



IMPACT OF SOCIO-ECONOMIC STATUS ON PREVALENCE OF OVERWEIGHT AND OBESITY  
AMONG URBAN SCHOOL CHILDREN OF VISAKHAPATNAM, NORTH-COASTAL ANDHRA PRADESH

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ABSTRACT

**Objective:** Childhood obesity is one of the most serious public health challenges of the 21<sup>st</sup> century. Since the problem is global, the present study was undertaken to assess the prevalence of overweight and obesity and compared their association with social & economic status among urban school children of Visakhapatnam, North Coastal Andhra Pradesh, South India.

**Methods:** A total of 1000 children from public and private schools in and around Visakhapatnam were included in this study. Data for children aged 10-12 years of both sexes were collected. Body Mass Index (BMI) was computed using the following standard equation:  $BMI = \text{Weight (kg)}/\text{height (m)}^2$ . Presence of overweight and obesity were evaluated using the age-sex specific growth charts recommended by Centre for Disease Control, USA.

**Results:** The overall prevalence of overweight and obesity were 13.1% (95% CI:11.01-15.19) and 5.1% (95% CI:3.74-6.46) respectively, which together constitute 18.2% (95% CI:15.81-20.59). The prevalence of obesity and overweight were highest among boys (18.4%), at the age of 10 years (23.8%), in private schools (24.5%) and especially in the children with high social status (24.4%) and economic status (28.9%). Thus, the significantly associated categories, according to the weight of the children are age ( $p=0.002$ ), type of school ( $p=0.000$ ), social ( $p=0.000$ ) and economic status ( $p=0.001$ ). The odds ratio estimates revealed that the children aged 10 years, studying in private school, belongs to high social and economic status were at increased risk to have the overweight and obesity when compared with the other categories within each variable.

**Conclusion:** The study confirmed the findings of earlier studies carried out in India and other countries. It emphasized that the children of high social and economic status were significantly associated with the risk of being overweight and obesity. Thus, similar studies with more number of variables should be undertaken among children, which would help us to have a better and clearer picture on the overweight and obesity situation in India.

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INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. Obesity is becoming an increasingly important clinical and public health challenge throughout the world. It was described that overweight and obesity are the fifth leading risk of global deaths. About one in ten of the world's adult population was obese and around 43 million children under age five were overweight (WHO, 2011). Globally an estimated 10% of school-aged children between 5 to 17 years of age are overweight or obese (Bharati *et al.*, 2008).

It is a serious public health concern affecting a significant portion of the population in countries like USA, as 31% were overweight and 16% were obese, among children aged 6 to 19 yr in 1999-2002 (Hedley *et al.*, 2004). The prevalence of obese school children is 20% in UK and Australia, 15.8% in Saudi Arabia, 15.6% in Thailand, 10% in Japan and 7.8% in Iran (Al-Nuaim *et al.*, 1996; Mo-Suwan *et al.*, 1993). A wide range of prevalence levels exist, that prevalence of overweight and obesity in Africa and Asia averaging well below 10% and in America and Europe above 20% (Kosti and Panagiotakos, 2006). It is well documented that the prevalence rate has largely increased over the last two decades in both developed and developing countries (Doll *et al.*, 2002). The most significant long-term consequences of childhood and adolescent overweight and obesity are their persistence into

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adulthood overweight and obesity with all attendant health risks such as dyslipidemia, hyperinsulinemia, type 2 diabetes, hypertension, cardiovascular diseases, arthritis and behavioral problems (Must and Strauss, 1999; Power *et al.*, 1997). Obesity has now become an important health problem in developing countries like India. The prevalence is higher in urban than rural areas (Popkin and Doak, 1998; Kaur *et al.*, 2005). Recent data on South Indian school children showed that the overweight percent has increased from 4.94% in 2003 to 6.57% in 2005 (Raj *et al.*, 2007). In addition, prevalence of obesity varies across socio-economic strata. In developed countries children of low socio-economic status are more affected than their affluent counterparts (Strauss and Pollack, 2001). The opposite is observed in developing countries as children of the upper socio-economic strata are more likely than poor children to be obese (Salmon *et al.*, 2005; Chhatwal *et al.*, 2004).

Since limited data are available from India regarding the distribution and profile of childhood obesity, nevertheless the published studies in India showed that the prevalence of overweight and obesity at Punjab, Maharashtra, Delhi and Chennai was 11% to 29% (Kaur *et al.*, 2005). Therefore the present study was undertaken to examine the time trends in childhood obesity in a representative sample of school children from Visakhapatnam and determine the relationship of obesity and overweight with social and economic status.

## MATERIALS AND METHODS

A cross sectional study was done on 1000 children aged 10 to 12 years from public and private schools in and around Visakhapatnam. Generally, in India, children belongs to low social and economic status study in public schools which impart free education, whereas children from higher social and economic status attend the private schools which have considerably high fee structure. According to population probability sample, 5 private and 5 public schools were included in the study. The data were collected using pre-tested and semi-structured questionnaire, which was drafted using relevant literature. The survey instrument consisted of 2 parts- a) Socio-demographic details and b) anthropometric measurements. Anthropometric measurements taken in the study include weight in kilograms (kg), height in centimeters (cm). Height was measured with an anthropometer rod with a precision of 1mm and weight was taken without shoes and recorded on a digital scale to the nearest 0.1 kilogram. BMI was calculated using the formula weight in kilograms / (height in meter)<sup>2</sup>. After BMI was calculated for children, the BMI number was plotted on the BMI-for-age growth charts (separate for boys and girls) popularly known as CDC growth charts to obtain a percentile ranking. Children were classified as underweight and healthy weight using BMI-for-age <5<sup>th</sup> and 5<sup>th</sup> to <85<sup>th</sup> percentile respectively. Overweight and obesity were classified using BMI-for-age between 85<sup>th</sup> to <95<sup>th</sup> and 95<sup>th</sup> or more respectively. The level of education achieved by either mother or father and combined income of the parents were used to define social and economic status respectively.

Data were analyzed using SPSS for windows, version 16.0. Following an initial description analysis, prevalence rate for overweight and obesity were calculated based on the BMI percentiles. The Chi-square ( $\chi^2$ ), odds ratio (OR) and 95%

confidence interval (95% CI) were calculated for each associated category. P <0.05 was considered as statistically significant.

## RESULTS

Distribution of the sample by different variables based on weight category was shown in Table 1. A total of 1000 children aged 10 to 12 years participated in this study. Out of them, 537 (53.7%) were boys and 463 (46.3%) were girls. The children were classified into four groups for better stratification of weight status. Among these, 51 (5.1%) were obese, 131 (13.1%) were overweight, 692 (69.2%) were healthy weight and 126 (12.6%) were under weight. The prevalence of overweight and obesity was higher in boys than in girls (18.4% vs. 17.9%). It increased with age being highest in the 10 years age when compared to children of 11-12 years age group (23.8% vs 14.7% or 10.5% respectively). Children studying in private schools were more likely to be obese and overweight (24.5% vs.10%) when compared to public school children. The prevalence of overweight and obesity was highest among Muslims (27.2%) and was lowest among Christians (17.1%). The children weight category was significantly associated with age (p=0.002), school type (p=0.000), social status (p=0.000) and economic status (p=0.001).

The Prevalence of overweight and obesity by age and sex of the subjects was shown in Table 2. The prevalence peaks at age 10 years for both boys and girls. The overweight and obesity is high in boys at the age 10 and 11, but high in girls at the age 12. The comparison rates of overweight /obesity by age and sex of the subjects is presented in Figure 1. Risk factors of overweight and obesity related to individual and family characteristics were presented in Table 3. The odds ratio revealed that the risk of overweight and obesity was significantly higher among children aged (age 12 was set as reference) 11 yr. (OR:1.466; 95% CI:0.831-2.586) and 10 yr. (OR:2.656; 95% CI:1.558-4.527), children studying in private schools than those studying in public schools (OR:2.931, 95% CI:2.028-4.237), children belongs to (low social status was set as reference) middle social status (OR:2.529; 95% CI:0.749-8.535) and high social status (OR:7.833; CI:2.433-25.216), children belongs to (low economic status was set as reference) middle economic status (OR:5.092; CI:1.841-14.082) and high economic status (OR:9.122; 95% CI:3.074-27.067).

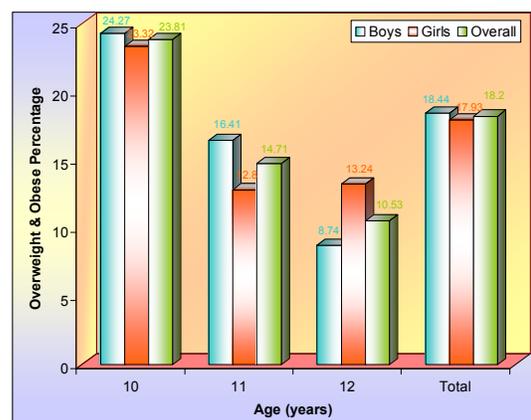


Fig. 1. Comparison of rates of overweight/obesity by age and sex of the subjects

**Table 1. Distribution of the sample by different variables based on weight category**

Variable	Category	Total (n)	Child Category n (%)				$\chi^2$	p value
			Obese	Over Weight	Healthy Weight	Under Weight		
Age	10	462	29(6.3)	81(17.5)	299(64.7)	53(11.5)	20.461	.002
	11	367	15(4.1)	39(10.6)	263(71.7)	50(13.6)		
	12	171	7(4.1)	11(6.4)	130(76)	23(13.5)		
Sex	Boys	537	24(4.5)	75(13.9)	364(67.8)	74(13.8)	3.188	.364
	Girls	463	27(5.8)	56(12.1)	328(70.8)	52(11.2)		
School	Pub	432	8(1.9)	35(8.1)	320(74.1)	69(16.0)	39.713	.000
	Pvt	568	43(7.6)	96(16.9)	372(65.5)	57(10.0)		
Religion	Hindu	936	45(4.8)	124(13.2)	650(69.4)	117(12.5)	7.415	.594
	Christian	41	3(7.3)	4(9.8)	26(63.4)	8(19.5)		
	Muslim	22	3(13.6)	3(13.6)	15(68.2)	1(4.5)		
	Sikh	1	0(0)	0(0)	1(100)	0(0)		
Social Status	High	616	41(6.7)	109(17.7)	402(65.3)	64(10.4)	45.094	.000
	Middle	308	10(3.2)	19(6.2)	229(74.4)	50(16.2)		
	Low	76	0(0)	3(3.9)	61(80.3)	12(15.8)		
Economic Status	High	104	11(10.6)	19(18.3)	61(58.7)	13(12.5)	22.652	.001
	Middle	802	39(4.9)	109(13.6)	556(69.3)	98(12.2)		
	Low	94	1(1.1)	3(3.2)	75(79.8)	15(16)		

**Table 2. Prevalence of overweight and obesity by age and sex of the subjects**

Age	N	Boys			N	Girls			Overall %
		Overweight %	Obese %	Total %		Overweight %	Obese %	Total %	
10	239	17.99	6.28	24.27	223	17.04	6.28	23.32	23.81
11	195	12.82	3.59	16.41	172	8.14	4.66	12.8	14.71
12	103	6.8	1.94	8.74	68	5.88	7.35	13.24	10.53
Total	537	13.97	4.47	18.44	463	12.1	5.83	17.93	18.2

**Table 3. Risk Factors of Overweight and Obesity : Individual and Family Characteristics**

Variable	Total N (%)	Overweight & Obesity N (%)	OR (95% CI)	p value
Sex:				
Boys	537 (53.7)	99 (18.4)	1	
Girls	463 (46.3)	83 (17.9)	0.966 (0.7 – 1.334)	0.836
Age:				
12	171 (17.1)	18 (10.5)	1	
11	367 (36.7)	54 (14.7)	1.466 (0.831 – 2.586)	0.184
10	462 (46.2)	110 (23.8)	2.656 (1.558 – 4.527)	0.000
School:				
Public	432 (43.2)	43 (10)	1	
Private	568 (56.8)	139 (24.5)	2.931 (2.028 – 4.237)	0
Social Status:				
Low	76 (7.6)	3 (3.9)	1	
Middle	308 (30.8)	29 (9.4)	2.529 (0.749 – 8.535)	0.122
High	616 (61.6)	150 (24.4)	7.833 (2.433 – 25.216)	0.000
Economic Status:				
Low	94 (9.4)	4 (4.3)	1	
Middle	802 (80.2)	148 (18.5)	5.092 (1.841 – 14.082)	0.000
High	104 (10.4)	30 (28.8)	9.122 (3.074 – 27.067)	0.000

**Table 4. Prevalence of overweight and obesity based on school type**

Variable	Category	Total (n)	Public School			Private School		
			Overweight (%)	Obese (%)	Total (%)	Overweight (%)	Obese (%)	Total (%)
Age	10	462	18(3.89)	2(0.43)	20(4.32)	63(13.63)	27(5.84)	90(19.48)
	11	367	12(3.26)	2(0.54)	14(3.81)	27(7.35)	13(3.54)	40(10.89)
	12	171	5(2.92)	4(2.34)	9(5.26)	6(3.50)	3(1.75)	9(5.26)
Sex	Boys	537	20(3.72)	3(0.55)	23(4.28)	55(10.24)	21(3.91)	76(14.15)
	Girls	463	15(3.23)	5(1.07)	20(4.31)	41(8.85)	22(4.75)	63(13.60)
Religion	Hindu	936	30(3.20)	6(0.64)	36(3.84)	94(10.04)	39(4.16)	133(14.2)
	Muslim	22	2(9.09)	1(4.54)	3(13.63)	1(4.54)	2(9.09)	3(13.63)
	Christian	41	3(7.31)	1(2.43)	4(9.75)	1(2.43)	2(4.87)	3(7.31)
	Sikh	1	0	0	0	0	0	0
Social Status	High	616	22(3.57)	6(0.97)	28(4.54)	87(14.12)	35(5.68)	122(19.80)
	Middle	308	10(3.24)	2(0.64)	12(3.89)	9(2.92)	8(2.59)	17(5.51)
	Low	76	3(3.94)	0	3(3.94)	0	0	0
Economic Status	High	104	1(0.96)	0	1(0.96)	18(17.30)	11(10.57)	29(27.88)
	Middle	802	32(3.99)	8(0.99)	40(4.98)	77(9.60)	31(3.86)	108(13.46)
	Low	94	2(2.12)	0	2(2.12)	1(1.06)	1(1.06)	2(2.12)

The prevalence of overweight and obesity in public and private school children were distributed by age, gender, religion, social and economic status, which was shown in Table 4. Overall 16.9% of overweight and 7.57% of children are obese in private schools, whereas 8.1% of overweight and 1.85% obese children are seen in public schools. In most of the cases the prevalence of overweight and obesity is higher in private school children than that of public school children in all the categorized variables.

## DISCUSSION

Childhood obesity is emerging as a major health problem in India, especially in children from urban higher socioeconomic areas (Kuriyan *et al.*, 2007). The patterns of overweight/obesity differ by age, sex, rural or urban residence and socioeconomic position and vary between and within countries (Matijasevich *et al.*, 2009). The present study planned to evaluate in detail, the complete spectrum of childhood obesity and compare the prevalence in different socio-economic groups. Obesity increases the risk for a variety of chronic diseases including coronary artery disease, strokes (Pyle *et al.*, 2006), glucose intolerance (Swallen *et al.*, 2005) and some forms of cancer. It is not a direct cause of most diseases, but unfavorably alters the risk factor profile. Thus, obesity is considered as 7th leading cause with 280,000 preventable deaths in 2005 (Rutt and Coleman 2005).

The preliminary data reported in the present study concerning the prevalence of overweight and obesity among school children support the findings of other investigators that this condition is an emerging public health problem. In the present study the overall prevalence of overweight and obesity was 13.1% and 5.1% respectively, which was higher than previously reported among urban adolescents of Hyderabad (Laxmaiah *et al.*, 2007). In India, very few studies were carried out where our overweight and obese percent is low when compared with studies carried in cities such as Pune, Maharashtra (Kaur *et al.*, 2005) and high when compared with the study in Midnapore town. The widely differing overweight and obese percent may be due to definitions used, age group and sex taken for the study. The prevalence of overweight and obesity was higher in 10 years than 11 and 12 years, which is similar to the study in Midnapore town (Samiran Bisai *et al.*, 2010). In the present study, prevalence of overweight among boys was found to be higher than that of girls. The higher prevalence of overweight among boys in our study was consistent with the gender difference in other Indian studies (Sharma *et al.*, 2007; Chhatwal *et al.*, 2004; Kaur *et al.*, 2008). Similar results are also reported from different parts of the world (Tremblay *et al.*, 2002; Kautiainen *et al.*, 2002; Vignolo *et al.*, 2004). On the contrary, several studies from India (Kapil *et al.*, 2002; Marwaha *et al.*, 2006; Sidhu *et al.*, 2006) and abroad (Stettler *et al.*, 2002; Kruger *et al.*, 2006; Ben-Bassey *et al.*, 2007; Stark *et al.*, 1981) have reported higher prevalence of overweight among girls. All these studies clearly indicate that the sex of the child has an influence on the prevalence of overweight and obesity. Our data shows that more boys than girls were overweight, but there were more obese girls compared to boys. This higher prevalence of obesity among girls may be related to the adolescent growth spurt and the effects of hormonal surge which occurs earlier in girls (Chhatwal *et al.*, 2004).

The significant association between the school type and overweight or obesity stated the fact that the children from private schools belongs to higher socio-economic status. For their parents' occupations, the parents of the private schools children were more likely to be educated and professionals compared to those from public schools who were more often uneducated and unskilled workers. This clearly illustrates that the children attending private schools were richer when compared with their contemporaries from public schools and these have been strongly linked to the pathogenesis of obesity. This implies the importance of the family characteristics in the causation or predisposition of an individual to overweight and obese (Pandez *et al.*, 2005). In developing countries, however, the level of obesity is greater in the higher socio-economic status segments of society in China and Russia (Wang, 2001). The prevalence is similar to what is reported in different parts of the country like Rajasthan (Kaneria *et al.*, 2006), Hyderabad (Laxmaiah *et al.*, 2007), South Karnataka (Shashidhar Koitan *et al.*, 2010), Chennai (Shabana Tharkar and Vijay Viswanathan, 2009).

## Conclusion

The increases in obesity worldwide are due to social and environmental factors including changes in parental employment patterns, increased television viewing, concerns about neighborhood safety, and the increased availability of video games. Findings from the present study suggest that another factor that may be contributing to the increase in obesity is lack of obesity knowledge in this age group. Nutrition interventions involving schools can focus on various components within the system and curriculum. These programs can include enhancing the nutrition knowledge of students, promoting healthy eating, and increasing nutrition awareness among them. In conclusion, factors such as urban residency, social and economic status and parental education identified as predictors of childhood overweight and obesity. Parents and teachers should be encouraged to promote a healthy balance of food, drink and physical activity within and outside the school. It is also recommended that enlightenment programmes on obesity targeted at childhood should take their different socio-economic backgrounds into consideration to be effective. Further study using more variables is needed.

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