Correlates of Overweight and Obesity Among Urban School Going Children of Nagpur City

SUBHASH B.THAKRE, SHEETAL P. MOHANE, SURESH M. UGHADE, SUSHAMA S. THAKRE, SURESH S. MOREY, ARUN Y. HUMNE

ABSTRACT

Introduction: Overweight and obesity during childhood are a matter of growing concern in India. Most individuals develop their eating and activity patterns during childhood. Obesity in children and adolescents is gradually becoming a major public health problem in many developing countries, including India. The objective of the present study is to estimate the prevalence of overweight and obesity among school children and to identify the factors which influenced childhood overweight and obesity.

Materials and Methods: A cross-sectional study was carried out from July 2009 to January 2011 on school children who were aged between 5 and 16 years.

Results: The prevalence of overweight and obesity among children was 9.00% and 5.5% respectively. Overall, the prevalence of overweight/obesity was 14.52%. The risk of overweight/obesity was significantly (p<0.0120) higher among children who belonged to the upper SES and to the age group of $\geq$ 10 years, who viewed television for $\geq$ 1 hour, who slept for only $\geq$ 7 hours (OR=1.87; 95% CI=1.87-2.53) and who used vehicles to go to school (OR=1.59 ;95%CI =1.14-2.24). The prevalence of overweight and obesity was significantly (p<0.0032) lower among children who swam, danced regularly (p<0.0353) and played outdoor games (p<0.0323) than their counterparts. Its association was found to be protective against overweight/ obesity. The risk of overweight /obesity was significantly higher among children who were non-vegetarians (OR=1.88; 95% CI=1.39-2.55, p<0.0001), who regularly consumed junk food (OR=2.54; 95% CI=1.82-3.53, p<0.0001), and in whom the calorie intake was more than the recommended daily allowances (OR=1.88; 95% CI=1.39-2.55, p<0.0001).

Conclusion: This study confirmed the findings of earlier studies which were carried out in the other parts of the country and it emphasized that regular physical exercise, regulated television viewing, and a healthy eating behaviour could contribute to control overweight and obesity.

INTRODUCTION

Childhood obesity was considered as a problem in affluent countries. Today, this problem has started appearing even in developing countries [1]. Globally, the prevalence of childhood obesity varies from over 30% in USA to less than 2% in sub-Saharan Africa [2]. The national representative data for childhood obesity in India is unavailable. However, the available Indian studies have revealed that the prevalence of overweight and obesity in India was 3.1% to 29% and 0.73 % to 7% respectively [3-10]. Obesity in children and adolescents is gradually becoming a major public health problem in many developing countries, including India [11]. 50-80% of the obese children will continue to be obese adults [12]. However, whether or not obesity persists into adulthood, the obesity in childhood appears to increase the risk of subsequent morbidities [13].

The transitions in the nutrition and lifestyle, e.g. the popularity of fast foods and soft drinks, a sedentary life style, lack of exercise, and computer use are the common trends which are adopted by children today [14]. There is no published data on a representative sample from Nagpur on the prevalence of childhood overweight and obesity. With this background in mind, the present study was undertaken in the central part of Nagpur city to estimate the prevalence of overweight and obesity among school children who were aged between 5 and 16 years and to identify the factors which influenced childhood overweight/obesity.

MATERIALS AND METHOD

Study design and setting
The present cross sectional study was undertaken in the Tejaswini Vidya Mandir High School which is one of the private unaided schools in Nagpur city, Nagpur District, Maharashtra state..

Study population and study area
1524 students in the age group of 5-16 years, who were studying in class I-X, in private unaided schools (where the annual fees was more than Rs.10400) of an urban area of Nagpur were enlisted for the study.

Study period
This study was carried out from July 2009 to January 2011.

Sample size-sampling technique
Considering the prevalence of obesity of 3.3% as was reported in a pilot study, an alpha error of 5 per cent, an absolute allowable error 1 per cent and a non-response rate 10 per cent, the sample size was calculated as 1235. However, there were a total of 1524 students in the school. Hence, all the students were included in the study. The consecutive samples of all the 1524 children were included in the study.

Instrument and technique
The consent of the school authorities was obtained after explaining to them the objectives as well as the method of the

study. A predesigned and pretested questionnaire was used to interview the study participants to elicit the information on their family characteristics like economic status, religion, education and occupation of the parents. Information on individual characteristics like age, sex, eating habits, and time which was spent for television viewing and outdoor games were also collected. In our study, we considered fast food consumption as "yes", if the child was having fast food more than three times a week. Similarly, if the child regularly played outdoor and indoor games routinely for >30 min/day, we considered this characteristic as "yes." The help of the school teacher was also taken if the child had any problem in explaining the father's occupation. During the data collection, the class teachers were asked to accompany the students.

After the interview, a SECA Weighing Machine and a SECA Measuring Scale with a board were use to measure the weight (nearest to 0.10 kg) and height (nearest to 0.5 cm) of each child by using standard procedures [15].

The body mass index (BMI) was calculated as the weight in kilogram/height in meter^2. Overweight and obesity were assessed by considering the BMI for a particular age and sex. Students who had a BMI for age-sex ≥ the 85th percentile to < the 95 percentile of the reference population were classified as overweight and who had a BMI for age-sex ≥ the 95th percentile of the reference population was classified as obese [16].

Statistical Analysis

The data were entered into an Excel 2007 Microsoft spreadsheet and were analyzed by using the Epi_Info (version 6.04) and the STRATA – 8 software packages. The continuous variables were presented as mean ± SD. The categorical variables were expressed in percentage. The Odds Ratio (OR) and the 95 per cent Confidence interval (95% CI) were calculated for each categorical risk factor. The associations were assessed by using the Chi-square test. For all the statistical tests, a p value of <0.05 was considered as statistically significant.

RESULTS

A total of 1524 school children (52.56% boys and 47.44% girls) in the age group of 5-16 years, with a mean age of 10.12±2.89 years, were studied. A majority [1341 (88.0%)] of the mothers were educated beyond high school, and 1375 (90.22%) fathers were educated beyond high school. A majority [1204 (79.0%)] of the mothers were housewives. The fathers were mostly employed as skilled workers and professionals [1497(98.33%)]. The major religions of the study subjects were Hinduism and Buddhism [1417 (92.97%)]. No statistically significant difference was observed in both the groups in regards of the education of the mothers (more than high school or less than high school), the education of the fathers (more than high school or less than high school), the occupations of the mothers and fathers and the religions of the study subjects.

| Demographic fea-tures | Students 5-16 years | | P |
	Students No (%)	Overweight/ Obesity No (%)	
Boys Girls	801(52.56) 724(47.44)	116(14.48) 105 (14.50)	0.9819 NS
Mothers education < High school ≥ High school	183(12.00) 1341(88.00)	26(14.21) 195(14.54)	0.904 NS
Fathers education < High school ≥ High school	149(9.78) 1375(90.22)	25(16.78) 196(12.29)	0.046 NS
Occupation of mother House wife Unskilled/semiskilled Skilled/professional	1204(79.00) 22(1.45) 298(19.55)	170(14.11) 1(4.55) 50(16.77)	0.207 NS
Occupation of father Unskilled/semiskilled Skilled/professional	27(1.77) 1497(98.33)	4(14.81) 220(14.69)	0.780 NS
Religion Hindu and Buddhist Jain and Others (Muslims, Sikh and Christian)	1417(92.97) 107(7.20)	202(14.26) 21(19.63)	0.130 NS

[Table/Fig-1]: Selected socio-demographic characteristics of the study sample (n=1524)

[Table/Fig-2] gives the overall prevalence of overweight and obesity by gender among schoolchildren in Nagpur. The overall prevalence of overweight among the children was 9.00% and the prevalence of obesity was 5.5%. Overall, the prevalence of overweight/obesity was 14.52%. The prevalence of overweight/obesity was equal in boys and girls. In this study, no difference was observed by gender between overweight and obesity, and for overweight/obesity together. The mean BMI of boys and girls was (15.71±3.612)kg/m^2 and (16.87±4.08)kg/m^2 respectively.

On doing univariate analysis, the risk of overweight/obesity was found to be significantly higher among children from the age group of ≥ 10 years than children from the age group of <10 years (OR=1.39; 95% CI= 1.02-1.89, p<0.291). A significant difference was observed in children of the upper SES (OR=1.57; 95%CI=1.09-2.28, p<0.0120) and in those who viewed TV for ≥ one hour than those who viewed it for < 1 hours (OR=1.40;95%CI=1.04-1.89, p<0.02). A significant difference was also observed in children who attended school by cycling or walking than in children who did so by using other vehicles (OR=1.59; 95%CI =1.14-2.24, p<0.0046) and in children who slept for ≥ 7 hours than children who slept for < 7 hours (OR=1.87; 95%CI=1.38-2.53,p<0.0001). The prevalence of overweight and obesity was significantly lower among children who swam (p<0.0032), danced regularly (p< 0.0353) and played outdoor games (p<0.0323) than their other counterparts. Hence, factors like swimming and not swimming (OR=0.38; 95%CI 0.18-0.74), dancing regularly and not dancing (OR=0.65; 95%CI 0.42-0.98), playing/not playing indoor games and outdoor games (OR=0.69; 95%CI 0.49-0.99) were found to be protective against overweight/obesity.

Variable	Sub-variable	Percentage	Mean BMI	Overweight ≥ 85 to <95th percentile	Obese ≥ 95th percentile	Overall Overweight and obese No (%)
Sex	Boys	52.56	15.71	72(9.0%)	44(5.5%)	116 (14.48)
	Girls	47.44	16.87	65(9.0%)	40(5.5%)	105(14.52)

[Table/Fig-2]: Prevalence of overweight and obesity in schoolchildren aged 5-16 years (n=1524)

Variables	Total num-bers	Overweight/obesity No (%)	OR (95% CI)	P value
Overall	1524	221(14.50)		
Age <10 years ≥10 years	647 877	79(12.21) 142(16.19)	1.39 1.02-1.89	0.0291
Socio-economic status (SES) Upper Lower	1115(73.16) 409(26.84)	177(15.87) 44(10.76)	1.57 (1.09-2.28)	0.0120
Television viewing <60 min ≥60 min	861 663	109(12.66) 102(15.38)	1.40 (1.04-1.89)	0.02
Swimming No Yes	1371 153	211(15.39) 10(6.54)	0.38 (0.18-0.74)	0.0032
Dancing No Yes	1224 300	189(15.47) 32(10.67)	0.65 (0.42-0.98)	0.0353
Games No/indoor Outdoor games	287 1237	53(18.47) 168(13.58)	0.69 (0.49-0.99)	0.0323
Means used to attend school regularly Walk/bicycle Autorikshaw /car/Motor-cycle/Scooter etc.	513 1011	56(10.92) 165(16.32)	1.59 (1.44-2.24)	0.0046
Duration of sleep ≤7 hours >7 hours	787 737	85 (10.80) 136(18.45)	1.87 (1.38-2.53)	0.0001

[Table/Fig-3]: Socio-demographic and activity-related risk factors of overweight/obesity

Variables	Total numbers	Over-weight/obesity No (%)	OR (95% CI)	p value
Eating habits Vegetarian Non-vegetarian	796 728	86 (11.8) 135 (17.0)	1.88 (1.39-2.55)	0.0001
consuming milk Daily Not Consuming milk	1411 113	197 (13.96) 24 (21.20)	1.66 (0.99-2.71)	0.0345
Junk food Never/occasional Regular/Frequently	1244 280	149 (11.98) 72 (25.71)	2.54 (1.82-3.53)	0.0001
Fruits Not consuming/occasional Consume regularly	106 1418	28 (26.42) 193 (13.61)	2.28 (1.38-3.66)	0.0003
Eating in the restaurant Never/occasional Regular ≥ once/twice/week	1464 60	209(14.28) 12(20.00)	1.50 (0.71-2.93)	0.2171 NS
Consumption of Green salad Never/occasional 1345 Regular	1345 179	32(17.9) 189 (14.05)	1.33 (0.85-2.03)	0.1721 NS
Soft drinks/sweets/chocolates No/occasional Regular	251 1273	29(11.55) 192(15.08)	1.36 (0.89-2.14)	0.1468 NS
Calories intake (n=150) ≤ RDA >RDA	93 57	5(5.37) 23(40.35)	1.88 (1.39-2.55)	0.0001

[Table/Fig-4]: Dietary-related risk factors for the overweight/obesity NS- Not significant.

[Table/Fig-4] shows that the risk of overweight /obesity was significantly higher among children who were non-vegetarians (OR=1.88; 95% CI=1.39-2.55, p<0.0001) and among those who did not consume milk (OR=1.66; 95% CI=0.99-2.71, p<0.0345). The risk of obesity/overweight was also significantly high in those who regularly consumed junk food (OR=2.54; 95% CI=1.82-3.53, p<0.0001), those who did not consume fruits (OR=2.28; 95% CI=1.38-3.66, p<0.0003), and in whom the calorie intake was more than the recommended daily allowances (RDA) (OR=1.88; 95% CI=1.39-2.55, p<0.0001). Eating in restaurants regularly, eating green salads regularly and the consumption of soft drinks/chocolates were found to be non significant.

DISCUSSION

Childhood obesity was considered as a problem in affluent countries. Now- a-days, this problem has started appearing in the developing countries also [1]. Obesity among children in India has became a public health problem (prevalence >5%) [15]. In this study, we have presented the estimates on the prevalence of overweight and obesity in school children who were aged 5-16 years in Nagpur city, by using the individual weight and height measures to calculate the BMI. The overall prevalence of overweight among the urban school children was 9.0% and the prevalence of obesity was 5.5%. Overall, the prevalence of overweight/obesity was 14.5% in the age group of 5 to 16 years.

Various studies from India have also shown the increased prevalence of obesity in India. The results of a study from Punjab revealed that children in the age group of 11–17 years, who resided

in the urban areas, were more overweight (11.6%) as compared to the children from the rural areas (4.7%). However, more children were found to be obese in the rural areas (3.6%) as compared to those in the urban areas (2.6%) [4]. The results of the study [3] which was done on 1228 boys at Pune, in the age group of 10–15 years, showed that the prevalence of obesity was 5.7%, whereas the prevalence of overweight was 19.9%. A cross-sectional study which was carried out on 2008 school children of the age group of 9–15 years in Punjab, revealed that the overall prevalence of obesity and overweight were 11.1% and 14.2% respectively [5]. Another study which was conducted by the Nutrition Foundation of India, found that among 5000 children who were aged 4–18 years in a Delhi private school, 29% were overweight [6]. A similar study [7] which was done in south India showed the prevalence of obesity to be 3.1% and that of overweight to be 16.8%. A study on 707 children in the age group of 10–15 years at Chennai revealed that 10% of the subjects were overweight and that 6% of them were obese [17].Studies from the rural areas mainly emphasized on undernutrition, and data on overweight/obesity was not available. However, Deshmukh et al [8] reported the prevalence of obesity to be 2.2 per cent in the rural Wardha district by using the same definition. In our study, the prevalence which was reported was more than double of that which was reported in Deshmukh's study. Bharati et al [9] reported that the prevalence of overweight/obesity in Wardha city was 4.3%. A very low prevalence of overweight (4.17%) and obesity (0.73%) was reported from Lucknow city [17].

The reason for the higher prevalence of overweight (26%) and obesity (7.4%) among the adolescent populations which were studied in Delhi and Ludhiana may be that the subjects who were selected for these studies were affluent.

In the present study, the important determinants of overweight and obesity were, age more than 10 years, upper socio-economic status, watching TV for more than 1 hour per day, the use of an automobile as a means of transport to reach school, and sleeping for > 7 hours/day. A similar finding was observed in other studies also [10,18,19,20]. In addition, the prevalence of overweight/obesity was high among children who were involved in sedentary activities such as spending ≥ 1 hour in viewing television. Our observations were consistent with the observations of other studies [21, 22]. Klesges et al [21] also reported the effect of watching television on the metabolic rate and overweight and obesity in children. In urban areas, considering the necessity of keeping children away from heavy traffic, they are not allowed to ride bicycles and are only allowed to play indoor games or watch television. Therefore, they are not encouraged to participate in outdoor sports and games. A clear socio-economic gradient in the prevalence of overweight and obesity was observed in our study, which was consistent with the findings of other studies [10]. This could be because of several reasons which were related to obesity, which were encountered largely in children with a higher socio-economic status. These studies had reported that a rise in sedentary behaviour such as the increased use of vehicular transport and decreased physical activity had led to an increase in the prevalence of overweight and obesity.

This implies the importance of individual characteristics in the causation or predisposition of an individual to overweight and obesity. Bharati et al [9] and Avula et al [10] reported a similar predisposition in Wardha and Hyderabad. All these factors are related to a sedentary lifestyle. Overweight/obesity has become the classical disease of all the age groups [9]. A significant difference was reported in the factors like a non-vegetarian diet, the consumption of junk food, lack of consumption of milk, consumption of calories in more than the recommended doses and a lack of consumption of fruits regularly. However, factors like swimming, dancing and playing outdoor games were found to be protective for overweight/obesity.

Our results revealed that regular physical activity was important for reducing the prevalence of overweight and obesity. The prevalence was significantly lower in children who participated regularly in swimming, dancing and in outdoor games. Every student should take part in outdoor games and sports, irrespective of his/her gender. Teachers should be motivated to explain the significance of physical activities to the students. All the physical activities in the school need to be supervised and performed in the presence of physical education instructors. Currently, on an average, one session per week may be assigned to the physical training activities, which may be increased to twice later.

CONCLUSION

From the present study, it can be concluded that a significantly high prevalence of overweight/obesity was reported in children of the upper SES and among those who watched TV for ≥ 1 hour, those who used vehicles, those who slept for ≥ 7 hours and those who had dietary habits. Factors like swimming, dancing regularly and playing outdoor games were found to be protective. Therefore, the

roles of physical activity, games and sports should be emphasized. There is an urgent need to educate the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight /obesity.

BIBLIOGRAPHY

[1] Kumar S, Mahabalaraju DK, Anuroopa MS. The prevalence of obesity and its influencing factor among affluent school children of Davangere city. *Indian J Community Med*. 2007; 32(1):15-17.

[2] Al-Nuaim AR, Bamgboye E.A, al-Herbish A. The pattern of growth and obesity in Saudi Arabian male school children. *International Journal of Obesity and Related Metabolic Disorders* 1996; 20:1000-05.

[3] Khadilkar VV, Khadilkar VA. The prevalence of overweight/obesity in different school boys in Pune. *Indian Pediatr* 2004; 41:857-58.

[4] Mohan B, Kumar N, Aslam N, Rangbulla A, Kumbkarni S, Sood NK, et al. The prevalence of sustained hypertension and obesity in urban and rural school going children in Ludhiana. *Indian Heart J*., 2004; 56: 310–14.

[5] Chhatwal J, Verma M, Riar SK. Obesity among the pre-adolescents and adolescents of a developing country (India). *Asia Pac.J. Clin. Nutr*., 2004; 13: 231–35.

[6] Chatterjee P., India sees a parallel rise in malnutrition and obesity. *Lancet* 2002; 360: 1948.

[7] Ramachandran A, Snehlata C, Vinitha R, Thayyil M. The prevalence of overweight in urban Indian adolescent school children. *Diabetes Res. Clin. Practice* 2002; 57: 185–190.

[8] Deshmukh PR, Gupta SS, Bharambe MS, Dongre AR, Maliye C, Kaur S, *et al*. Nutritional status of adolescents in rural Wardha. *Indian J Pediatr* 2006;73:15-7.

[9] Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight and obesity among school going children of Wardha city, Central India. *Indian J Med Res* 2008;127:539-43.

[10] Laxmaiah A, Nagalla B, Vijayragawan K, Nair M. Factors affecting the prevalence of overweight among 12-17 year old urban adolescents in Hyderabad, India. *Obesity* 2007; 15:1384-90.

[11] Popkin BM, Doak CM. The obesity epidemic is a worldwide phenomenon. *Nutr Rev.* 1998;56:106–14.

[12] Styne DM. Childhood obesity and adolescent obesity: PCNA 2001; 48: 823-47.

[13] Gidding SS, Bao W, Srinivasan SR, Berenson GS. Effects of secular trends in obesity on the coronary risk factors in children: The Bogalusa Heart Study. *J Pediatr.* 1995;127:868–74.

[14] Jalaja Kumari D, Sri Hari Krishna B. Prevalence and risk factors for adolescents (13–17 years): overweight and obesity. *Current Science* 2011; 100(3):372-76

[15] Integrated Disease Surveillance Project (IDSP) NCD Risk Factor Surveillance. Training Manual for Field Workers and Field Supervisors which was developed under the GOI-WHO Collaborative Programme, New Delhi: GOI, 2004-05.

[16] The new BMI criteria for Asians from the regional office for the western pacific region of the WHO Overview of the CDC growth charts. Available from URL: http://www.cdc.gov/nccdphp/dnpa/growthcharts/ training/modules/module2/text/page1a.htm.

[17] Vora R, Bharadwaj P, Shrivastava JP, Vora A. Overweight and obesity among school-going children in Lucknow city. *Indian J Community Med.* 2011; 18(2):59-62.

[18] Mahajan PB, Purty AJ, Singh Z, Cherian J, Natesan M, Arepally S, et al. Study of childhood obesity among school children who were aged 6 to 12 years in the union territory of Puducherry. *Indian J Community Med*. 2011 Jan-Mar; 36(1): 45–50.

[19] Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: Time trends and its relationship with hypertension. *Natl Med J India*. 2007;20:288–93.

[20] Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting the prevalence of overweight among 12- to 17-year-old urban adolescents in Hyderabad, India. *Obesity*. 2007;15:1384–90.

[21] Kashmini K. Prevalence of overweight and obesity among school children who were aged between 7-16 years amongst the 3 major ethnic groups in Kuala Lumpur, Malaysia. *Ashia Pacif J Clin Nutr* 1997; 6:172-74.

[22] Klesges RC, Shelton ML. Effect of television on the metabolic rate: Potential implication for childhood obesity. *Pediatrics* 1993; 91: 281-86.

AUTHOR(S):
1. Dr. Subhash B. Thakre
2. Dr. Sheetal P.Mohane
3. Dr. Suresh M.Ughade
4. Dr. Sushama S. Thakre
5. Dr.Suresh S. Morey
6. Dr. Arun Y. Humane

PARTICULARS OF CONTRIBUTORS:
1. Associate professor, Preventive and Social Medicine, Government Medical College, Nagpur, India.
2. Tutor, Preventive and Social Medicine, Government Medical College, Nagpur, India.
3. Lecturer, Preventive and Social Medicine, Government Medical College, Nagpur, India.
4. Associate professor, Preventive and Social Medicine, Indira Gandhi Government Medical College, Nagpur, India.
5. Lecturer, Department of Preventive and Social Medicine, Government Medical College, Nagpur, India.
6. Professor and Head Department of Preventive and Social Medicine, Indira Gandhi Government Medical College, Nagpur, India.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Subhash B. Thakre
Plot. No.9,Swami Swarupanand Society,
Narendra Nagar, Ngpur-15, India.
Phone: 9822366532
E-mail : drsubhasht@rediffmail.com;
sushamathakre@rediffmail.com

DECLARATION ON COMPETING INTERESTS:
No competing Interests.