sup>

**ABSTRACT:** Obesity is currently one of the major public health problems, in both developed and developing countries. Obesity is a risk factor for metabolic syndrome. Increasing rates of childhood obesity and more sedentary lifestyles has led to an age shift in metabolic syndrome which now occurs at an earlier age. Thus, the present study was conducted to get an idea about the occurrence of obesity among adolescent school children, risk factors associated with the condition and the related morbidity among them.

**MATERIALS AND METHODS:** A cross-sectional descriptive study carried out in two higher secondary government girl schools with the help of a pre-designed and pre-tested questionnaire.

**RESULTS:** Out of 245 students 16.73% were overweight and 6.54% were obese. Among overweight students, 59.65% exercised less than 4 hours a week, 61.4% watched TV  $\geq$  4 hours per week, 87.72% consumed junk food  $\geq$  4 days per week and 45.61% skipped meals. Puberty related menstrual irregularities, hypothyroidism, acne and stria were more commonly found in overweight students

**CONCLUSION:** The rapidly increasing prevalence of obesity accompanied by unhealthy lifestyle habits among adolescents is one of the most challenging dilemmas of public health importance.

### INTRODUCTION

Obesity is a chronic, multifactorial condition that results from accumulation of fat, regionally located throughout the body, due to the positive difference between food consumption and energy expenditure.<sup>1</sup> Obesity is currently one of the major public health problems, not only in developed country, but also in developing country. Obesity is preceded by the state of overweight, which is important for intervention necessary for prevention, like life style modification.<sup>2</sup>

During the past three decades, the number of overweight adolescents increased while adolescent engagement in physical activity decreased.<sup>3</sup> Obesity is a risk factor for metabolic syndrome. As a consequence of increasing rates of childhood obesity and more sedentary lifestyles, the age shift of metabolic syndrome occurs in earlier age group.<sup>4-6</sup> Metabolic syndrome is a clustering of

cardiovascular disease risk factors that includes glucose intolerance, hypertension, elevated triglycerides, low HDL cholesterol and obesity.<sup>7</sup> The prevalence of the metabolic syndrome in children and adolescents is relatively low (4%) when compared to the adult population (24%), except amongst overweight and obese adolescents where the prevalence of the metabolic syndrome has been reported as high as 29%.<sup>8,9,10</sup>

Recently, it has been shown that there might be an independent, inverse relationship between objectively measured Physical Activity and metabolic risk factors in children.<sup>11</sup>

CDC developed a physical activity and fitness objective for adolescents in the Healthy People 2010 campaign: to increase the proportion of adolescents who engage in moderate physical activity (MPA) that promotes

GJMEDPH 2013; Vol. 2, issue 6

<sup>1, 2, 3, 4</sup> Assistant Professor;  
Dept. of Community Medicine;  
NRS Medical College,  
Kolkata, India

<sup>5</sup> Associate Professor; Dept. of  
Community Medicine, NRS Medical  
College,  
Kolkata, India

Corresponding Author  
\* Assistant Professor,  
Dept. of Community Medicine  
NRS Medical College  
P 58 H, CIT Road, Scheme No VI-M,  
Kolkata- 54, India

E-mail address:  
drsonalisain@yahoo.co.uk,  
drsonalisain@gmail.com

Conflict of Interest—none

cardiovascular fitness at least 5 days per week for 30 or more minutes per session.<sup>12</sup>

Obesity has a complex relationship with female pubertal development and menarche and it leads to earlier menarche. Obesity also causes hormonal derangement and ovulatory dysfunction, insulin resistance, hyperandrogenism and depressed level of sex hormone binding globulin. Thus obese girls often suffer from menstrual irregularity, anovulation and signs of androgen excess e.g. acne, hirsutism. It is also found that many obese women meet the criteria of polycystic ovarian disease but are unaware of the diagnosis, which is also true for the adolescent age group.<sup>13, 14, 15</sup>

Thus, the present study was conducted to assess the occurrence of obesity among the adolescent school children, risk factors associated with the condition and the related morbidity among them.

#### **MATERIALS AND METHOD**

A cross sectional, descriptive type of study was carried out in two Bengali medium higher secondary government girl schools situated in south Kolkata (Alipore Multipurpose High School & Chetla Girls High School). The study duration was 2 months. All the students of Class VIII & Class IX were considered for the study. A predesigned and pretested questionnaire was formulated and validated. Pretesting was done in another school and necessary modification was done afterwards. The protocol of the study was formulated and formal permission was obtained from both the Institution Ethical Committee and the respective School Authority. The class teachers and the students were explained about the purpose of the study and the procedure was briefed. All the students were then asked to fill up the questionnaire distributed to them. Those who were unwilling to participate were excluded from the study. The students were asked to fill up information regarding their socio-demographic profile like, age, religion, family particulars etc.

A questionnaire was used to assess the kind, frequency and number of hours of extra-curricular physical activity. Usual TV viewing and PC use were measured by the questions "About how many hours a day do you usually watch television and videos in your leisure time?" and "About how many hours a day do you usually use a computer in leisure time?"

The students were then enquired about the medical illnesses & / or any health related problem they had. Their anthropometric measurements were taken (e.g. Height, weight, waist & hip circumference). Body mass index (BMI) was calculated using anthropometric measurements (weight and height) and plotted in the CDC 2000 standard reference growth chart for Girls of 2-20 years in order to assess anthropometric status. According to that , they were classified into - Expected Normal weight ( > 3rd to < 85th percentile ), overweight ( 85th – 95th percentile ), obese ( > 95th percentile ) and underweight ( < 3rd percentile ) as recommended by WHO (1995).<sup>16,17</sup>

Their waist: hip ratio was also calculated. If the ratio was > 0.85, it was considered as significant risk factor related to obesity. The data were analysed with the help of Statcal (Epi info version 7.1.2)<sup>18</sup>

#### **RESULTS**

In the present study, total 267 students were approached but only 245 students were present and gave consent for participation on the day of study, so the response rate was 91.76%.

Fig 1 shows that in the present study 72.24% of students were within the range of normal body weight, 16.73% were overweight and 6.54% were obese. But very few (4.49%) were underweight. Underweight participants were excluded from the analysis. Thus total study population became 234. Mean age of study population was  $13.54 \pm 1.7$  years.

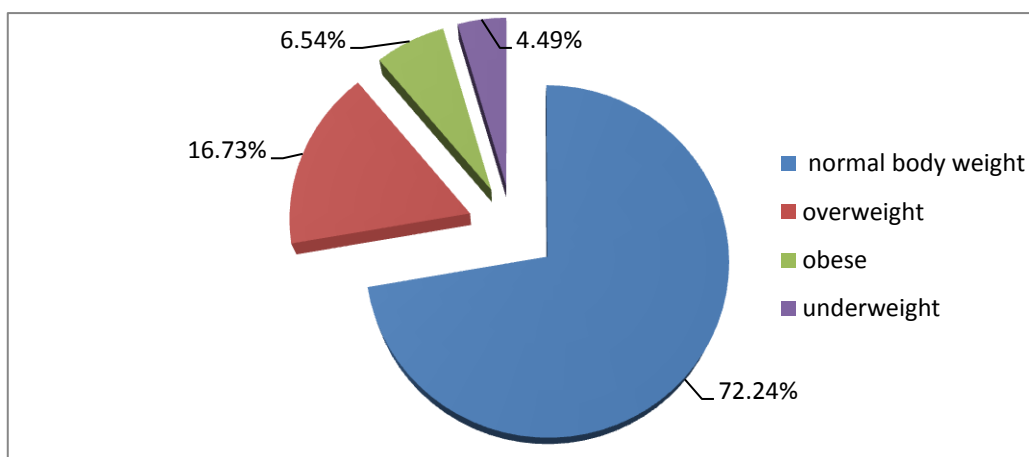


Figure 1: Proportion of students suffering from obesity (n=245)

Table 1 illustrates that 98.71% of the students were Hindus while rest were Muslims. Overweight was slightly more in Muslim students. 83.33% were from nuclear family, less number of students i.e. 16.67% were from joint families. Overweight

students were more common in joint family, compared to their counterparts from nuclear families. Most of the girls (97.9%) were from families with per capita income of more than Rs. 500/- per month.

Table 1: Socio-demographic profile of the study population

Socio-demographic profile	BMI >85 <sup>th</sup> percentile (n1=57) (100%)	BMI < 85 <sup>th</sup> percentile (n2= 177) (100%)	Total (N= 234) (100%)	Odds ratio	CI
<b>A. Age ( in years ):</b>					
12	5 ( 8.7 )	17( 9.6)	22( 9.4 )	1	
13	23( 40.3 )	62( 35.0)	85( 36.3 )	1.261	0.4173-3.8120
14	27( 47.5 )	93( 52.6)	120( 51.4 )	0.987	0.334-2.9221
15	2 ( 3.5 )	5( 2.8)	7( 2.9 )	1.360	0.1995-9.2693
X <sup>2</sup> =0.66, p=0.882, df=3					
<b>B. Religion:</b>					
Hindu	55( 96.5)	174( 98.4)	229( 97.9)	1	
Muslim	2(3.5)	3 ( 1.6)	5( 2.1)	0.4741	0.0772-2.9109
X <sup>2</sup> =0.68, p=0.410					
<b>C. Type of Family:</b>					
Nuclear	32(56.2)	124( 70.1)	156( 66.7)	1	
Joint	25(43.8)	53( 29.9)	78( 33.3)	0.5471	0.2960-1.0111
X <sup>2</sup> =3.76, p=0.052					
<b>D. Per capita monthly Income (Rs):</b>					
<500	1( 1.7 )	4( 2.2 )	5( 2.1)	1	
500 - 2000	19( 33.3)	53( 29.9)	72( 30.7)	1.434	1.1507-13.6495
>2000	37( 65.0)	120( 67.9)	157( 67.2)	1.233	0.1337-11.3799
X <sup>2</sup> =0.27, p=0.875, df=2					

It was found from Table 2 that 51.71% of students, exercises regularly, at least  $\geq 4$  hours per week, 59.65% of overweight and obese exercised less than 4 hours a week. 61.4% of overweight students watched TV  $\geq 4$  hours per week compared to 46.89% of their non-obese counterpart. 87.72% of overweight and obese students consumed junk food  $\geq 4$  days per week, whereas 82.48% of non-

obese students have the same food consumption pattern. Habit of skipping meal was more in overweight and obese students i.e. 45.61% but much less i.e. 29.37% in non-obese students. Parental obesity was found more in obese and overweight students i.e. 42.10%, rather than only in 19.77% of non-obese students.

**Table 2: Lifestyle and other correlates of obesity**

Associated factors	BMI >85 <sup>th</sup> percentile (n1=57) (100%)	BMI < 85 <sup>th</sup> percentile (n2= 177) (100%)	Total (N= 234) (100%)
<b>A. Exercise</b>			
< 4 hrs. /week	34(59.65%)	79 (44.64 %)	113 (48.29 %)
$\geq 4$ hrs. /week	23(40.35%)	98 (55.36 %)	121 (51.71 %)
Odds ratio- 1.833 CI(0.9999-3.3632), $X^2=3.89$ , p=0.048			
<b>B. TV/ Computer use</b>			
$\geq 4$ hrs. /week	35 ( 61.41%)	83 (46.89%)	118 (50.42 %)
< 4 hrs. /week	22 (38.59 %)	94 (53.11%)	116 (49.58 %)
Odds ratio- 1.801( 0.9794-3.3145), $X^2=3.68$ , p=0.056			
<b>C. Junk food consumption</b>			
$\geq 4$ times / Week	50 (87.72%)	146(82.48%)	196(83.77%)
< 4 times / Week	7 (12.28 %)	31 (17.51%)	38 (16.23%)
Odds ratio- 1.516 CI( 0.6386-3.6595), $X^2=0.87$ , p=0.351			
<b>D. Regular Skip meals</b>			
Present	26 (45.61%)	52 (29.37%)	78 (33.33%)
Odds ratio- 2.016 (1.0917-3.7273), $X^2=5.11$ , p=0.023			
<b>E. Parental obesity</b>			
Present	24 ( 42.1%)	35 (19.77%)	59 (25.21%)
Odds ratio- 2.95 CI(1.5514-5.6120), $X^2=3.91$ , p=0.048			

It was found from Table 3 that 44.01% of girls were with waist: hip ratio  $>0.85$ , which was more among the overweight students (56.14%). 22.22% of the students suffered from acne and 5.98% from striae. But both were more common in overweight students, compared to their counterparts [33.33% and 10.52 % respectively]. 5.26% of overweight students suffered from hypothyroidism. 30.03% of all students complained of lethargy. Among the gynaecological morbidity, puberty related menstrual disorders were the most common.

10.68% suffered from menorrhagia, 37.6% suffered from menstrual irregularity like metrorrhagia and 35.89% suffered from dysmenorrhoea. All these complaints were more commonly found among the obese students [15.78% versus 9.03%, 54.38% versus 32.2%, 45.61% versus 32.76% respectively]. Though intake of regular medication (e.g. corticosteroids) can be related to overweight /obesity, none of the students were found to be taking them. Regarding drugs, 3 students were on Eltroxin therapy, 1 on antiepileptic therapy, 2 on Homeopathic medicine, 5 on some vitamin supplements and ayurvedic preparation.

**Table 3: Co-morbidities of obesity among the study population**

Morbidity associated with obesity	BMI > 85 <sup>th</sup> percentile (n1= 57) Overweight (100%)	BMI ≤ 85 <sup>th</sup> percentile (n2= 177) Normal weight (100%)	Total (N=234) (100%)
<b>Waist : Hip &gt; 0.85</b>	32 (56.14)	71 (40.11)	103 (44.01)
X <sup>2</sup> =4.49, p=0.034, OR=1.91			
<b>Coarse Skin</b>	7 (2.28)	26 (14.68)	33 (14.10)
X <sup>2</sup> =0.21, p=0.649, OR=0.81			
<b>Acne</b>	19 (33.33)	33 (18.64)	52 (22.22)
X <sup>2</sup> =5.38, p=0.020, OR=2.18			
<b>Lethargy</b>	21 (36.84)	68(38.41)	89 (38.03)
X <sup>2</sup> =0.05, p=0.831, OR=0.94			
<b>Hypothyroidism</b>	3 (5.26)	0	3(1.28)
<b>Striae</b>	6 (10.52)	8 (4.51)	14 (5.98)
X <sup>2</sup> =2.77, p=0.096, OR=2.49			
<b>Gynaecological disorder</b>			
<b>Menorrhagia</b>	9 (15.78)	16 (9.03)	25(10.68)
X <sup>2</sup> =2.06, p=0.151, OR=1.89			
<b>Metrorrhagia</b>	31 (54.38)	57 (32.2)	88 (37.6)
X <sup>2</sup> =9.04, p=0.002, OR=2.51			
<b>Dysmenorrhoea</b>	26 (45.61)	58 (32.76)	84 (35.89)
X <sup>2</sup> =3.09, p=0.079, OR=1.72			

## DISCUSSION

Recently there has been a growing concern over the current trend of increasing prevalence of overweight and obesity among children and adolescents. Overweight children often become overweight adults and overweight in adulthood is a health risk.<sup>19, 20, 21</sup>

The present study was conducted with an effort to identify the problem of obesity in the adolescent age group and the related morbidities. The result unexpectedly indicated that the prevalence of overweight & obesity (17.95% and 6.41%) in the study population were quite high, compared to findings of other studies. Goyal R et al found that prevalence of overweight and obesity in Indian adolescent school going children was found to be 9.2% and 1.5% respectively.<sup>22</sup> A study conducted in Brazil showed that 7.3% were overweight and 4.5% were obese among the adolescent school children, which is quite low compared to the present study.<sup>2</sup>

Socio-demographic profile of a group of people influences the life style, food consumption pattern, physical activity and public services like health services.<sup>23</sup>

In the present study, table 1 shows that majority of obese students were in the 13- 14 years age group , from Hindu , nuclear families with per capita income of > Rs 500/- per month . Prevalence of overweight students was greater in average income group (26.3%), but less present in low and high income group (20% & 23.5% respectively). Goyal et al also found that prevalence of overweight among children was higher in middle income group, compared to higher income group and was least in lower income group; where family income was used as a primary indicator of socioeconomic condition.<sup>22</sup> Salem Z found no difference in the distribution of BMI according to the measures of parental education or income.<sup>24</sup> But Borges G found in a

Mexican study that obesity prevalence increased as the parental income increased to high average group ( 13%, 16.4%,18.7% ) and again came down to 13% in high income group. Similar pattern was found in parental educational status, i.e. obesity was more in children with average parental education.<sup>25</sup>

Unhealthy lifestyle behaviours like improper diet and insufficient physical activity compromise the health of adolescents and what is more alarming is that such behaviour acquired during this stage of life, are likely to persist later on in adulthood. High consumption of saturated fats, salt and refined carbohydrates as in junk foods and low consumption of fruits and vegetables pose a risk for cardiovascular disease. The present study found that overweight students had more habit of doing less exercise and watching more of television, video games and computer use, regular habit of skipping of meal, family history of parental obesity compared to their normal weight counterpart. A study done by S Toselli reported similar findings that an increase in hours spent watching TV/PC was associated with increasing BMI with significant differences between obese subjects and subjects belonging to the other weight categories. People who spent fewer hours in extracurricular physical activity belong to the normal weight and overweight categories.<sup>17</sup> Table 3 shows gynaecological morbidity were more commonly found among the obese students. Obesity was present in half of patients of polycystic ovarian disease (PCOD) presenting with secondary amenorrhea (duration 4-5 months) or oligomenorrhea.<sup>26</sup>

Schools provide an ideal opportunity for identifying and counselling for correction of underlying pathological factors of overweight / obesity by adherence to healthy lifestyle habits, medical treatment and periodical checkups during parent- teachers meeting. Besides, guardians can also be informed about the benefits of healthy life style habits, balanced diet, importance of taking meals on time and not skipping meals etc.

## CONCLUSION

The present study observes an alarming proportion of overweight and obesity among urban school going adolescents with majority reported to having unhealthy dietary habits and insufficient physical

activity. While the medical community struggles to develop effective strategies for the treatment of this epidemic, timely identification of obesity and preventive measures targeting this vulnerable age group remains the initial crucial step in the management of obesity to prevent a catastrophe of lifestyle diseases like diabetes and cardiovascular diseases in the near future.

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