

## Prevalence of Obesity among Adolescent School Going Children (13-15 Years) in Coimbatore

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### Abstract:

**Background:** To assess the prevalence of obesity in adolescents (13-15 years) in selected area of Coimbatore District.

**Material and Methods:** A school based survey was carried out among 11,330 adolescents between the age group of 13 to 15 years in four different schools Government aided (1536), Corporation (631), Government school (841) and private school (8322). The obesity was assessed using an updated Body Mass Index (BMI) reference chart developed by Centre for Disease Control.

**Results:** The study shows that equal distribution of boys and girls were involved. The overall prevalence of underweight, normal, overweight and obesity in adolescent was 28%, 46%, 18% and 8%. It is evidence from the result, that the percentage of obesity is higher in private schools (10%) when compared to other schools. On comparing the BMI with different schools, it was noted that there was no significant difference ( $p=0.072$ ) at 0.05% level. The gender specific prevalence of obesity among the participants shows that 49% boys and 50% girls. Anthropometric assessment revealed that the mean height and weight of the obese participants were more than the NCHS standard. BMI shows that there is no significant difference at 0.05% level between boys and girls in all age group though girls had a higher BMI than boys.

**Conclusion:** It is concluded that proper nutrition is essential to keep the adolescent healthy and able to grow and develop properly. Eating balance and healthy foods helps adolescent to participate better in academics. Individually targeted obesity prevention education programme will produce beneficial effects on their lifestyle pattern.

**Key words:** Adolescent obesity, Body Mass index, Centre for Disease Control, Coimbatore

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### I. Introduction

Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called "New World Syndrome," creating an enormous socioeconomic and public health burden in poorer countries (1). Obesity is one of the important risk factors for non-communicable diseases. Obesity is a most prevalent malnutrition all over the world (2). It is characterized by abnormal growth of adipose tissue. Indeed, we are amidst an epidemic of obesity (3). Obesity is a major public health concern with a highly increasing prevalence in adolescents and childhood population. Obesity increased dramatically, particularly since 1980's throughout the world. This trend prompted the World Health Organization in 1998 to recognize a "global epidemic of obesity" (4). Obesity has become the most prevalent nutritional problem in the world, eclipsing under nutrition and infectious diseases and is emerging as the most significant contributor to ill health and mortality and is affecting not only adults but also children and adolescents (5).

Obesity is rapidly increasing in developing countries undergoing rapid nutrition and lifestyle transition, and it often co-exists with under-nutrition. The rising prevalence of overweight and obesity in developing countries is largely due to rapid urbanization, mechanization and rapid changes in diets and life styles that have occurred with economic development and market globalization. This is having a significant impact on health, and nutritional status of population, particularly in children (6).

Obesity and overweight among school children are emerging as an important public health problem in India (7, 8). These problems showed rapid increase, especially in cities and among affluent youth (9, 10).

Obesity in children and adolescents leads to health consequences among them and also increases risk of obesity in adulthood. Different studies conducted during last decade in India reported prevalence of obesity in range of 2.9%–14.3%, and of overweight in range of 1.5%–24.0% (11).

The term Adolescent is derived from Latin word “adolescence” meaning “to grow”, or “to mature”. The WHO defines adolescent as an individual in the age group of 10-19 years. There are three stages in adolescence, early adolescence (11-14 years of age), middle adolescent (15-17 years of age) and late adolescence (18-21 years of age). In India there are 243 million adolescents constituting to 21.4% of the country’s total population (12).

Adolescence, the second decade of life, is a period in which an individual undergoes major physical and psychological changes. Alongside this, there are enormous changes in the person’s social interactions and relationships. At the same time, it is a period of risk: a period when health problems that have serious immediate consequences can occur or when problem behaviours that could have serious adverse effects on health in the future are initiated (13).

Adolescence is perceived as one of the healthy periods in the life. The transition through adolescence and into early adulthood is recognized as an influential age for excess weight gain, marked by poor dietary patterns and physical inactivity. They are fascinated by new tastes and have faulty eating habits along with physical inactivity which may lead to overweight. Adolescence is generally characterized as a period of growing independence, where individuals are increasingly beginning to make their own decisions about their day-to-day life (14). Household family income, related socio-economic factors and overweight in mothers were most significantly associated with obesity in children (15).

As rates of obesity rising among the adolescent children the risk factors of associated diseases also increases in future in their life. Accumulation of fat in later cases of life leads to increased risk of hyper tension, diabetes, heart diseases, arterial collapse, thrombosis, liver failure, psychological imbalance and threat of cancer. In India, about \$200 billion was spent towards medical expenses related to obesity issues during 2005-2015. It is estimated to increase by two or three fold in next decade. So immediate standard measures need to be taken to control obesity among children through conducting awareness camps and implementing strict nutritional plans.

## **II. Methods And Material**

**Selection of Area:** The present study was conducted in East zone of Coimbatore city of Tamil Nadu. As the investigator was familiar with the area and a good rapport was established with the school authorities and hence, the study was confirmed to this area. As the interest and comfortability of the researcher, East zone was selected as it is easily approachable by the investigator. About 22 schools comprising offive Government Aided schools (financed by Government partly), three corporation schools, four Government schools (fully financed by the Government) and ten private schools (financed by private management without any Government grants) in east zone of Coimbatore district were selected for conduct of the study.

**Selection of Children:** Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called “new economic syndrome” creating an enormous socio-economic and public health burden in poorer countries. Obesity is not a single disorder but a heterogeneous group of conditions with multiple causes.

A study in India, revealed that among adolescent the prevalence of obesity was 29 percent in boys and 32 percent in girls. The prevalence of underweight was 34 percent in boys and 26 percent in girls (16).With these points in mind, the investigator selected adolescent in the age group of 13-15 years for the study. A total of 11,330 adolescent participants comprising of boys and girls which included 1536 adolescent from Government aided schools, 841 adolescent from Government schools, 631 adolescent from corporation schools and 8322 adolescent participants from private schools of east zone of Coimbatore were screened for the prevalence of obesity.

**Screening for obesity:** The subjects were screened for obesity by measuring their height and weight and calculating their Body Mass Index (BMI). Obesity status is usually indicated by Body Mass Index, which weight is adjusted for height. Weight status is based on the BMI level for adults but for children based on percentile. Based on age and specific BMI percentiles, the subjects were classified as underweight (< 5<sup>th</sup> percentile), normal (5<sup>th</sup>-< 85<sup>th</sup> percentile),overweight (85<sup>th</sup>-<95<sup>th</sup> percentile) and obese (>95<sup>th</sup> percentile). In order to screen for obesity, the standing height and body weight of the participants of all 11,330 adolescent were recorded.

**1. Measurement of Height:** A stadiometer was used to measure the height of the adolescent population. The participants were made to stand straight erect without shoes on a flat floor by the scale with heels together and toes apart. The head was held comfortably erect with the arms hanging freely at the sides, in a natural manner. The head piece of the stadiometer was lowered slowly and was placed in the sagittal plane overthe head of the participants applying a slight pressure to reduce the thickness of hair and make contact with the top of the head.Using the above technique height of the adolescent was measured.

**2. Measurement of Weight:** Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status of young children. Weights of children are typically evaluated in relation to average weight for age, height and gender. Body weight of the adolescent was measured using a digital weighing balance. The balance was adjusted to zero and the readings were recorded. The subjects were asked to stand on the weighing scale bare footed without touching anything, knees not bent and head straight and looking forward. The readings were carefully viewed and recorded nearest to 0.5g(17).

**3. Body Mass Index:** Weight and height can be related in several ways. Of this ratio called BMI or Quelet Index ( $\text{Kg/m}^2$ ) is most useful. BMI is the standard criterion for measuring obesity in children and adults, and when used for children, provides a uniform measure across age groups. Body mass index is defined as weight in kilograms divided by height in meters square ( $\text{Kg/m}^2$ ).

After calculating the BMI for the participants, the BMI value obtained was plotted on the CDC BMI-for-age growth charts for both girls and boys to obtain a percentile ranking. Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children and they indicate the relative position of the child's BMI value among children of the same age and sex.

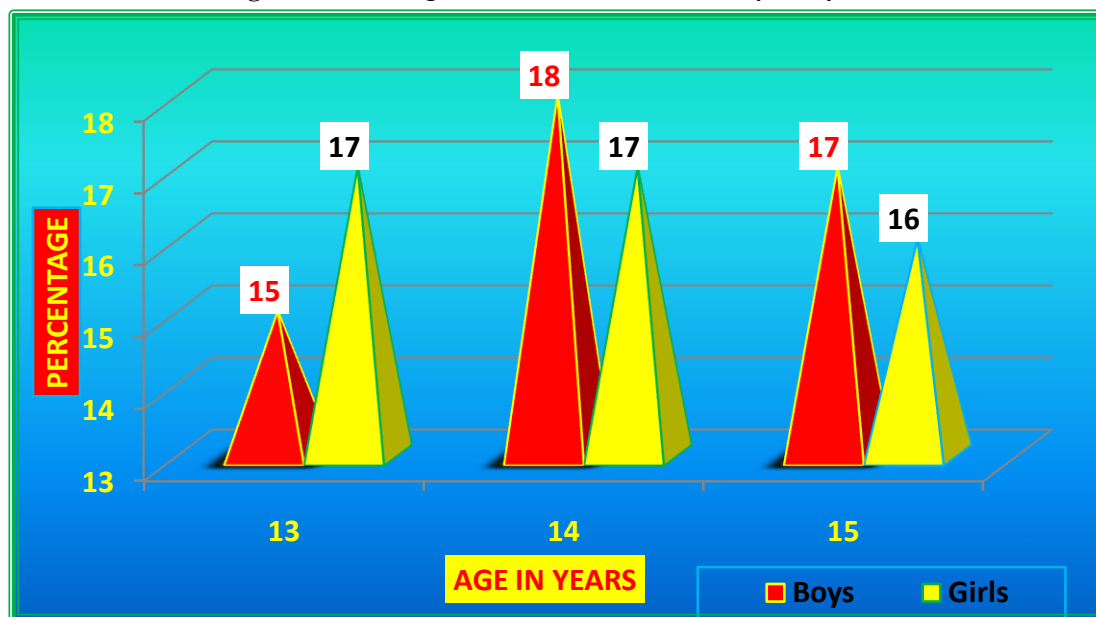
### III. Results And Discussion

A total of 22 schools, comprising of 5 Government aided schools, 3 Corporation schools, 4 Government schools and 10 private schools of Coimbatore were selected through purposive sampling method for the conduct of the prevalence study. From these schools, a total of 11,330 children (13-15 years) which included 1536 adolescent from Government aided schools, 841 adolescent from Government schools, 631 adolescent from Corporation schools and 8322 adolescent from private schools were screened for normal, overweight, obesity and underweight by measuring their height and weight and calculating the Body Mass Index.

#### 1. Overall age and sex distribution of the participants:

The figure I, represent the overall age and sex distribution among adolescent population participated in the study (13-15 years) in selected schools of Coimbatore.

Figure 1. Overall age and sex distribution of the participants



It was noted from the result that there are about 15 percent of boys and 17 percent of girls in the age group of 13 years. 18 percent of boys and 17 percent of girls in the study were in the age group of 14 years. The percentage of boys and girls in the age group of 15 years were 17 and 16 percent. Thus, it was concluded that equal distribution (50 percent each) of boys and girls were involved in the study. The study coincide with the study carried out by Ponni and Dorothy (2012), in which the total sampling size in the study was 6000 adolescent, one thousand and two hundred samples were selected from each district (600 boys and 600 girls). One hundred boys and one hundred girls were selected from each age group (2).

**2. Overall distribution of underweight, normal, overweight and obese among the participants**

Given table represents the overall distribution of underweight, normal, overweight and obese among adolescent school going children (13-15 years) in selected schools of Coimbatore.

**TABLE- I**  
**Overall distribution of underweight, normal, overweight and obese among the participants**  
**N=11,330**

Gender	Underweight (<5 <sup>th</sup> Percentile)		Normal (5-< 85 <sup>th</sup> Percentile)		Overweight (85-<95 <sup>th</sup> Percentile)		Obese (>95 <sup>th</sup> Percentile)	
	No.	%	No.	%	No.	%	No.	%
Boys	1346	12	3097	27	755	7	467	4
Girls	1777	16	2200	19	1202	11	486	4
<b>TOTAL</b>	<b>3123</b>	<b>28</b>	<b>5297</b>	<b>46</b>	<b>1957</b>	<b>18</b>	<b>953</b>	<b>8</b>

Source: \*BMI percentiles (CDC, 2007)

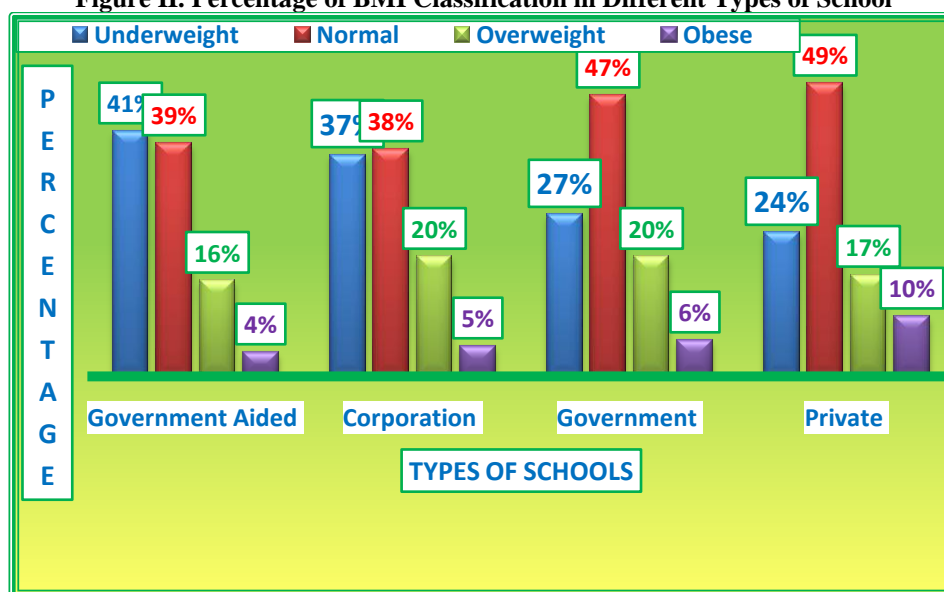
The overall prevalence of overweight and obesity among adolescent school children belonging to 22 schools of Coimbatore was found to be 18 per cent and 8 per cent respectively. The percentage of normal adolescent school children was 46 per cent and underweight adolescent school children were 28 per cent respectively. The result of the study was similar to the study carried out by Ramachandran *et al*, 2002 among 4700 school children in the age group of 13–18 years; 2382 (50.7%) were boys and 2318 (49.3%) were girls, it was concluded that the prevalence of overweight (BMI<sub>25</sub>) was high among urban southern Indian children. (17.8% in boys, 15.8% in girls) obesity (BMI<sub>30</sub> kg/m<sup>2</sup>) was seen in 3.6% of boys and 2.9% of girls (6).

**3. Percentage of Normal, Underweight, Overweight and Obese Children in Different types of Schools in Coimbatore**

The percentage of normal, underweight, overweight and obese children (13-15 years) in different types of schools in Coimbatore is given in Figure II.

The percentage of overweight in Government aided schools and private school was 16 and 17 percent whereas the percentage is same (20 percent) in corporation and Government schools. Whereas the prevalence rate of obesity among the selected adolescent participants in the study shows that in Government aided school was 4 percent, Corporation schools it was 5 percent, Government school it was 6 percent and in private schools it was found to be 10 percent. It is evident from the results, that the percentage of obesity was higher in private schools. It is evident from the results carried out by Kalpana and Lakshmi (2011) that the percentage of overweight (13.7 percent) and obesity (10.3 percent) was higher in private schools when compared to aided and Government schools (5). On applying statistical tool (ANOVA test) for comparison of BMI and types of school, it was noted that there was no significant difference (p=0.072) at 0.05% level when comparing the classification of BMI with the participants from different schools.

**Figure II. Percentage of BMI Classification in Different Types of School**



**4. Age and sex wise prevalence of obesity among adolescent (13-15 years) in Coimbatore**

Among the obese adolescent participants in the study, further distribution of the adolescent by age and sex wise was done and the same was given in Table II.

**TABLE II  
AGE AND SEXWISE PREVALENCE OF OBESITY AMONG THE PARTICIPANTS**

Sex/age (in years)	Obese (n= 953)				Total (953)	
	Boys		Girls		No.	%
	No.	%	No.	%		
13	84	9	102	11	186	20
14	164	17	146	15	310	32
15	219	23	238	25	457	48
<b>TOTAL</b>	<b>467</b>	<b>49</b>	<b>486</b>	<b>51</b>	<b>953</b>	<b>100</b>
<b>Chi square</b>	<b>3.199<sup>ns</sup></b>					

**Note: ns-Not significant (0.05%)**

The prevalence of obesity among boys in the selected age of 13 years was 9 percent, where as in the girls in the same age group was 11 percent. The percentage of obesity among boys and girls in the age group of 14 years was 17 percent and 15 percent. 23 percent of boys and 25 percent of girls in the age group of 15 years were obese. The result of the study shows that the prevalence obesity in the age group of 13 -15 years was found to be 49 per cent in boys whereas among girls of the same age group it was found that 51percent. The findings revealed that the prevalence of obesity was more among girls than boys in the age group of 13-15 years. Statistical analysis shows that there is no significant difference at 5% level (p=0.20) between boys and girls involved in the study. The result of the study is similar to the study conducted by Sadhu Charan Panda (2017), among 560 students from 11 to 15 years in two government and two private schools into normal, underweight, overweight and obese according to their BMI. The study concluded that the prevalence of overweight and obesity were 8.9% and 3.4% respectively. Obesity was found more among girls (3.8%) and more children from private school were obese (18).

**5. Anthropometric measurements of obese children**

The following table III, shows that in the age groups of 13-15 years, the selected participants their mean height corresponds to that of NCHS Value. From the above table it is evident that in the age group consisting of 13 years, the obese boys had the mean height of 154.42±2.5 and the mean height of the obese girls was 156.04±5.3. In the age group of 14 years, the obese boys had the mean height of 161±4.9 and the obese girls are 160.05±4.5. In the age group of 15 years, the obese boys had the mean height of 167.01±6.5 and the obese girls are 162±4.3.

From the table, it is evident that, in the age group of 13 years, the mean weight of obese boys was 56±5.42 and the mean weight of obese girls was 63.09±5.3. In the age group of 14 years, the mean weight of obese boys was 66.99±2.66 and for obese girls it was 68.9±7.3. In the age group of 15 years, the mean weight of obese boys was 73.54±6.55 and for obese girls it was 71.9±3.93.

**TABLE III. Mean Anthropometric Measurements of Obese Adolescent**

Age (yrs)	Height (cm)						Weight (kg)					
	Obese boys (467)			Obese girls (486)			Obese boys (467)			Obese girls (486)		
	Mean ±SD	NCHS	E/D	Mean ±SD	NCHS	E/D	Mean ±SD	NCHS	E/D	Mean ±SD	NCHS	E/D
13	154.42±2.5	153	+1	156.04±5.3	155	+1	56.0±5.42	40.9	+16	63.09±5.3	44	+19
14	161±4.9	160	+1	160.05±4.5	159	+1	66.99±2.66	47	+19	68.9±7.3	48	+20
15	167.01±6.5	166	+1	162±4.3	161	+1	73.54±6.55	52.6	+21	71.9±3.93	51	+20

**Note: \*NCHS (2002), E/D-Excess/Deficit**

The findings of the study revealed that the mean weight of the obese adolescent increased with age. The increase in weight and ultimately obesity may be associated with the increase in adipose tissue and the pubertal growth spurt. According to Lawrence and William in 2004, weight velocity increases and peaks during the adolescent growth spurt. Pubertal weight gain accounts for about 50 percent of an individual's ideal adult body weight. As age increases, a decrease in our physical abilities leads to a decrease in our metabolic rate (amount of energy used in a given period), which in turn contributes to weight gain (1,19).

### 6. Mean Body Mass Index (BMI) of the obese adolescent

BMI is a useful tool to identify possible weight problems; it screens children and teens for being obese, overweight, healthy weight and underweight. BMI is a reliable indicator of body mass fatness for most children and teens. BMI was classified using CDC percentiles (Centre for Disease Control, 2000). The BMI of the obese adolescents were assessed and the results are presented in Table IV.

**TABLE-IV**  
**MEAN BMI OF THE OBESE ADOLESCENT PARTICIPANTS**  
**n=953**

Age (in years)	Mean Body Mass Index (BMI)		F-test
	Boys Mean±SD	Girls Mean±SD	
13	25±2.58	26±2.81	1.18 <sup>ns</sup>
14	26±1.98	27±4.04	4.31 <sup>ns</sup>
15	27±3.26	28±2.55	0.62 <sup>ns</sup>

Note: s-Significant at 0.05%, ns-Not significant at 0.05%

The Table IV shows, statistically it was found that there is no significant difference at 5% level in the BMI of boys and girls in the age group of 13 years (F=1.18) and 14 years (F=4.31) and no significant difference of the same in the age group of 15 years (F=0.62) boys and girls BMI. Thus it was evidence from the study that girls had a higher BMI while compared with boys of the same age.

### IV. Conclusion

Obesity is one of the emerging problems in all age group irrespective of gender. Obesity is very common among adolescent age group due to unhealthy eating habits, increase use of computer gadgets and lack of physical activity. The study concludes that there is increase prevalence of obesity in the age group of 13-15 years and the rate of obesity is high among adolescent girls than compare to boys of the same age group and it was noted that the prevalence is high in private schools than other schools. Effective prevention and intervention programme can be carried-out to overcome obesity.

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