Research Article

Prevalence and determinants of overweight and obesity among affluent adolescents in Vijayawada city, Andhra Pradesh, India

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Abstract

Background: Obesity is an emergent problem in India, which is adding to disease burden. To prevent adult obesity, knowledge of prevalence and determinants of childhood obesity is essential. There is no study related to childhood obesity in the newly formed state of Andhra Pradesh; this would be the first one to document the prevalence and determinants in this region.

Objective: To assess the prevalence and determinants of overweight and obesity in the affluent adolescents of Vijayawada city.

Materials and Methods: A cross-sectional study with a sample size of 1721 students aged 12–15 years from randomly selected from seven affluent private schools with fee $>$20, 000 rupees per annum of Vijayawada from March 2013 to January 2014. The height and weight of the participants were measured and body mass index was calculated. A predesigned and pretested questionnaire was administered to assess the physical activity and dietary habits. Data were managed on an Excel spreadsheet and odds ratio was used to calculate strength of association. Variables showing $P < 0.05$ were considered as statistically significant risk and were subjected to multiple regression analysis.

Results: The overall prevalence of overweight and obesity was 26.9% and 8.7%. Among the study participants, 50.6% were boys of which 15.7% were overweight and 5.4% were obese, and 49.38% were girls of which 11.2% were overweight and 3.4% were obese. The major risk factors include eating outside home, eating while watching TV, increased frequency of snacking outside, lack of outdoor sports, going to school on vehicles, prolonged school timings, long periods of watching TV/using computer, no daily exercise, both parents working, less hours of physical training at school, and absence of playground in the school.

Conclusion: The overall prevalence of overweight and obesity was found to be 26.9% and 8.7%. The major risk factors were eating outside home, eating while watching TV, frequency of snacking outside, not playing outdoor games, both parents working, vehicular mode of transport to school, increased hours spent in school per day, not exercising daily, long periods of watching TV/using computer, less hours of physical training in school per week, and absence of playground in the school. Frequency of carbonated drinks, daytime sleep, and frequency of snacking at home were found not to influence the prevalence of overweight and obesity.

KEY WORDS: Affluent, India, adolescent, childhood, risk factors

Introduction

Obesity is evolving as a major nutritional problem in developing countries, resulting in increased burden of chronic disease.[1] The global prevalence of overweight including obesity in children aged 5–17 years is estimated by the WHO and International Obesity Task Force to be approximately 10%. India ranks third in the obesity list with every fifth Indian being either overweight or obese[2] yet obesity is not at national health hazard in India. There is no nationally representative data on childhood obesity; however, studies conducted in Chennai and Delhi have shown the prevalence of 6.2% and 7.4%, respectively.[3,4]

In 30% cases, obesity begins in childhood and 80% of these children become obese adults.[5] In a Harvard study, morbidity from cardiovascular disease, diabetes, and obesity-related cancers and arthritis was 50%–100% higher in obese

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individuals who were also obese as children.[6] Obesity increases subsequent morbidity in children regardless of its persistence into adulthood.[6] Evaluation of obesity in childhood offers the best hope for preventing obesity and its progression. Obesity is easier to treat in children by directing sessions that emphasize healthy eating and exercise habits.

There is a paradigm shift in the quality of life, resulting in increase in the prevalence of childhood obesity in the urban population along with a parallel increase in associated chronic diseases and their clinical onset at ever younger ages. Moreover, the body composition and metabolism of Indians make them especially prone to adiposity and its consequences. Joshi and Joshi[7] have found obesity as an emerging problem in preschool, school-going, and adolescent children. In a study conducted in Chennai by Ramachandran et al.,[8] the prevalence of overweight including obesity in adolescents ranged from 22% in better off schools to 4.5% in lower-income group schools.

A recent study carried out in Surat, Gujarat, reported the prevalence of obesity in the affluent adolescents to be 6.5%.[9] Another similar study conducted in Telangana found the prevalence of obesity to be 2.8% in Hyderabad.[10] The present study is the first of its kind in coastal Andhra region describing not only the prevalence but also the determinants of obesity and overweight among the affluent adolescents.

Materials and Methods

This is a cross-sectional study in which students from school with annual fee $>$20,000 rupees per annum were selected. The permission to conduct the study was granted by 11 schools, out of which 7 schools were selected using a random number table. The sample size was estimated for infinite population using the formula $4pq/d^2$ where the prevalence of overweight was taken as 7%. The required precision estimate was set to 20%. Adding 10% nonresponsive error, the sample size was rounded off to 10%.

The subjects were adolescents aged 12–15 years in the city of Vijayawada, Andhra Pradesh, which is one of the most developed cities in the state. The following subjects were eliminated from the study: (1) those who had been advised bed rest for more than 2 weeks during past 6 months due to any sickness, (2) those who had any chronic systemic illness, (3) those who had any physical deformities, (4) those who were absent during the time of conduction of the study due to any reason, and (5) those who were unwilling to participate in the study.

The study protocol was approved by ethics committee of the Government Siddhartha Medical College, Vijayawada. A prior consent for the study conduction was taken from school administration and from parents. At the time of initiating the study, each participant was informed about the study protocol and written consent was obtained. As far as possible, free time or physical activity periods were used for the study, so that routine classes remained unaffected.

In each class, predesigned and pretested questionnaires were distributed. The questionnaire was explained to the students beforehand so that they could answer correctly. The dietary history and physical activity were assessed by a set of questions that the students had to answer. For the question regarding physical training hours in school and daily exercise, the children were asked NOT to consider physical training hours in school as part of daily exercise.

Anthropometric measurements were taken by trained medicos. Height and weight were measured using stadiometer and beam balance with a sensitivity of 0.1 cm and 0.1 kg, respectively. Zero error was set after every 20 measurements. To assess the height, the students were asked to stand straight without any footwear with the heels, buttocks, and back touching the vertical limb of the stadiometer and the body stretching upwards to the fullest extent with arms hanging on the side. The head was aligned in the Frankfurt plane.

The students were asked to remove footwear before measuring the weight. Body mass index (BMI) was calculated and according to IAP Guidelines children above 85th percentile were considered overweight and that above 95th percentile were considered obese.[11]

Statistical analysis

Data were recorded on a predesigned pro forma and entered on an Excel spreadsheet and all entries were double checked for any possible typing error. Frequencies were generated by PROC FREQ procedure using SAS software. Odds ratios and 95% confidence intervals were generated by PROC LOGISTIC procedure-based multivariate analysis (logistic regression). *P*-values were generated by PROC GLM procedure based on generalized linear model (advanced technique for analysis of variance). Multiple regressions were generated by PROC REG procedure based on multiple regression models.

Results

A total of 1900 students from seven affluent schools (including corporate and noncorporate schools) who satisfied the inclusion criteria were enrolled in the study. Excluding the students who submitted inadequate data, 1721 students were analyzed for overweight and obesity. Among all the students, 871 (50.6%) were boys of which 15.7% were overweight and 5.4% were obese whereas 850 (49.38%) were girls of which 11.2% were overweight and 3.4% were obese.

The overall prevalence of overweight and obesity was found to be 26.9% and 8.7%. The prevalence of obesity as well as preobesity was higher in boys when compared to girls but the difference was very small and not statistically significant. Among boys, the 13-year-olds contributed maximum to the obesity and overweight prevalence. The 15- and 16 year-old girls showed the least prevalence of obesity [Table 1].

Table 1: Comparison between corporate and non-corporate schools

Parameter	Corporate	Noncorporate
Number of schools in study	3	4
Average % of children obese	5.6	3.1
Average % of children overweight	18.7	8.2

Students studying in corporate schools (schools with long working hours, no playground, and less emphasis on physical training, sports, and extracurricular activities) had a higher prevalence of obesity and overweight compared to those studying in noncorporate (missionary, funded, etc.) schools, which lay more emphasis on overall development of the child [Table 2].

On bivariate analysis, variables with $P < 0.05$ were considered to be statistically significant [Table 3]. The significant risk factors were subjected to multiple logistic regression analysis [Table 4] to assess their significance as individual risk factors.

Eating outside home—main servings/week >2 (P = 0.00; OR = 9.134)—was the found to be the major risk factor. Eating while watching TV (P = 0.03; OR = 3.976) was associated with 3.97 times greater risk of developing overweight and obesity. Frequency of snacking outside (P = 0.021; OR = 2.891) was found to be a significant risk factor and with daily snacking outside, the risk of developing overweight and obesity was found to be 2.891 times. Decreased frequency of playing outdoor games (P = 0.00; OR = 1.799) was found to be a significant risk factor. Not playing outdoor games at all was associated with 1.799 times greater risk of developing obesity and overweight. Not Exercising daily (P = 0.04; OR = 1.189) was a significant risk factor among those children who were not exercising daily, with 1.189 times greater risk of developing overweight and obesity when compared to those who exercised daily. Mode of transport to school (P = 0.00; OR = 1.760) was a significant risk factor. Children who went to school on an automobile were at 1.76 times higher risk compared to children who walked to school. Hours spent in school per day (P = 0.03; OR = 1.155) was a significant risk factor. Children going to schools with working hours >6/day were 1.155 times at a higher risk of developing overweight and obesity than those with school hours between 4 and 6/day. Hours of physical training in school per week (P = 0.00; OR = 1.894) was a significant risk factor. The children going to schools with less than 1 h of physical training per week were at 1.894 times higher risk. Children going to schools without a playground (P = 0.049; OR = 1.293) were at 1.293 times higher risk of developing overweight and obesity. When both the parents of the child were working (P = 0.02; OR = 2.695), the child was found to be 2.695 times at risk of developing overweight and obesity. Watching TV/using computer more than 3 h per day (P = 0.02; OR = 1.069) was associated with a slightly increased risk.

Discussion

The overall prevalence of overweight was found to be 26.9 and that of obesity was found to be 8.7%. The prevalence of overweight and obesity among boys was 15.7% and 5.4% whereas that among girls was 11.2% and 3.4%. This prevalence was higher compared to that reported in the study conducted by Gouhar et al. in Hyderabad (6.6% and 2.8%).[11] The other studies conducted at Punjab,[12] Karnataka,[13] Kerala,[14] Delhi,[15] and Gujarat[9] have reported a similar prevalence of overweight and obesity.

Eating outside home (school canteen, fast food centers) was a significant risk factor. Those children buying lunch at school canteen and restaurants are more likely to develop overweight and obesity.[16,17] Frequency of snacking outside was a significant risk factor, and it was observed that prevalence of overweight and obesity increased in children and adolescents with frequent consumption of outside snacks.[18,19]

Eating while watching TV could be driven by seeing the advertisements.[9] Research has shown that most commercials during children's television shows are related to high energy density and poor nutritional quality food products.[20,21] Cohering with this, our study showed an increased risk in children who are eating while watching TV.

Playing outdoor games for at least an hour per day was related with significantly decreased risk of overweight and obesity. A study found that outdoor physical activity is associated with significant and beneficial changes in fat percentage, waist circumference, systolic blood pressure,

Table 2: Age- and sex-wise distribution of overweight and obesity

Age/Sex	Boys				Girls			
	Overweight		Obese		Overweight		Obese	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
12	27	3.28	14	1.70	18	2.23	8	0.99
13	58	7.06	25	3.04	42	5.21	9	1.12
14	34	4.14	4	0.49	25	3.10	10	1.24
15	9	1.09	1	0.12	4	0.50	0	0.00
16	1	0.12	0	0.00	1	0.12	0	0.00

Table 3: Bivariate relationship between variables obesity and overweight

Parameters		Obesity and Overweight				Odds Ratio	95% CI	*P*-value
		Yes	%	No	%			
Main servings outside home/week	⩽2	230	13.43	985	57.54	9.134	0.946–1.359	0.0002*
	>2	72	4.21	425	24.82			
Snacking at home/day	1 = once	226	13.21	992	57.98	1.0	1.124–1.603	0.1030
	2 = two	75	4.38	411	24.02			
	3 = three	0	0.00	7	0.41			
Snacking outside	1 = daily	21	1.23	178	10.40	2.891	0.792–1.003	0.021*
	2 = >3/week	94	5.49	333	19.46			
	3 = <2/week	186	10.87	899	52.54			
TV while eating	1 = yes	243	14.20	1156	67.56	3.976	0.789–1.207	0.0323*
	2 = no	58	3.39	254	14.85			
Carbonated drinks/juices	1 = daily	32	1.87	119	6.95	0.987	0.870–1.120	0.0733
	2 = >3/week	88	5.14	389	22.74			
	3 = <2/week	181	10.58	902	52.72			
Parents work	1 = yes	117	6.84	694	40.56	2.695	0.589–0.820	0.0274*
	2 = no	184	10.75	716	41.85			
Hours of watching TV and computer/day	1 = <1h	169	9.88	781	45.67	1.069	0.953–1.198	0.0211*
	2 = 1 to 3 h	96	5.61	428	25.03			
	3 = >3 h	36	2.11	200	11.70			
Outdoor games	1 = daily	98	5.73	478	27.94	1.799	0.711–0.898	0.0072*
	2 = weekly	151	8.83	673	39.33			
	3 = none	52	3.04	258	15.08			
	4	0	0.00	1	0.06			
Exercise daily	1 = yes	112	6.55	387	22.62	1.189	0.993–1.425	0.0441*
	2 = no	189	11.05	1023	59.79			
Transport	1 = walk	58	3.39	438	25.60	1.760	0.690–0.837	0.0022*
	2 = cycle	52	3.04	347	20.28			
	3 = automobile	191	11.16	625	36.53			
Day sleep	1 = yes	26	1.52	158	9.23	0.020	0.691–1.173	0.1273
	2 = no	275	16.07	1252	73.17			
School hours	1 = <4 h	NA				1.155	NA	0.0313*
	2 = 4 to 6 h	174	10.11	798	46.37			
	3 = >6 h	129	7.50	620	36.03			
Physical training hours/week in school	1 = <1h	94	5.46	452	26.26	1.894	0.817–0.979	0.0035*
	2 = 1 to 3 h	35	2.03	168	9.76			
	3 = >3 h	174	10.11	798	46.37			
Playground	1 = yes	209	12.14	966	56.13	1.293	1.084–1.542	0.049*
	2 = no	94	5.46	452	26.26			

*Statistically significant.

insulin, low-density lipoprotein cholesterol, and total cholesterol, as well as with small nonsignificant changes in diastolic blood pressure, glucose, and high-density lipoprotein cholesterol.[22]

Mode of transport to school was found to be a significant risk factor in line with study by Larsen et al.[23] where only 22% overweight were using active means of transport and 30% nonoverweight were using active means of transport.

Physical training hours in school (<3h/week) was associated with increased prevalence of overweight and obesity. Children doing daily physical exercise apart from the physical training at school showed greater decline in the risk. Research shows that doing moderate exercise daily leads to decrease in the prevalence of overweight and obesity.[24] The Endocrine Society recommends in its guidelines that schools should provide 1 h of daily exercise in all grades.[25]

The present-day corporate schools are characterized by long study hours, no/few physical training hours, and absence of playground. These three factors were significant in our study and hence, more prevalence of overweight as well as obesity was observed in corporate schools compared to noncorporate [missionary, funded, etc.] schools. More than

Table 4: Risk factors for overweight and obesity using multiple logistic regression analysis

Variable	Parameter Estimate	*t*-Value	Pr > |t|
Main servings outside home/week	0.12464	1.17	0.0025
Snacking outside	0.03055	0.16	0.0058
TV while eating	0.13567	0.39	0.0047
Parents work	0.43524	1.59	0.0027
Hours of watching TV and computer/day	0.22760	1.23	0.0082
Outdoor games	0.54520	2.82	0.0048
Exercise daily	0.24058	0.82	0.0048
Transport	0.45029	2.78	0.0055
Day sleep	0.38710	0.91	0.0027
School hours	0.52928	0.62	0.0064
Physical training hours/week in school	0.64381	1.38	0.0067

half of the obese children in our study were found to be from such corporate schools.

Watching TV/using computer for more than 60 min was found to be significantly associated with increase in the prevalence of overweight and obesity and was found to relate to physical inactivity and snacking during this time.[26]

Working parents was a significant risk factor with positive relationship between both parents working and incidence of childhood obesity. This is in agreement with that reported in a study conducted by Huffman et al.[27] However, further information on aspects such as a working mother had more effect than a working father and relation between hours of work and BMI could not be elicited as these questions were not included in the questionnaire.

Snacking at home/day and daytime sleep were not found to be significantly associated with increased risk of developing overweight and obesity. This could be due to busy schedule of the students—as soon as they arrive home, they go to some playground or coaching institute, so there is no time for them to sleep/eat.

Frequency of carbonated drinks/juices was not found to be a significant risk factor. Probably due to the soaring temperatures and humid climate of Vijayawada, and also due to the custom of frequently consuming buttermilk, lemon water, etc. It could also be due to consideration of buttermilk and other drinks under the category of juices. Ravi and Truman[28] have reported a high consumption of carbonated beverages among overweight adolescents.

Limitations of this Study

The first limitation in our study is the reliance on the answers of the students regarding their physical activity and dietary pattern. Efforts were made to make these answers as accurate as possible by explaining the meaning of each question and the choices and providing a column for the parents' signature. The details regarding physical activity (moderate/vigorous exercise) were not elicited. The qualitative data regarding snacks/carbonated drinks/junk food were not taken into consideration. The hours of daily exercise was also not taken into consideration.

Conclusion

The overall prevalence of overweight and obesity was found to be 26.9% and 8.7%. The major risk factors were eating outside home, eating while watching TV, frequency of snacking outside, not playing outdoor games, vehicular mode of transport to school, increased hours spent in school per day, more hours of watching TV/using computer, not exercising daily, less hours of physical training in school per week, and absence of playground in the school. Frequency of carbonated drinks and frequency of snacking at home were found not to influence the prevalence of overweight and obesity.

The parents need to be more cautious about their child's dietary habits. They should be counseled by the pediatrician about the effects parenting can have on the child's BMI and also on his/her future.

The government needs to implement strict laws regarding the working hours of schools. Every school should have a playground. Children should be provided with physical training for at least 2 h per week. The cutoffs regarding working hours of the school should be followed strictly. All state boards should implement recording of body weight, height, BMI, and waist and hip circumference, just like the Central Board. The Board of Education should pay surprise visits to the schools to check the facilities and the quality of food provided in the canteen. Curriculum should include chapters on healthy living habits.

Children should be encouraged to play outdoor games instead of computer games. Incentives should be provided to children to maintain a healthy lifestyle.

Obesity and overweight are major burdens to the society. With previously mentioned easy measures, we can control overweight and obesity in children, which in turn will reduce the number of obese adults. This will reduce the costs incurred on chronic diseases and also make citizens efficient and healthy.

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