

## Original Research Article

# Factors affecting prevalence of overweight and obesity in urban adolescents: a study from North Chennai, India

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## ABSTRACT

**Background:** Obesity is escalating at an alarming rate especially among the urban population. Obesity in childhood is an important risk factor for obesity in adulthood. Overweight and obesity are related to physically inactivity, high social economic back ground and dietary transition. This study was done to estimate the overall prevalence of overweight and obesity among urban adolescents and to examine its associated factors.

**Methods:** This is a cross sectional community-based study conducted in North Chennai Corporation Zone II over a period of 2 years. A predesigned proforma was used to collect the demographic profile, socioeconomic status and level of physical activity. Trained Investigators were used to measure anthropometric measures. Data were analyzed with SPSS 16.0 and P value of <0.05 is taken as statistically significant.

**Results:** A total of 4900 children (M: 2317, F: 2583) were included in the study. The prevalence of overweight and obesity were found as 22.1 % and 4.1%. The proportion of overweight was highest at 14 years for boys and 15 years for girls. There is a statistical significance for overweight in relation to sex (P = 0.001), socioeconomic status (P = 0.00001), parent's occupation (P = 0.00001) and literacy status (P = 0.00001), junk food preference (P = 0.00001), mode of conveyance (P = 0.00001) and level of physical activity (P=0.00001).

**Conclusions:** As obesity in childhood has high risk of comorbidities, intervention studies have to be planned to educate the adolescents as they are the future society and the role models for their off springs.

**Keywords:** Adolescents, Obesity, Overweight

## INTRODUCTION

Obesity is a challenging multifactorial problem. It is escalating at an alarming rate across the globe in all age groups, especially among the urban population. Various studies have shown that there is up to 5-10 % increase in obesity per decade in the latter quarter of the last century. There is a striking increase in 50% of obese children from 1973-1991.<sup>1</sup> Obesity in childhood is an important risk factor for obesity in adulthood and up to 80% of them become obese adults.<sup>2</sup> This phenomenon of tracking warrants prevention and early intervention. There is a

paradox of under nutrition and obesity co-existing in the developing countries like India. In India, under nutrition attracted the focus of health workers, as childhood obesity was rarely seen. Childhood obesity is increasingly being observed with changing lifestyles of families with increased purchasing power, increasing hour of inactivity due to television, video games and computers have replaced outdoor games and other social activities.<sup>3</sup> It is attributable to urbanization, technology based sedentary life style, high fat high sugar junk food, increasing purchasing power, lack of exercise, excessive TV viewing and video games usage. 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.<sup>4</sup> The World Health Organization has described obesity as one of today's most neglected public health problems. Following the increase in adult obesity, the proportions of children and adolescents who are overweight and obese have also been increasing.<sup>5</sup> There are numerous health hazards that are linked to obesity like coronary artery disease, cerebrovascular diseases, hypertension etc. the most significant long-term consequences of childhood and adolescent overweight and obesity are their persistence into adulthood with all of the attended health risk.<sup>6-10</sup>

Several cross-sectional studies in western countries have shown that overweight and obese adolescents are less physically active than non-obese subjects and physically inactivity, high social economic back ground and dietary transition were found to be major factors. However, in this study, role of factors such as participation in sports and games, household chores, physical inactivity such as television viewing and playing computer/ video games and consumption of junk food were also studied. Therefore, this study was undertaken to estimate the overall prevalence of overweight and obesity among adolescents of zone II north Chennai, Tamil Nadu in south India and to examine its associated factors.

Ten percent of children, or at least 155 million youngsters worldwide, are overweight or obese.<sup>11</sup> What was once a health problem for the Industrialized world with its high calorie foods, labor-saving devices and dwindling levels of physical activity has now spread to developing Countries. Countries like Thailand, Iran, Nigeria and Brazil have all reported unprecedented levels of obesity with substantially rising trends every year.

In South Africa, about 25 percent of girls from 13-19 years are overweight or obese.<sup>12</sup> The epidemic of obesity, sits alongside the problem of under nutrition and infections in India thereby creating a greater burden of nutrition-related ill health among our children. The problem of childhood obesity is now sweeping our nation. Studies among school children indifferent parts of the country have demonstrated increasing prevalence of overweight and obesity, with great disparity between rural and urban parts of country. The prevalence of overweight was 37.5% in urban Delhi and 8% in rural Haryana.<sup>13</sup> The prevalence of overweight and obesity is higher in upper socioeconomic class (17.2% overweight and 4.8% obese) as compared to lower socioeconomic class (4% and <1%, respectively).

Although the prevalence of obesity may not be as high as in the West but the body composition and metabolism of Indians (Asians), with a 3 to 5% higher body fat and central location of body fat for the same BMI makes them more prone to its ill effect.<sup>14</sup> So, the study is done to assess the prevalence of overweight and obesity among

school age adolescents (11-17 years) residing in north Chennai zone with additional objectives to assess the various factors influencing overweight and obesity.

## METHODS

This was a cross sectional community-based study on school-going adolescents in 11 to 17 years age group, residing in zone 2 of north Chennai, the capital city of Tamil Nadu. The study region was north Chennai corporation zone II, which included Royapuram, Washermenpet, Tondiarpet, Basin Bridge and Korukkupet, over a period of 2 years.

For the study adolescent children, irrespective of gender were enrolled adopting multistage stratified cluster sampling procedure. For the selection of schools, the list of all schools belonging to all categories (government, private, semi-private) was obtained from the school authorities of the local government. Generally, government schools catered to poorer sections of the population. Whereas semi-private schools catered to lower middle and middle-income groups. The children from upper middle and high-income groups attend private schools. Probability proportionate to the size of the population (PPS) technique was used to decide the number of children to be studied from each school and then subsequently from each class and section. The total number of high and higher secondary schools in the region of interest was 26, out of which 14 institutions were selected. It was assumed that from each institution at least 50 subjects would be recruited from each class. The students from all the sections of each class are listed in alphabetical order and using random number generator the students of required population (i.e., 50) were recruited for the study. A. The number of schools included in this area was 14, of which 5 were government schools, the rest were private and semi-private. The educational institutions catering to disabled children were excluded. A total of 4900 students were thus selected.

The study was approved by the institutional ethical review board. After obtaining consent from the heads of the educational institutions, the students were selected and assent from all the selected adolescents and from their parents were obtained. A predesigned and pre-tested questionnaire was used for the interview, which included information about family characteristics, literacy status, individual characteristics like eating habits, mode of conveyance to school, time spent on television viewing and participation in games. The literacy status of the parents, per capita income and the occupation of the parents were collected as proxy variables for the calculation socio economic status.

Trained investigators weighed all the adolescents without shoes and heavy clothing with the subject standing motionless on the weighing scale with feet 15 cm apart with weight equally distributed on each leg with error margin of  $\pm 100$  grams. A portable anthropometric rod

was used for measuring height with an error to the nearest of 0.1 cm. The height was measured with subject standing in erect posture with the head positioned so that the top of the external auditory meatus was in the level of inferior margin of orbit. The international obesity task force references were used to define overweight and obesity in this study. The data was analysed using SPSS 16.0. Adolescence were categorized into two groups, overweight ( $\geq 85^{\text{th}}$  percentile) and obese ( $\geq 95^{\text{th}}$  percentile) using age and sex specific percentiles of BMI. Socioeconomic status was calculated based on modified Kuppasamy scale into lower (0-10), lower middle (11-15), upper middle (16-25) and upper (>25). The occupation of the father is categorized into group 1 (service or business), group 2 (others). The literacy status of parents was grouped as group 1 ( $\geq 10^{\text{th}}$  standard) and group 2 (<10<sup>th</sup> standard). The mode of conveyance to school was categorized as Group 1, those who come by bus, car or two-wheeler and Group 2, those by bi cycle and walking.

Physical activity was assessed by participation in household activities, indoor games, outdoor games and those involved in exercises like walking and jogging. Viewing television or playing video games were taken as marker of physical inactivity. Each variable was categorized based on hours of involvement per day/week. The prevalence of overweight and obesity and 95% confidence interval were calculated according to age, sex, socioeconomic status, type of school and physical activity level. Association were assessed using  $\chi^2$  test. Multiple logistic regressions were also carried out to examine association between independent variables and overweight and obesity. For all statistical test p value <0.05 was taken as a significant level.

## RESULTS

A total of 4900 adolescents in the age group of 11-17 years, with the mean age of 14 years, were studied. Of these 1082 were overweight and 200 were obese. The proportion of adolescents who were overweight (BMI  $\geq 85^{\text{th}}$  percentile) and obese (BMI  $\geq 95^{\text{th}}$  percentile) were 22.1% and 4.1% respectively. The proportion of overweight among adolescents tends to increase at 14-15 years of life as depicted in Table 1.

**Table 1: Age-wise profile of overweight and obesity of study adolescents.**

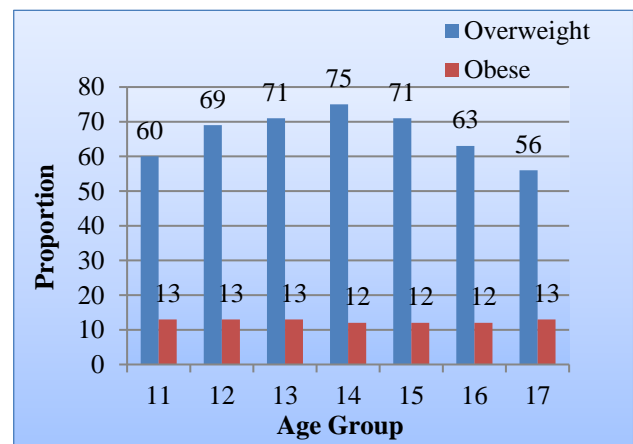
Age	Total	Overweight, N (%)	Obese, N (%)
11	700	134 (19.14)	29 (4.14)
12	700	144 (20.57)	30 (4.29)
13	700	159 (22.71)	28 (4.00)
14	700	169 (24.14)	28 (4.00)
15	700	172 (24.57)	30 (4.29)
16	700	159 (22.71)	28 (4.00)
17	700	145 (20.71)	27 (3.86)
Total	4900	1082 (22.08)	200 (4.08)

In the study group, 47% were boys and 53 % were girls. The proportion of overweight was higher among girls (23.9%) than among boys (20.1%) and the difference found was statistically significant ( $P = 0.001$ ). With regards to obesity the observation was similar to that of overweight, though not statistically significant ( $P = 0.34$ ) (Table 2).

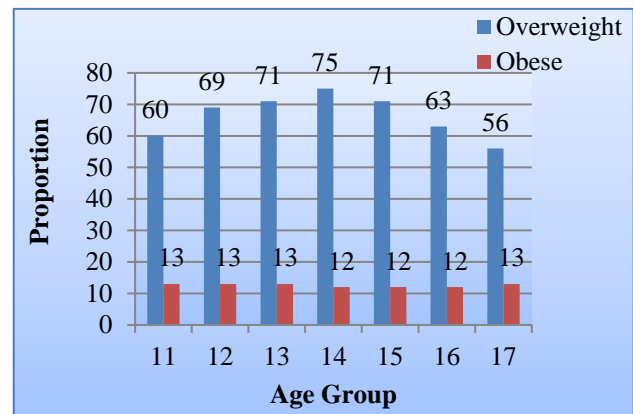
**Table 2: Sex distribution of the study population.**

	Male N (%)	Female N (%)	Total N (%)	P
Total	2317 (47.3)	2583 (52.7)	4900 (100)	
Overweight	465 (20.1)	617 (23.9)	1082 (22.08)	0.001
Obese	88 (3.8)	112 (4.3)	200 (4.08)	0.34

The proportion of overweight among boys varied with age, highest (23.5%) at the age of 14 years and lowest at 16.2% at 17 years. Whereas in girls, the peak (27.9) is at the age of 15 years was decreased to 25.1 at 17 years of age (Figure 1 and 2).



**Figure 1: Proportion of overweight and obesity among boys.**



**Figure 2: Proportion of overweight and obesity among girls.**

On analyzing the association with socio economic factors, 23% of adolescents belonged to lower socio-economic class, followed by lower middle, upper middle and upper at 40%, 26% and 17% respectively. Proportion

of children who were overweight and obesity was significantly higher among adolescents of higher socio-economic status compared to those with lower socio-economic status ( $P = 0.00001$ ) (Table 3).

**Table 3: Association with socioeconomic status with overweight and obesity.**

Socio economic status	Lower	Lower middle	Upper Middle	Upper	P
Total	1141	1665	1265	829	
Overweight, N (%)	53 (4.6)	242 (14.5)	328 (25.9)	459 (55.4)	0.00001
Obese, N (%)	10 (0.9)	42 (2.5)	60 (4.7)	88 (10.6)	0.00001

**Table 4: Association with occupation, literacy status and school type with overweight and obesity.**

Parameter	Occupation			Literacy Status			School Type		
	Service/ Business	Others	P	10 Std either Parent	≥10 std either Parent	P	Government	Private	P
Total	3528	1372		2232	2668		1750	3150	
Overweight N (%)	907 (25.7)	175 (12.8)	0.00001	684 (30.6)	398 (14.9)	0.00001	365 (20.9)	717 (22.8)	0.12
Obese N (%)	163 (4.6)	37 (2.7)	0.002	173 (7.8)	27 (1.0)	0.00001	60 (3.4)	140 (4.4)	0.08

**Table 5: Association with mode of conveyance and junk food preferences with overweight and obesity.**

Parameter	Mode of Conveyance			Junk Food		
	Group I	Group II	P	Like	Dislike	P
Total	3143	1757		2940	1960	
Overweight, N (%)	974 (31.0)	108 (6.1)	0.00001	807 (27.4)	275 (14.0)	0.00001
Obese, N (%)	188 (6.0)	12 (0.7)	0.00001	165 (5.6)	35 (1.8)	0.00001

Seventy two percent of parents were working in either service or business and 28% was in others. We have found that the proportion of overweight was higher ( $P = 0.00001$ ) among adolescences whose parents' occupation was service or business (25.7%) than others (12.8%). For obesity similar observations were found and it was statistically significant ( $P = 0.002$ ). Regarding literacy status of parents, those adolescents whose parents have studied 10<sup>th</sup> standard and above were found to be less overweight (16.9%) as compared to those with parents of lower literacy rate (30.6%) ( $P = 0.00001$ ).

Of the 14 schools sampled, 5 belong to government sector and 9 from private and semi-private groups. The proportion of overweight among the adolescence studying in private including semi private (22.8%) was higher among those in government schools (20.9%), however was not statistically significant ( $P = 0.12$ ). Looking into mode of conveyance to school, the proportion of overweight among Group I, those come by car, bus, and motorcycle was (31.0%), was significantly higher than those among Group II, by bicycle and walking (6.1%) ( $P = 0.00001$ ). Sixty percent of adolescents preferred to consume junk food as their

favorite dishes, of which 27.4% were overweight and 5.6% were obese when compared to those avoid junk funds in which 14.0% are overweight and 1.8% were obese respectively. This difference was found to be statistically significant ( $P = 0.00001$ ). All these parameters associated with overweight and obesity are summarized in Table 4 and 5.

Sixty three percent of adolescents participated in house hold chores and 99 % reported watching television on school days. Forty percent of adolescents did not participate in outdoor games whereas 38% were participating in outdoor games more than 6 hours per week. The proportion of overweight was significantly lower ( $P = 0.00001$ ) among the adolescents who participated in outdoor games for more than six hours in a week (7.3%) than those who do not participated (38.6%).

It was also significantly higher ( $P = 0.00001$ ) among the adolescents who did not perform any household chores (49.3%) than those perform (13.9%). Similarly, overweight and obesity was significantly higher in who were not involved in physical activities like walking and jogging. The proportion of overweight among



adolescents who were sedentary, watching television more than three hours per day (25.5%) was also significantly higher ( $P = 0.00001$ ) compared to those who watch 0 or less than 3 hours (7.5%), whereas for obesity

it is not statistically significant ( $P = 0.29$ ). All the factors contributing to level of physical activity related to overweight and obesity are summarized in Table 6 and 7.

**Table 6: Role of physical activity in overweight and obesity.**

Parameter	Household activities				Outdoor games				Indoor games			
	None	<3 hours/day	>3 hours/day	P	None	<6 hours/week	>6 hours/week	P	None	<6 hours/week	>6 hours/week	P
Total	884	937	87		2010	1012	1878		2386	1242	1272	
Overweight	436	219	427	0.00001	776	169	137	0.00001	804	190	88	0.00001
N (%)	(49.3)	(23.4)	(13.9)		(38.6)	(16.7)	(7.3)		(33.7)	(15.3)	(6.9)	
Obese	87	43	70	0.00001	137	3	32	0.00001	141	34	26	0.00001
N (%)	(9.8)	(4.6)	(2.3)		(6.8)	(3.1)	(1.7)		(5.9)	(2.7)	(2.0)	

**Table 7: Role of physical activity in overweight and obesity.**

Parameter	Walking				Jogging				Television viewing			
	None	<3 hours/day	>3 hours/day	P	None	<3 hours/day	>3 hours/day	p	None	<3 hours/day	>3 hours/day	P
Total	3600	1012	288		4090	528	282		46	892	3962	
Overweight	922	160	0	0.00001	998	84	0	0.00001	1	70	1010	0.00001
N (%)	(25.6)	(15.8)	(0)		(24.4)	(15.9)	(0)		(2.2)	(7.8)	(25.5)	
Obese	173	27	0	0.00001	184	16	0	0.0001	0	29	170	0.29
N (%)	(4.8)	(2.7)	(0)		(4.5)	(3.0)	(0)		(0)	(3.3)	(4.3)	

To adjust for potentially confounding variables and to study possible mediating factors, a multivariate logistic regression analysis was carried out. This analysis revealed that the risk of overweight was 10 times higher among adolescents of high socioeconomic status, 2.3 times higher among who were participating in <6 hours per week in outdoor games, 3.8 times higher among those who were not participating in household activities, 9 times higher among those who were watching television more than three hours per day.

## DISCUSSION

This is a comprehensive study attempting to document the prevalence of overweight and obesity and their associated factors that covered an adequate sample of urban adolescents. The overall prevalence of overweight ( $\geq 85^{\text{th}}$  percentile of BMI) among the urban adolescents studied (22.1%) was 3 times higher than that of their rural counterparts (7%) reported by the national nutrition monitoring bureau surveys in 2002.<sup>15</sup> In the present study, the prevalence was higher when compared to the studies carried out by Aggarwal et al in Ludhiana, (12.7%) and Khadilkar et al in Pune, Maharashtra (19.9%).<sup>16,17</sup> This may be due to the age group taken in the study as they studied in 10-15 years whereas the present study included up to 17 years. The prevalence was also seeming to be increasing in our city as the

previous studies shows about 17 % and 10 % were overweight by Ramachandran et al group and Subramaniam et al in Chennai respectively.<sup>18,19</sup> The prevalence was lower when compared to Delhi studies where they found 29% overweight by Nutrition foundation of India.<sup>20</sup> This is due to the fact that their studies have selected subjects from affluent societies. In Delhi study, the sample was taken from one school only.

A clear socioeconomic gradient was observed in this study, which is consistent with other studies.<sup>21,22</sup> This could be for several reasons that are related to obesity, encountered to a greater extent in higher socioeconomic groups. Studies have reported a rise in sedentary behaviors such as increased use of vehicular transport and decreased use physical activity has led to increased prevalence of overweight and obesity. The prevalence was significantly higher in the female in the present study where as it is only marginally higher in other studies. It can be due to a greater number of female samples in the present study.

Overweight and obesity is marginally higher in the pubertal age group, i.e., 13-15 years, as we observed in other studies in Delhi and Chennai, perhaps because of increase in adipose tissue and overall body weight in children during puberty. The prevalence was marginally lower in the post pubertal age group.

It has been reported that the number of fat cells increases during periods of rapid growth up to 16 years after which fat ordinarily accumulates by increasing size of fat cells already present.<sup>23</sup>

The results clearly revealed that regular physical activity was an important factor in reducing prevalence of overweight and obesity. The prevalence was significantly lower in the children who participated regularly in household chores ( $p < 0.001$ ), played outdoor games, and performed physical exercise. The diets of the children in the higher socioeconomic group are known for their higher fat content, and the subjects are involved in more sedentary activities. These observations are consistent with results of previous studies.<sup>24</sup> In addition, the prevalence of overweight and obesity were higher among children who were involved in sedentary activities such as spending 3 h/d on television viewing.<sup>25</sup> Klesges et al. also reported the effect of watching television on metabolic rate and overweight and obesity in children. In urban areas, considering the safety of keeping children away from heavy traffic, parents feel more comfortable if their children play indoor games or watch television and, therefore, do not encourage them to participate in outdoor sports and games.

Approximately 7.9% adolescents felt that they were either overweight or obese where as 70 % felt that they are of normal weight. More over there is a need to educate them about obesity and its co-morbidities and it should be included in their subjects. Freedman et al.<sup>26</sup> showed the adverse effects of overweight in their 17-year follow-up study and reported that an early average increase of 0.5 kg/m<sup>2</sup> of BMI in children increase the risk for hypertension, dyslipidemia, and type 2 diabetes a decade later. It is interesting to note that 8% of adolescents perceived that they were overweight, which indicates that the self-reporting of obesity could also be a good indicator of the problem.

## CONCLUSION

The major conclusion drawn from this study is that low levels of physical activity, watching television, and consuming junk foods are associated with a higher prevalence of overweight. Thus, participation in household activities and regular physical exercise could help in lowering the prevalence of overweight. Therefore, the role of physical activity, games, and sports should be emphasized, and facilities should be provided for outdoor games in schools, with compulsory hours of sports and games. There is an urgent need to educate the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects.

So, there is an urgent need to tackle these burgeoning problems regarding prevalence of overweight and obesity. The child who is overweight in his/her adolescence will carry over it into adult hood. They are at

the major risk of co morbidities when they were obese from childhood. Food preferences set earlier is likely to be carried out into adult hood so need to educate in the adolescents as they for the future society and the role models for their off springs. So, they intervention studies have to be planned to educate the society from the adolescent period. Nutrition should be a part of their syllabus and helps in adopting healthy nutritional practices. Parents are the role model for their children, educating them about healthy life styles is crucial in the prevention of obesity in children. The best way of treating obesity is by preventing it as the treatment aspects are difficult and shows little effects.

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