

Body Mass Index among adolescents: A cross sectional study



Medical Science

KEYWORDS : Body Mass Index, Adolescents, Obesity

Vasanta S Chandaki

Assistant Professor (Statistics), Department of Community Medicine, VIMS, Bellary

Dr.Ramesh.K

Assistant Professor, Department of Community Medicine, VIMS, Bellary *
Corresponding Author

ABSTRACT

Background: Body Mass Index, reflects both fat and fat-free components of body weight. BMI increases from birth to around one year, then declines to around age six, then increases through the remainder of childhood and adolescence. Methodology: A cross sectional study conducted among Government, Private unaided and Private aided High schools. The sample size was 1718 and study subjects were selected by Stratified random sampling technique. BMI was the study tool. Results: Study subjects included were both boys and girls, boys constituted 49.2% (845) and girls 50.8% (873) and the age of the study subjects ranged from 12 to 16 years. The distribution of BMI among boys and girls is almost similar. Conclusion: Regular monitoring BMI among school students may help in prevention of childhood and adolescent obesity

Introduction:

Body Mass Index is defined as weight (kg)/height squared (m²) is the most frequently used measure of weight in relation to height. It has been described as 'The backbone of the obesity classification system and surveillance Statistics an immensely valuable tool'¹.

Body mass index (BMI) is a practical measure used to determine overweight. BMI is a measure of weight in relation to height that is used to determine weight status. BMI can be calculated using either English or metric units. BMI is the most widely accepted method used to screen for overweight in children and adolescents because it is relatively easy to obtain the height and weight measurements needed to calculate BMI, measurements are non-invasive and BMI correlates with body fatness². While BMI is an accepted screening tool for the initial assessment of body fatness in children and adolescents, it is not a diagnostic measure because BMI is not a direct measure of body fatness. However, a number of authors have detailed its disadvantages^{3,4}.

The first of these is that BMI varies between males and females and according to age and level of maturity. Thus, while male and female BMIs tend to be similar in childhood, they are higher among females in adolescence.

In respect of age, BMI increases from birth to around one year, then declines to around age six, then increases through the remainder of childhood and adolescence. The point at which BMI reaches its lowest level and begins to increase is termed '**adiposity rebound**' with earlier adiposity rebound being associated with increased risk of subsequent overweight⁵. Such variations mean that among children and adolescents the significance of any particular BMI is more difficult to determine than within adult populations.

A second, and related limitation of BMI, is that it reflects both fat and fat-free components of body weight. However, as described earlier, populations differ in respect of both percentage fat mass and fat distribution, and in the relation between body composition and morbidity. This means, again, that the significance of any particular BMI will vary. Thus, among children with the same BMI, fat measurements are higher for whites than for blacks⁶.

Further, recent studies have suggested that increases in overall BMIs have been accompanied by larger increases in the percentage as fat mass and concomitant decreases in fat free mass. Importantly, this suggests that recent increases in adiposity are even greater than those suggested by increases in

BMI^{7,8} A third disadvantage of BMI is that since one of its components is height, the index also varies according to height, and this association in turn varies according to sex and age. Its relationship to height means that BMI is also affected by relative leg length.

A further disadvantage is that since BMI does not measure fat directly, there is no consensus about which cut-off to use in order to define obesity in children and adolescents.

Among adults, a WHO Expert Committee on Physical Status agreed, in 1993, to classify BMIs as follows: 25–29.9 as 'overweight' (or 'pre-obese'); 30–34.9 as 'obese class I'; 35–39.9 as 'obese class II'; and over 40 as 'obese class III'. This classification was based on the risk of co morbidities, rising across the four categories from 'increased', to 'moderate', 'severe' and 'very severe'^{9,10}. Unfortunately, much less is known about levels of risk associated with specific BMI levels in children and adolescents.

Methodology:

A cross sectional study was carried out among high schools of Thiruvananthapuram Corporation to find the Body Mass Index pattern. Students studying in 8,9 and 10th standard were the study subjects. This study was conducted among Government, Private aided and Private unaided schools. These schools were selected by simple random sampling and the required study subjects were selected based on Stratified random sampling after finding probability proportionate sampling size. The sample size of the study was 1718. After taking consent from the school authorities, a pre tested semi structured questionnaire was self administered to the students in the classroom and asked them to enter the relevant data, Weight and Height of the students were recorded following standard protocol and BMI was found. Data was entered in Microsoft excel and analyzed in SPSS.

Results:

Table.1: Distribution of study subjects according to the category of school

Category of school	Frequency	Percent
Government	622	36.2
Private aided	754	43.9
Private unaided	342	19.9
Total	1718	100.0

A total of 1718 students formed the study subjects, which included students from Government, Private aided and Private

unaided schools. Students of Government schools constituted 622 (36.2%), Private aided constituted 754 (43.9%) and students of Private unaided constituted 342 (19.9%). Altogether students of Private schools constituted 63.8% of study subjects.

Table.2: Age and Sex wise distribution of the study subjects

Age	sex				Total	
	Boys		Girls			
	N	%	N	%	N	%
12	25	3	56	6	81	4.7
13	241	28.5	285	32.6	526	30.6
14	271	32.1	285	32.6	556	32.3
15	261	30.9	233	26.7	494	28.8
16	47	5.5	14	1.6	61	3.6
Total	845	100	873	100	1718	100

Mean age of study subjects – 13.96 yrs (SD – 0.96)

Mean age of Boys – 14.08 yrs (SD – 0.96)

Mean age of Girls – 13.84 yrs (SD – 0.94)

The age of the study subjects ranged from 12 to 16 years, maximum numbers of students are in the age group of 14 years (32.3%) and as well as in the age group 13 years(30.6%) which together constituted about 63% of study subjects. It was observed that 3.6% of study subjects belongs to age 16 and 4.7% belong to the age 12 yrs.

Study subjects included were both boys and girls, boys constituted 49.2% (845) and girls 50.8% (873).

Table.3: Anthropometric indices of the study subjects

Variable	Boys		Girls		Total	
	Mean	SD	Mean	SD		
Weight (Kg)	48.20	12.48	47.16	10.42	47.68	11.49
Height (Cms)	158.24	9.40	152.46	6.41	155.30	8.53
BMI	19.10	4.06	20.26	4.12	19.69	4.13

The mean weight, height and BMI of study subjects are 47.68 kgs, 155.30 cms and 19.69 respectively The mean weight and height of boys are comparatively high with a difference of 1.04 kgs weight and 5.78 cms height but mean BMI was found to be high among girls with a difference of 1.16.

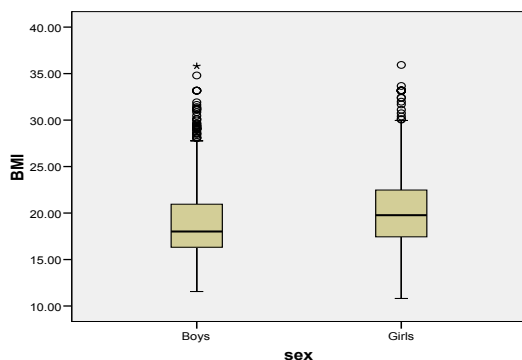


Fig.1: BMI among boys and girls

The distribution of BMI among boys and girls is almost similar with a slight difference. The median BMI of boys and girls are 18.01 and 19.77 respectively. The minimum and maxi-

mum BMI value among boys is 11.56 and 35.81 respectively whereas among girls, it is 10.81 and 35.93.

The Inter quartile range among boys and girls are 4.67 and 5.04 respectively.

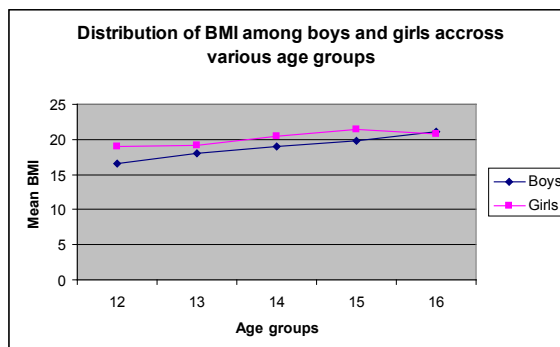


Fig.2: Distribution of BMI among Boys and Girls across various ages

The mean BMI is high for girls compared to boys across all the ages except for the age 16 yrs where mean BMI is slightly high for boys. It is found that the mean BMI of boys as well as girls increased with the age but with a slight dip for girls at the age of 16 yrs.

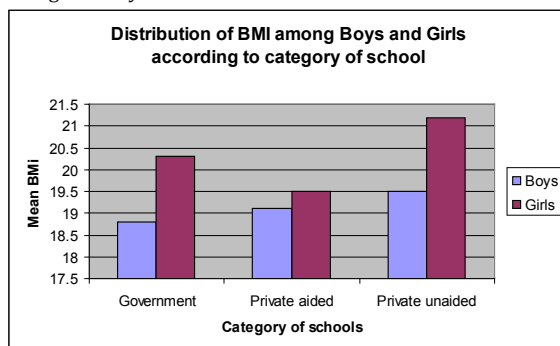


Fig.3: Distribution of BMI among study subjects according to category of school

In the above figure, it is evident that mean BMI is high for girls compared to boys in all the three categories of schools. Mean BMI is high for both boys and girls in private unaided schools compared to others. The mean BMI of boys is high in private unaided schools (19.5) followed by Private aided (19.1) and Government (18.8) but whereas mean BMI of girls is high in private unaided schools (21.2) followed by Government (20.3) and Private aided (19.5).

Discussion:

In this study, the age of the study subjects ranged from 12 to 16 years. The combined prevalence of overweight and obesity is found to be high in the age group 15 yrs i.e. 21.1% and is least in the age group 12 yrs i.e. 13.5%. It is also observed that the prevalence of overweight and obesity increases as the age increases (excluding age group 16 yrs). The prevalence peaked at 13, 14 and 15 yrs.

A school based study in Chennai done in adolescents showed that the prevalence peaked at 10,13 and 15 years¹¹ but whereas a study in Delhi showed that the maximum prevalence of obesity was at 10 -12 years¹². The high prevalence of overweight/obesity in adolescent is important because obese adolescents become obese adults thus increasing the risk of various diseases. This has been proved in many other studies

in the past and is being researched even today to find the exact etiology. It has been found that prevalence in higher ages of adolescents is reflective of overweight/obesity in adulthood¹³

Study subjects included were both boys and girls, boys constituted 49.2% (845) and girls 50.8% (873). The combined prevalence of overweight and obesity is high among girls (20%) compared to boys (16.40%). Boys showed a higher prevalence of obesity (6.3%) than girls (6.1%) while girls showed higher prevalence of overweight (13.8%) than boys (10%) which is similar to the findings of Delhi study. Similarly study conducted in Punjab also revealed that overweight was high among girls compared to boys whereas obesity was high among boys.

The present study used category of the schools as one of the socio economic status indicator based on assumption that students of high economic status joins private schools. The differences in types of school, Government, private aided and unaided was also examined and prevalence of overweight/obesity was found to be more in private unaided schools (22.2%) compared to aided (17.5%) and Government (17%). Similarly a study carried out in Ernakulum, Kerala showed that the proportion of overweight children was significantly higher in private schools, and the rising trend was limited to private schools¹⁴.

Conclusion:

1. Body Mass Index was found to be high among girls
2. It is found that the mean BMI of boys as well as girls increased with the age but with a slight dip for girls at the age of 16 yrs.

REFERENCE

1. Prentice A, Jebb SA: Beyond body mass index. *Obesity Reviews* 2001, 2:141-147. | 2. Dwyer T, Blizzard CL: Defining obesity in children by biological endpoint rather than population distribution. *International Journal of Obesity* 1996, 20(5):472-480. | 3. Garn SM, Leonard WR, Hawthorne VM: Three limitations of the body mass index. *American Journal of Clinical Nutrition* 1986, 44:996-997. | 4. McCarthy HD, Jarrett KV, Emmett PM, Rogers I: Trends in waist circumferences in young British children: a comparative study. *International Journal of Obesity* 2005, 29(2):157-162. | 5. Eisenmann JC, Heelan KA, Welk GJ: Assessing body composition among 3- to 8-year old children: anthropometry, BIA and BXA. *Obesity Research* 2004, 12(10):1633-1640 | 6. Daniels SR, Khoury PR, Morrison JA: The utility of body mass index as a measure of body fatness in children and adolescents: differences by race and gender. *Pediatrics* 1997, 99(6):804-807. | 7. McCarthy HD, Ellis SM, Cole TJ: Central overweight and obesity in British youth aged 11-16 years: cross sectional surveys of waist circumference. *BMJ* 2003, 326(7390):624. | 8. Ruxton CH, Reilly JJ, Kirk TR: Body composition of healthy 7- and 8-year-old children and a comparison with the 'reference child'. *International Journal of Obesity* 1999, 23:1276-1281. | 9. WHO: Physical status: the use and interpretation of anthropometry. Geneva, World Health Organisation, Technical Report Series, 854; 1995. | 10. WHO: Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva, World Health Organisation; 1998. | 11. Subramanyam V, Jayashree R, Rafi M. Prevalence of overweight and obesity in affluent adolescent girls in Chennai in 1981 and 1998. *Indian Pediatr.* 2003 Aug;40(8):775-9. | 12. Kapil umesh, et al. prevalence of obesity among affluent adolescent school children in Delhi. *Indian Pediatrics* 2002;39(5):449 - 452 | 13. Valdez R, Greenlund KJ, Wattigney WA, Bao W, Berenson GS: Use of weight-for-height indices in children to predict adult overweight: the Bogalusa Heart Study. *International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity* 1996, 20(8):715-721. | 14. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: time trends and relationship with hypertension. *Natl Med J India.* 2007 Nov-Dec;20(6):288-93. |