

# Is small town India falling into the nutritional trap of metro cities? A study in school-going adolescents

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## ABSTRACT

**Introduction:** There has been an increasing secular trend in the prevalence of overweight and obesity in developing countries. The prevalence reported among children and adolescents of some metro cities in India are comparable to that in some developed countries. Westernization of culture, rapid mushrooming of fast food joints, lack of physical activity, and increasing sedentary pursuits in the metro cities are some of the reasons implicated for this. The nutritional changes in small town school children might be following the same pattern of larger cities. **Aims and Objectives:** To study the prevalence of overweight and obesity among school-going adolescents of Aligarh and to study the sociodemographic and behavioral correlates of the same. **Materials and Methods:** A cross-sectional study done in two affluent and two nonaffluent schools in Aligarh, taking 330 adolescents from each group (total-660). Study tools included a predesigned and pretested questionnaire, Global Physical Activity Questionnaire, and anthropometric measurement. Overweight and obesity were defined based on World Health Organization 2007 Growth Reference. Chi-square test and multiple logistic regression analysis were done. **Results:** Prevalence of overweight and obesity was 9.8% and 4.8% among school-going adolescents. The difference in prevalence of overweight and obesity among affluent schools (14.8% and 8.2%) and nonaffluent schools (4.8% and 1.5%) was significant. Risk factors for overweight and obesity were affluence, higher maternal education, parental history of obesity, frequent fast food intake, and television (TV) viewing more than 2 h/day. **Conclusion:** Overweight and obesity among school-going adolescents is a crisis facing even smaller cities in India. Behavior change communication should be focused to adolescents, especially of the affluent section, toward restricting fast food intake, and TV viewing.

**Keywords:** Adolescents, obesity, overweight, World Health Organization 2007 Growth Reference

## Introduction

Obesity has been declared a global epidemic by World Health Organization (WHO) which has not only crossed geographical boundaries but has spread across all ages.<sup>[1]</sup> Rising prevalence of obesity among children and adolescents<sup>[2,3]</sup> and the fact that two-third of childhood obesity persists into adulthood,<sup>[4]</sup> is increasingly contributing to the escalating pool of this noncommunicable disease.

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Both developed<sup>[5]</sup> and developing countries<sup>[5]</sup> have witnessed a steep rise in the prevalence of overweight and obesity among children and adolescents. The prevalence of overweight and obesity has shown increasing trends in India also.<sup>[6]</sup> More so, the prevalence reported among children and adolescents of some metro cities in India<sup>[7,8]</sup> are comparable to that in some developed countries.<sup>[9,10]</sup> What could be the driving force behind this increasing trend? Westernization of culture, rapid mushrooming of fast food joints, lack of open spaces for physical activity, and increasing sedentary pursuits in the metro cities are some of the reasons implicated for increased overweight and

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obesity.<sup>[11]</sup> Small towns in India are also fast developing. Is small town India following the larger metro cities? Are the nutritional changes in small town school children following the same pattern of larger cities? Keeping these research questions in mind, a study was undertaken among the school-going adolescents of Aligarh, a small town located in the Central India, about 132 km from New Delhi, with the following objectives: (1) To study the prevalence of overweight and obesity among school-going adolescents of Aligarh and (2) to study the sociodemographic and behavioral correlates of the same.

## Materials and Methods

Aligarh is rapidly developing into a large town. Part of this “development” includes opening up of fast food chains, increasing social norm of eating out, more access to internet, video games and television (TV) viewing and school children of affluent families having more spending money. Although in large sections of the population the age-old customs of eating home food still persists, multinational companies are luring the young to new eating habits.

A cross-sectional study was conducted from August 2009 to July 2010, in two affluent (having tuition fees more than Rs. 10,000/annum) and two nonaffluent schools (having tuition fees <Rs. 10,000/annum) in Aligarh. Type of school has been used as a proxy for socioeconomic status. The study design was approved by the Institutional Ethical Committee.

Taking estimated prevalence of overweight as 3.23%,<sup>[6]</sup> alpha error of 5%, 2% absolute allowable error and 10% nonresponse rate, sample size calculated was 321 and rounded off to 330. Thus, 330 adolescents were covered in both types of schools (affluent and nonaffluent group), making the total sample size 660.

Purposive selection of two affluent and two nonaffluent schools was done to allow for practical feasibility. Probability proportionate to size of the population technique was used and systematic random sampling done. Apparently healthy school children of V–X<sup>th</sup> standard, who had completed 10 years of age on the date of interview and were not more than 16 years of age (as per school records) were interviewed after taking informed consent from the school authorities and the parents. Children having any chronic illness, severe malnutrition, endocrinal problems, physical, and mental defects, those with apparent obesity-induced or associated with any syndrome and those found to be smokers (defined as any amount of smoking or tobacco chewing at any time during past 6 months) and those not cooperating for anthropometric measurements were excluded. A predesigned and pretested questionnaire was used to collect data for sociodemographic and behavioral factors. Information regarding parent’s education and occupation and family history of obesity were collected from the child’s parents. Total dietary intakes per day were assessed by using individual 24 h recall method. Deficient, adequate, and excess calorie intakes per day

were defined as per the total calorie requirements of adolescents, age and sex wise, as recommended by Indian Council of Medical Research.<sup>[12]</sup> A Pretested Food Frequency Questionnaire was used to assess the frequency of fruit and fast food intake during the past 1 month. Fast foods were defined as the foods sold in a restaurant or store which are rapidly prepared and quickly served in a packaged form for take away<sup>[13]</sup> and included burgers, pizzas, fries, patties, nuggets, and Indian foods such as pakora, samosa, and namkeen.

Students were interviewed about duration of watching TV and time spent in other sedentary activities per day during the past 1 month, which were then converted into categorized variables. Total physical activity level (PAL) of the adolescents and the total sedentary time per day was assessed using Global Physical Activity Questionnaire.<sup>[14]</sup>

Anthropometric measurements of weight (to the nearest 0.1 kg) and standing height (to the nearest 0.1 cm) were taken according to standard methodology.<sup>[15]</sup> Body mass index (BMI) was calculated as the ratio of body weight to body height squared expressed as kg/m<sup>2</sup>. Blood pressure was measured by mercury sphygmomanometer using standard methodology.<sup>[16]</sup>

Nutritional status was defined using BMI for age and sex percentiles given by WHO Growth Reference 2007.<sup>[17]</sup> For the purpose of studying determinants of overweight and obesity, all the students were grouped into (a) overweight (including obese) and (b) nonoverweight/nonobese. The strength of association of determinants of overweight (including obesity) was studied by unadjusted odds ratio (95% confidence interval [CI]). Variables having significant association were subjected to stepwise multiple logistic regression model to determine the significant independent risk factors of overweight and obesity. Data analysis was done using IBM SPSS version 20 and  $P < 0.05$  was considered as statistically significant.

## Results

Of the total study subjects 57.6% (380 out of 660) were males. The age group of 10–13 years included 49.1% of adolescents and 50.9% were in the >13–16 years age group. The nutritional status of the study population according to BMI has been shown in Table 1.

The overall prevalence of overweight and obesity among school-going adolescents was found to be 9.8% and 4.8%, respectively [Table 1]. Although a higher prevalence of overweight and obesity was found among boys (11.3% overweight and 5.5% obesity) as compared to girls (7.9% overweight and 3.9% obesity), the difference was not statistically significant.

The nutritional status was found to differ significantly ( $\chi^2 = 99.593$ ,  $df = 3$ ,  $P < 0.05$ ) between the affluent and nonaffluent group as shown in Table 1. In the nonaffluent schools, the proportion of

**Table 1: Nutritional status of the study population with respect to sex and type of school**

Nutritional status according to BMI	Sex, n (%)		Type of school, n (%)		Total, n (%)
	Male (n=380)	Female (n=280)	Affluent school (n=330)	Nonaffluent School (n=330)	
Underweight	106 (27.9)	93 (33.2)	45 (13.6)	154 (46.7)	199 (30.2)
Normal	210 (55.3)	154 (55.0)	209 (63.3)	155 (47.0)	364 (55.2)
Overweight	43 (11.3)	22 (7.9)	49 (14.8)	16 (4.8)	65 (9.8)
Obese	21 (5.5)	11 (3.9)	27 (8.2)	05 (1.5)	32 (4.8)
	$\chi^2=4.32, df=3, P>0.05$		$\chi^2=99.59, df=3, P<0.05$		

BMI: Body mass index

underweight adolescents was significantly higher than in affluent schools. The proportion of adolescents having normal weight was much higher in affluent schools. Furthermore, in the affluent schools, the proportion of overweight (14.8%) and obese (8.2%) adolescents were significantly higher compared to nonaffluent schools. Looking at the two ends of the spectrum, proportion of over-nutrition in affluent schools (14.8% overweight and 8.2% obesity) was much higher than under-nutrition (13.6%). The sociodemographic profile of the study population and various behavioral factors were studied according to type of school, by applying Chi-square, and found to differ significantly between the affluent and nonaffluent group [Tables 2 and 3, respectively]. Ninety percent of the adolescents of nonaffluent group were having a large family size as compared to about three-fourth adolescents in affluent group. Significantly higher proportions of adolescents from affluent group had higher paternal and maternal education. More than 55% of the affluent adolescents had fathers with business as their occupation as compared to 40% in case of adolescents of nonaffluent group. Parental history of obesity was also found to be significantly higher among the adolescents of affluent group. Vegetarian diet, use of ghee and vanaspati, excess total calories intake, eating out at least once a week and fast food intake 5 times or more per week was found to be significantly higher among the adolescents of affluent group than the nonaffluent group. PAL was found to be high among only 15.8% of affluent group as compared to 23% among the nonaffluent group adolescents ( $P < 0.05$ ). Significantly higher proportions of affluent adolescents were found to have more total sedentary time per day and TV viewing as compared to nonaffluent adolescents. On multiple logistic regression analysis, belonging to affluent group, mother's education more than or equal to graduate, parental history of obesity, frequent fast food intake, and TV viewing more than 2 h/day were found to be the independent risk factors for overweight and obesity [Table 4].

## Discussions and Conclusion

The prevalence of overweight and obesity among the school-going adolescents of Aligarh was found to be almost as high as reported in larger cities of the country.<sup>[18,19]</sup> The nutritional evolution in most Asian countries has markedly increased the burden of obesity.<sup>[20]</sup> India is also undergoing a nutrition transition.<sup>[21]</sup> The double burden of nutritional disease faced by the Asian countries is also the result of this transition.<sup>[22]</sup> This "double burden" of nutritional disorders is also evident in this study, with the prevalence of overweight (including obesity)

**Table 2: Sociodemographic profile of the study subjects**

Variable	Type of schools		Test of significance
	Affluent group n (%)	Nonaffluent group n (%)	
Sex			
Male	189 (57.3)	191 (57.9)	$\chi^2=0.03;$ df=1; $P>0.05$
Female	141 (42.7)	139 (42.1)	
Size of family			
≤4	78 (23.6)	33 (10.0)	$\chi^2=21.93;$ df=1; $P<0.05$
≥5	252 (76.4)	297 (90.0)	
Father's education			
Up to high school	50 (15.2)	92 (27.9)	$\chi^2=16.61;$ df=2; $P<0.05$
Inter	68 (20.6)	50 (15.2)	
≥ graduate	212 (64.2)	188 (57.0)	
Mother's education			
Up to high school	80 (24.2)	174 (52.7)	$\chi^2=61.71;$ df=2; $P<0.05$
Inter	67 (20.3)	59 (17.9)	
≥ graduate	183 (55.5)	97 (29.4)	
Father's occupation			
Others	27 (8.2)	51 (15.5)	$\chi^2=23.12;$ df=3; $P<0.05$
Business	186 (56.4)	135 (40.9)	
Service	64 (19.4)	98 (29.7)	
Professional	53 (16.1)	46 (13.9)	
Mother's occupation			
Housework	301 (91.2)	314 (95.2)	$\chi^2=4.03;$ df=1; $P<0.05$
Working	29 (8.8)	16 (4.8)	
Family history of obesity			
Absent	220 (66.7)	246 (74.5)	$\chi^2=9.21;$ df=2; $P<0.05$
In either parent	91 (27.6)	78 (23.6)	
In both the parents	19 (5.8)	6 (1.8)	

being 14.7% (97 out of 660) while about 30% of the adolescents were underweight. However, over-nutrition in affluent schools was higher than under-nutrition. Rapid urbanization has created an obesogenic environment by promoting motorized transport, unsafe roads and traffic, eating up open spaces and playgrounds on one hand; and on another by providing more opportunities for sedentary leisure pursuits and fast food consumption outlets.<sup>[23]</sup> This has been reported to be the cause of rising trend of obesity in the larger cities of India, especially the affluent section of society.<sup>[11]</sup> Interestingly, even smaller but fast developing cities are also witnessing the problem of overweight and obesity, as shown by this study. The obesogenic environment of large metro cities is being duplicated in these cities, and unless timely action

**Table 3: Association between behavioral factors and type of school**

Variable	Type of schools		P
	Affluent group n (%)	Nonaffluent group n (%)	
Type of diet			
Vegetarian	171 (51.8)	57 (17.3)	$\chi^2=87.08$ ; df=1; P<0.05
Nonvegetarian	159 (48.2)	273 (82.7)	
Cooking medium			
Refined/mustard oil	200 (60.6)	286 (86.7)	$\chi^2=62.98$ ; df=2; P<0.05
Ghee/vanaspati	62 (18.8)	11 (3.3)	
Any use of ghee/vanaspati	68 (10.0)	33 (10.0)	
Total calorie intake			
Adequate	44 (13.3)	26 (7.9)	$\chi^2=34.96$ ; df=2; P<0.05
Deficient	215 (65.2)	279 (84.5)	
Excess	71 (21.5)	25 (7.6)	
Eating out			
< once a week	265 (80.3)	286 (86.7)	$\chi^2=7.27$ ; df=2; P<0.05
Once a week	41 (12.4)	21 (6.4)	
> once a week	24 (7.3)	23 (7.0)	
Fast food intake			
< once a week	46 (13.9)	66 (20.0)	$\chi^2=8.32$ ; df=3; P<0.05
1–2 times a week	144 (43.6)	148 (44.8)	
3–4 times a week	72 (21.8)	71 (21.5)	
≥5 times a week	68 (20.6)	45 (13.6)	
Fruit intake			
< once a week	57 (17.3)	85 (25.8)	$\chi^2=12.40$ ; df=3; P<0.05
1–2 times a week	74 (22.4)	85 (25.8)	
3–4 times a week	55 (16.7)	55 (16.7)	
≥5 times a week	144 (43.6)	105 (31.8)	
PAL			
Low	90 (27.3)	95 (28.8)	$\chi^2=7.06$ ; df=2; P<0.05
Moderate	188 (57.0)	159 (48.2)	
High	52 (15.8)	76 (23.0)	
TV viewing (h/day)			
Do not watch	49 (14.8)	97 (29.4)	$\chi^2=20.52$ ; df=3; P<0.05
Up to 1	160 (48.5)	129 (39.1)	
1–2	74 (22.4)	66 (20.0)	
>2	47 (14.2)	38 (11.5)	
Total sedentary time (h/day)			
Up to 6	107 (32.4)	121 (36.7)	$\chi^2=1.46$ ; df=2; P>0.05
6–10	201 (60.9)	186 (56.4)	
>10	22 (6.7)	23 (7.0)	

TV: Television; PAL: Physical activity level

**Table 4: Risk factors for overweight (including obesity) using stepwise logistic regression analysis**

Variable	OR	95% CI	P
Affluent school	2.4	1.3–4.5	0.006
Mother's education (≥ graduate)	3.1	1.3–7.0	0.008
Family history of obesity in both the parents	6.7	2.6–17.1	<0.001
Fast food intake 3–4 times a week	7.4	2.4–23.0	0.001
Fast food intake ≥5 times a week	8.1	2.2–25.7	<0.001
TV viewing >2 h/day	2.8	1.1–7.1	0.030

OR: Odds ratio; TV: Television; CI: Confidence interval

is taken to address these changes, the problem of overweight and obesity may escalate uncontrollably.

In this study, it was found that adolescents of affluent schools were 2.4 times more at risk of having overweight and obesity. This trend of increased overweight and obesity among affluent section has been reported by many other researchers too.<sup>[24,25]</sup> This may be explained by the fact that affluent group goes hand-in-hand with more spending money and more accessibility to fast foods, motorized transport, and sedentary pursuits such as computer and video games. The affluent group in this study had significantly higher use of ghee, eating out, fast food intake, TV viewing, and time spent in sedentary activities as compared to the nonaffluent group.

A higher maternal education level was found to increase 3.1 times the odds of having overweight and obesity among school-going adolescents. This finding is also reflected in another study done in India.<sup>[26]</sup> It is expected that mothers who are educated should be planning better meals for their children but apparently they are not. This indicates that higher education may not necessarily mean better health education. This emphasizes the need for enriching and reinforcing individual awareness at family and community level. Educating parents of obese children has been shown to produce positive changes in the children's dietary intake.<sup>[27]</sup> Interestingly, working status of mothers was not found to be a risk factor for overweight.

Parental obesity has been implicated as a risk factor for overweight and obesity among children and adolescents by many authors<sup>[28-30]</sup> and was found to be an independent risk factor in this study too. Family history of obesity in both the parents increased the odds of overweight and obesity by 6.7 times. Parental obesity may increase the risk of obesity through genetic mechanisms or by shared familial characteristics in the environment such as food preferences.<sup>[31]</sup>

The study has found fast-food intake to be a significant risk factor of overweight and obesity, and the risk increased with increased frequency of intake. Fast food typically incorporates all of the potentially adverse dietary factors, including saturated and trans fat, high glycemic index, high energy density, and increasingly, large portion size.<sup>[32]</sup> All these factors favor overweight and obesity. Another Indian study has also reported the prevalence of overweight to be higher among those adolescents who were fond of junk foods.<sup>[24,25]</sup> The authors have found in their study that the children from private schools consumed more of fast food items and carbonated drinks due to easy availability in the school canteen. Fast food intake was found to be higher in affluent adolescents in this study also. The association between fast food consumption and obesity clearly indicates the need for improvements in family and school food environments.

TV viewing >2 h daily was found to increase the odds of overweight and obesity among adolescents by 2.8 times. Some other authors have also reported similarly.<sup>[28,29]</sup> Children seem to passively consume excessive amounts of energy dense foods while watching TV. Furthermore, TV advertising could adversely affect dietary patterns at other times throughout the

day.<sup>[32]</sup> A randomized controlled trial has shown that reducing TV, videotape, and video game use may be a promising, population-based approach to help prevent childhood obesity.<sup>[33]</sup>

Physical inactivity has been shown to predispose to obesity by decreasing energy expenditure.<sup>[34]</sup> On univariate analysis, low PAL was found to increase the risk of overweight and obesity by 2.6 times (CI 1.2–5.4,  $P < 0.05$ ), but no independent risk was found on multivariate analysis. In spite of proven benefits,<sup>[35]</sup> levels of physical activity have been decreasing among urban children and adolescents.<sup>[36]</sup> In this study, high PAL was found to be significantly ( $P < 0.5$ ) lower among affluent adolescents (15.8%) than among the nonaffluent adolescents (23.0%).

It can be concluded from this study that overweight and obesity among school-going adolescents is a crisis facing even smaller cities in India, and action to control it must begin now. Given the current trends in pediatric overweight and obesity, it is very crucial that preventive strategies should be implemented through schools and community-based programs involving both education and intervention. Prevention starting in early childhood (life course approach) is a critical area of work to prevent obesity.

Limitations of the study include a purposive selection of schools and use of 24 h recall for assessment of dietary intake per day. Because most individuals' diets vary greatly from day to day, data from a single 24 h recall might fail to characterize an individual's usual diet.

As the findings of a school-based study like this cannot be generalized to the whole population, a larger study conducted in schools as well as the general adolescent population can provide more conclusive results about overweight and obesity and their risk factors.

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### Conflicts of interest

There are no conflicts of interest.

## References

1. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 2000;894:i-xii, 1-253.
2. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA* 2006;295:1549-55.
3. Popkin BM, Gordon-Larsen P. The nutrition transition: Worldwide obesity dynamics and their determinants. *Int J Obes* 2004;28 Suppl 2:s2-9.
4. Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Prev Med* 1993;22:167-77.
5. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* 2006;1:11-25.
6. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: Time trends and relationship with hypertension. *Natl Med J India* 2007;20:288-93.
7. Khadilkar VV, Khadilkar AV. Prevalence of obesity in affluent school boys in Pune. *Indian Pediatr* 2004;41:857-8.
8. Sharma A, Sharma K, Mathur KP. Growth pattern and prevalence of obesity in affluent schoolchildren of Delhi. *Public Health Nutr* 2007;10:485-91.
9. Kurth BM, Schaffrath Rosario A. The prevalence of overweight and obese children and adolescents living in Germany. Results of the German health interview and examination survey for children and adolescents (KiGGS). *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2007;50:736-43.
10. Salvadori M, Sontrop JM, Garg AX, Truong J, Suri RS, Mahmud FH, *et al.* Elevated blood pressure in relation to overweight and obesity among children in a rural Canadian community. *Pediatrics* 2008;122:e821-7.
11. Kalra S, Unnikrishnan AG. Obesity in India: The weight of the nation. *J Med Nutr Nutraceut* 2012;1:37-41.
12. Indian Council of Medical Research. Nutrient Requirements and Recommended Dietary Allowances: A Report of the Expert Group of the ICMR; 1990.
13. Fast Foods: Wikipedia the Free Encyclopedia. Available from: [http://www.en.wikipedia.org/wiki/Fast\\_food](http://www.en.wikipedia.org/wiki/Fast_food). [Last accessed on 2009 Aug 10].
14. Global Physical Activity Questionnaire (GPAQ). Available from: <http://www.who.int/chp/steps>. [Last accessed on 2009 Aug 10].
15. WHO Expert Committee. Physical status - The use and interpretation of anthropometry. Recommended measurement protocols and derivation of indices. WHO Tech Rep Ser 1995;854:424-38.
16. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics* 2004;114:555-76.
17. WHO Growth Reference; 2007. Available from: [http://www.who.int/growthref/who2007\\_bmi\\_for\\_age/en/index.html](http://www.who.int/growthref/who2007_bmi_for_age/en/index.html). [Last accessed on 2009 Dec 05].
18. Sidhu S, Marwah G, Prabhjot. Prevalence of overweight and obesity among the affluent adolescent school children of Amritsar, Punjab. *Coll Antropol* 2005;29:53-5.
19. Goyal RK, Shah VN, Saboo BD, Phatak SR, Shah NN, Gohel MC, *et al.* Prevalence of overweight and obesity in Indian adolescent school going children: Its relationship with socioeconomic status and associated lifestyle factors. *J Assoc Physicians India* 2010;58:151-8.
20. Popkin BM. The nutrition transition and obesity in the developing world. *J Nutr* 2001;131:871S-3S.
21. Griffiths PL, Bentley ME. The nutrition transition is underway in India. *J Nutr* 2001;131:2692-700.
22. Jafar TH, Qadri Z, Islam M, Hatcher J, Bhutta ZA, Chaturvedi N. Rise in childhood obesity with persistently high rates of undernutrition among urban school-aged

- Indo-Asian children. *Arch Dis Child* 2008;93:373-8.
23. Kjellström T, Håkansta C, Hogstedt C. Globalisation and public health-overview and a Swedish perspective. *Scand J Public Health Suppl* 2007;70:2-68.
  24. Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting prevalence of overweight among 12- to 17-year-old urban adolescents in Hyderabad, India. *Obesity (Silver Spring)* 2007;15:1384-90.
  25. Tharkar S, Viswanathan V. Impact of socioeconomic status on prevalence of overweight and obesity among children and adolescents in urban India. *Open Obes J* 2009;1:9-14.
  26. National Institute of Nutrition (NIN), Hyderabad. Adolescent Obesity - Andhra Pradesh; 2006-2007. Available from: [http://www.whoindia.org/linkfiles/nmh\\_resources\\_ncd\\_risk\\_nin\\_report.pdf](http://www.whoindia.org/linkfiles/nmh_resources_ncd_risk_nin_report.pdf). [Last accessed on 2010 Jan 10].
  27. Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with the parents as the exclusive agents of change. *Int J Obes Relat Metab Disord* 1998;22:1217-24.
  28. Lee K, Kwon ER, Park TJ, Park MS, Lenders CM. Parental overweight as an indicator of childhood overweight: How sensitive? *Asia Pac J Clin Nutr* 2006;15:196-200.
  29. Kleiser C, Schaffrath Rosario A, Mensink GB, Prinz-Langenohl R, Kurth BM. Potential determinants of obesity among children and adolescents in Germany: Results from the cross-sectional KiGGS study. *BMC Public Health* 2009;9:46.
  30. Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, *et al.* Early life risk factors for obesity in childhood: Cohort study. *BMJ* 2005;330:1357.
  31. Francis LA, Lee Y, Birch LL. Parental weight status and girls' television viewing, snacking, and body mass indexes. *Obes Res* 2003;11:143-51.
  32. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: Public-health crisis, common sense cure. *Lancet* 2002;360:473-82.
  33. Robinson TN. Reducing children's television viewing to prevent obesity: A randomized controlled trial. *JAMA* 1999;282:1561-7.
  34. Stamatakis E, Hirani V, Rennie K. Moderate-to-vigorous physical activity and sedentary behaviours in relation to body mass index-defined and waist circumference-defined obesity. *Br J Nutr* 2009;101:765-73.
  35. Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee Report, 2008. Washington, DC: U.S. Department of Health and Human Services, 2008. Available from <http://health.gov/paguidelines/report/pdf/committeereport.pdf> [Last accessed on 2016 Feb 24].
  36. Swaminathan S, Selvam S, Thomas T, Kurpad AV, Vaz M. Longitudinal trends in physical activity patterns in selected urban South Indian school children. *Indian J Med Res* 2011;134:174-80.