



## Variability of Body-mass-index in school children of Pune, Maharashtra, India

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### Abstract

**Background:** Nutritional variation of adolescence and children is an important transitional phase between childhood and adulthood characterized by marked acceleration in growth. Childhood obesity is commonly seen in urban cities. The body-mass-index (BMI) defined is an anthropometric index of weight and height, it defines the nutritional aspect as underweight, normal, overweight and obese. With growing concerns of increased obesity in school children there was a need to study the existing variability in BMI in this population.

**Aims and Objectives:** This study was carried out to determine the variation of BMI with boys and girls in school going adolescence and children and to explore the differences in BMI of boys and girls in school going adolescence and children.

**Methods:** A total of 200 student children and adolescents (110 girls and 90 boys) participated in the study from various schools of Pune city. The average mean age was 13.5±2.5 years of girls and boys included in this study. For BMI calculation CDC growth chart used.

**Results:** The average BMI (Mean±SD) was 25.79±2.49. The average heights of the students were 1.55 meters. Out

of 200 students the average weight of boys was 38.52±2.48, and average weight of girls was 42.99±2.01. This shows that girls having higher weight percentage than the boys. The average fat percentage for boys was 20.18 and for girls were 22.21. Out of 200 students we found 119 students coming in underweight category, 26 were normal, overweight were 31 and obese were 24. The average weight of all students was 42.82±8.2.

**Conclusion:** Our study concludes that the boys (38.52±2.48) having lower weight percentage than the girls (42.99±2.01). The average fat percentage for boys (20.18) and girls (22.21) concludes that girls having higher fat percentages than the boys. Study revealed that, highest students coming in underweight category as compared to normal, overweight, and obese. The outcomes of present study pointed out importance of the health related issue like obesity in prevalence to lack of nutrition by the determination of BMI and its variation.

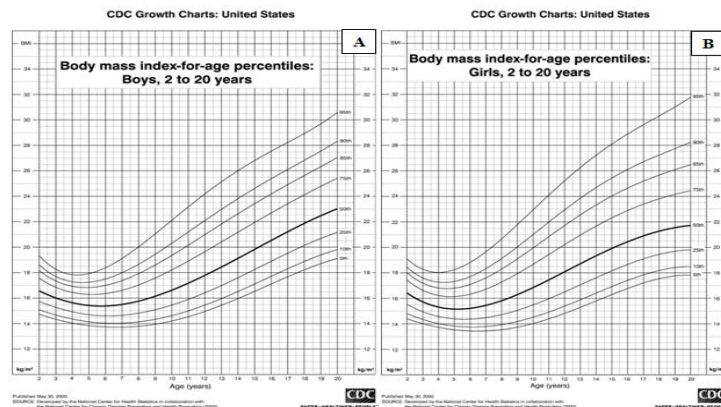
**Key Words:** Adolescence, Body fat percent, Body mass index, School going children

### Introduction

Adolescence is a transitional phase between childhood and adulthood characterized by the marked acceleration in

growth. Failure to achieve optimum nutrition intake at this time can potentially retard physical growth, intellectual capacity, and sexual maturation.<sup>1</sup> Overall, 20% of the global population constitutes of adolescence and most of it resides in developing countries. Hence, health and well-being of such a vast resource must be of high priority.

Recently health has become a major instrument of overall socio-economic development and creation of a new social order.<sup>2</sup> Many developing countries, the progress of nutritional transition has been characterized by the presence of nutritional deficiencies and also increased Prevalence of obesity in adolescents. These are fundamentally associated with changes in lifestyle and eating habits simultaneously.<sup>3</sup> Inadequate nutrition and changing lifestyle behavior in adolescence not only leads to problems of under-nutrition and developmental deficiencies but also put them at high risk for chronic diseases. Several socioeconomic and demographic factors are of the prime importance which affects adolescence nutritional status. Furthermore, eating habits in children are changing like low consumption of fruits, green leafy vegetables, and milk and at the same time increase consumption of dry snacks, bakery products, and soft drinks, thus increases adiposity in children.<sup>4</sup> From the recent fitness study, it comes to know that one out of 3 school going children are lacking from healthy Body Mass Index (BMI).<sup>5</sup> Recently EduSports conducted the seventh annual school health and fitness study (2016) in which they revealed that despite gender, age or city- BMI levels of school going children are not up to the mark.<sup>5</sup> The centers for disease control and prevention (CDC) growth chart was used to assess the risk of overweight screening in children and adolescence shows in **Figure 1**. Childhood obesity is a most important public health problem, given its increasing prevalence and adverse health consequences.<sup>6</sup>



**Figure 1: A) CDC growth charts for boys; B) CDC growth charts for girls.**

**Material and Methods**

This study was carried out at various schools in Pune city. The permission was taken from respective school administration for conduction of study. Pune city is the state of Maharashtra was distributed into different geographical zones and then schools were selected randomly from different zones of the Pune city total of 200 student children and adolescents (110 girls and 90 boys). Government schools, government aided schools and private schools were included to consider different socioeconomic strata students. Overall 200 students were enrolled into the study of standard 7<sup>th</sup> and 9<sup>th</sup> between the mean age 13.5±2.5 years according to inclusion and exclusion criteria. Prior to the study the test procedures were explained to the subjects in detail to ensure proper understanding and helpful co-operation and to obtain and to measure reliable data from the tests. Parental written consent was taken prior to the study.

Table 1: BMI classification with range.

BMI	Range
Underweight	< 18.5
Normal	18.5-23
Overweight	23- 27.5
Obese	> 27.5

The baseline data of height and weight were measured using the standard procedures suggested by Jelliffe.<sup>7</sup> The

classification of BMI shows in **Table 1**. The BMI is calculated by weight in kg divided by height in meter square. The nutritional status of children calculated by CDC growth 20 charts The BMI-for-age percentile growth charts are the most commonly used indicator to measure the size and growth patterns of children and teens in the United States. Body fat percentage was calculated by body fat analyzer weighing machine (Tanita). **Table 2** shows categorical weight status and percentile range of underweight, normal or healthy weight, overweight, obese children.

Table 2: Weight and percentile range.

Weight status category	Percentile range
Underweight	Less than the 5 <sup>th</sup> percentile
Normal or Healthy Weight	5 <sup>th</sup> percentile to less than the 85 <sup>th</sup> percentile
Overweight	85 <sup>th</sup> to less than the 95 <sup>th</sup> percentile
Obese	Equal to or greater than the 95 <sup>th</sup> percentile

**Result**

A total of 200 student children and adolescents (110 girls and 90 boys) participated in the study from various schools of Pune city with the average mean age of 13.5±2.5 years. The all children were studied according to their BMI, dietary habit, and history of obesity among their parents as shown in **Table 3 and Table 4**.

Table 3: BMI and diet history of children.

Variable	Classification	Number	Total
BMI percentile	≥85	23 girls/ 12 boys	200
	<85	87 girls/ 78 boys	
Diet	Non vegetarian	70 girls/ 75 boys	200
	Vegetarian	40 girls/ 15 boys	

**Table 4: Distribution of the children as per the BMI in pre-intervention and post-intervention (n=200).**

BMI	Pre-intervention
Underweight	119
Normal or healthy	26
Over weight	31
Obese	24
<b>Total</b>	<b>200</b>

From the above table the higher number of children were <85 percentile of BMI with higher number of non vegetarian.

The distribution of children as per the average BMI was 25.79 ± 2.49 and the average weight was 42.82±8.2 kg as shown in **Table 5**. The average height of the students was 1.55 meters. Out of 200 students the average weight of boys was 38.52±2.48, and average weight of girls was 42.99±2.01. This shows that girls having higher weight percentage than the boys. The average fat percentage for boys was 20.18 and for girls were 22.21. Out of 200 students we found 119 students coming in underweight category, 26 were normal, overweight were 31 and obese were 24. The average weight of all students was 42.82±8.2.

Table 5: Distribution of the children as per the average BMI (n=200).

Variable	Value
Average BMI (Mean ± SD)	25.79 ± 2.49
Height (meter)	1.55
Average weight (kg)	All 42.82±8.2
	Boys 38.52±2.48
	Girls 42.99±2.01
Fat (%)	Boys 20.18
	Girls 22.21

**Discussion**

The determination and prevalence of BMI with obesity and overweight differs remarkably across the countries

suggesting that nutritional, health, and environmental factors to examine variation in genetic difference across children. The use of different standards or references to examine childhood obesity makes difficulty in finding with population. Based on BMI we have considering the prevalence of obesity and overweight. An anthropological body literature survey questioned the validity of weight/height indicators as body compositions.

In 1966-1970 to 17.4% similar trends have been observed in Canada, the United Kingdom and Europe.<sup>8-12</sup> In addition to the growing numbers of obese children, the proportions of children with BMI greater than the 10<sup>th</sup>, 50<sup>th</sup>, 85<sup>th</sup> and 90<sup>th</sup> percentiles continue to increase, which indicates an increase in weight for height across the entire population.<sup>8,13</sup> These trends are likely to result in significant increases in the rates of coronary artery disease, hypertension, diabetes mellitus and other obesity-related diseases in young and middle-aged adults.<sup>14-16</sup>

In our study we have found that the prevalence of obesity is around 12% in the similar study done by Pradeepa R and Anjana RM, et al also found the Indian population is prone for higher obesity.<sup>17</sup> A review of longitudinal studies found that under nutrition (wasting and underweight) was almost twice as common among deceased children, but it concluded that studies that attempt to link the determinants of growth faltering with those of childhood mortality appeared.<sup>18</sup> Analysis of longitudinal community-based studies on children aged less than 5 years showed that having a underweight resulted in an increased risk of mortality, particularly from infectious diseases like diarrhea, etc.<sup>19</sup> Similarly, our study showed 119 children in the underweight category. Other systemic review they have been found that the overweight and combined overweight/obesity prevalence showed an increasing trend. The prevalence of overweight increased from 9.7 per cent prior to 2001 to 13.9 per cent in studies detailed after 2010.<sup>20</sup> Our study showed that, girls are

having high prevalence of obesity as compared to boys. Similar study done by Jagadesan S, Harish R, et al. also shows a higher prevalence rates of overweight/obesity among girls in their study.<sup>21</sup> Khadilkar et al. reported on affluent Indian 2 to 17 years old children and showed that the prevalence of overweight and obesity was 18.2 per cent by the IOTF classification while it was 23.9 per cent using WHO cut-points and the prevalence was higher in boys.<sup>22</sup> There is also a rise in technological advancement and automation that has reduced children's involvement in physical activities.<sup>23</sup>

Furthermore, the effect of obesity on longevity stated that the end of the life expectancy and youth of today may, on average, live less healthy and shorter lives than that their parents.<sup>24</sup> The another study of obesity in children and adolescence reported needs for develop way of successful program activity into every day practice in home or surrounding environment for live happy.<sup>25</sup> Some of the studies reported need of physical activity in pediatric obesity cure and treatments may be improving the outcomes of obesity and co-morbidities conditions.<sup>26</sup> The school based, various component physical activities also control the higher rate of BMI, fasting glucose level, and increase duration of moderate to vigorous physical activity.<sup>27</sup> The central for disease control and prevention may provide questionnaire to control the rate of BMI.<sup>28, 29</sup> The limitation of the study was to small number of the students for the examination of BMI. Less parameter with lower data availability for the study results may cause difficulty for understanding the actual outcomes of the study. Furthermore, higher numbers of students were required with multiple parameters for the excellent outcomes and nutritional growth of children.

### Conclusion

This shows that girls having higher weight percentage than the boys. The average fat percentage for boys was 20.18 and for girls were 22.21. Out of 200 students we

found 119 students coming in underweight category, 26 were normal, overweight were 31 and obese were 24. The average weight of all students was  $42.82 \pm 8.2$ .

The current study conclude that, there is prevalence of obesity in school going children also prevalence of under nutrition remains high in children from the less affluent classes and considering their dietary pattern, it is less likely that children from this class will be overweight in the near futures. So, a measure to make this type of population in a healthy zone is the challenge for the future aspects.

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