Prevalence of Overweight and Obesity in Adolescents of Urban & Rural Area of Surat, Gujarat

Divyesh Vadasmiya, Hitesh Patel

Abstract: *Background: The present study in prevalence of overweight and obesity among urban & rural adolescents in Surat. Objectives: To estimate the prevalence of overweight &obesity among urban & rural adolescents in Surat population and to study the socio-demographic factors associated with obesity. Materials and methods: The data were derived from cross-sectional sampling of children, 176 in rural and 213 in urban, aged 14–16 years doing study in government schools in year of 2009. Age, gender and body mass index (BMI) were used to define overweight and obesity. Results: The prevalence of obesity increased significantly from 12.8% in rural to 14.6% in urban (p<0.01), whereas underweight decreased from 13.6% to 4.6% (p<0.001). There was a significantly higher risk of being overweight and obese in urban than rural, after adjusting for age, gender. Urban Males had significantly higher increase in prevalence and risk of being overweight and obese. Conclusion: This study showed an increasing in prevalence of overweight and obesity in urban adolescents especially with male gender, calling for an urgent need for immediate and targeted preventive measures.*

Keywords: Adolescent, Body Mass Index (BMI), Overweight, Obesity

1. Introduction

The epidemic of childhood obesity is a substantial health burden worldwide[1, 2, 3]and its impact is being observed in developing countries as well[4, 5]. However, the problem is of a larger magnitude in developing countries like India where a significant proportion of the population belongs to younger age group[6].Risingprevalence of obesity in India may be attributed to various factors, like sedentary life-style, healthy food habits, cultural practices and increasing affluence of middle class population[7, 8, 9, 10]. Further, obesity is associated with multiple co-morbidities such as type 2diabetes mellitus, dyslipidemia, polycystic ovarian disease, hypertension, and the metabolic syndrome, which are increasingly becoming common among children and urban adolescents[8, 9, 10.]

However, limited literature is available on prevalence of [8, 9, 10]Adolescent obesity in India. While under-nutrition in children has been the major public health concern in India over the past several decades[11], little attention has been paid to childhood overweight and obesity until recently. The emerging evidence suggests an increase in over-nutrition status among children as well asadults[4, 12]. The National Family Health Survey (NFHS-3) 2005–RURAL data showed that combined prevalence of obesity was 9.3% and 12.6% among men and women aged 15–49 years, respectively[13]. The aim of our study was to determine health status of urban &rural adolescents (14–16 years age) in Surat population.

2. Material And Methods

Anthropometric measurements were undertaken in 176 in rural and 213 in urban adolescent children (aged 14–16 years) from government schools of Surat District & Surat City, respectively. A list containing the names of all senior secondary government schools located in Surat District & Surat City was prepared. Two government secondary schools from rural area of Surat District & Two government secondary schools from urban area of surat city were randomly selected and enrolled for the study. Each standard is further divided into sections depending on the number of students.

Two to three sections were randomly selected in all standards on the basis of number of students. Our team of researchers visited each school during an allocated time in the morning for measurement of anthropometric indices. Body weight (kg) and body height (m) were measured with subjects wearing light clothing without shoes and the body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters. All data were collected during the period between February 2009 and May2009.Generally, age 14 and 16 correspond to Standard IX and XII, respectively in the Indian Education system. All participants gave informed consent with parents' written consent. Prior approval from Principal, government authority had been concluded. Only children without history of any active disease or significant past medical history were included in the study.

Definition of overweight and obesity
Three criteria were used for the definitions of overweight and obesity: 1. An international BMI-for-age reference curve for defining overweight and obesity in children 2 to 18years of age by the US National Center for Health Statistics, Centers for Disease Control and Prevention(CDC) and the International Obesity Task Force(IOTF) in 2000 (IOTF criteria)[14].

These criteria were based on median BMI [BMI, the 14weight in kilograms divided by the square of the height in meters] by age and gender in six nationally representative datasets from Brazil, HongKong, Netherlands, Singapore, the UK and the US from an international growth survey in 2000. These surveys had over 10, 000 subjects each and together covered 97, 876boys and 94, 841 girls. Overweight and obesity we redefined as BMI-for- age ≥ 25 and ≥ 30 kg/m^2 respectively. 2. A Chinese national BMI reference curve for Chinese children and adolescents reported by the Group of China Obesity Task Force (COTF) in 2004 (COTF criteria)[15] - These criteria were based on the Chinese National Survey on Students Constitution and Health in

2000 involving 244, 200 primary and secondary Chinese students aged 7–18 years. Overweight and obesity were defined as BMI for- age ≥ 24 and$\geq 28 kg/m^2$ respectively. 3. CDC 2000 Growth Charts for the United States(CDC criteria)[16] -These criteria were based on the US National data collected in a series of 5 surveys between 1963 and 1994 for children and adolescents aged 2–20 years. Overweight and obesity were defined as BMI-for-age ≥ 85 and ≥ 95 percentiles respectively. We have follow IOTF criteria for our research.

3. Statistical Analysis

All data are expressed as mean $\pm$ SD or n (%) where appropriate. Chi-square tests and Student's t test were used for group comparisons. All comparisons were made two-sided and a *p*-value < 0.05 (2-tailed) was considered as significant. Study population consisted of 176 in rural and 213 in urban 14–16 year old children from government funded schools of Surat, India. Gender distribution did not show any significant difference (males: 57.2% inrural & 56.6% in urban; p= 0.441). Mean age of study populations was 15.1 $\pm$1.2 years in rural and 15.4$\pm$ 1.1 years in urban (p<0.001). The overall mean BMI increased significantly from 20.5 $\pm$3.9 kg/m^{2}to 21.9 $\pm$ 3.6 kg/m$^{\pm}$ (Table 01).

Table 1: Comparison of BMI (Kg/m) Status

Category	Rural (mean ±SD)	Urban (mean ±SD)
BMI of Males	19.3±3.6	21.2±3.2
BMI of Females	21.1±4.1	22.4±4.5
BMI of Government funded school	20.5±3.9	21.9±3.6

Prevalence of overweight increased non-significantly from 25.8% in rural to 26.3% in urban (p= 0.459) while obesity prevalence increased non-significantly from 12.8% in rural to 14.6% in urban (p =0.612) (Table 02)

Table 2: Comparison of Adolescent Status

	Rural	Urban	P value
Underweight	13.6	4.6	<0.001
Overweight	25.8	26.3	0.469
Obesity	12.8	14.6	0.612

Males showed a significant increase in prevalence of both overweight (25.6% to 27.4%; p=0.046) and obesity (11.2% to 14.3%; p=0.008) (Table 3 & 4).

Table 3: Overweight Adolescent

Category	Rural	Urban	P value
Males	25.6	27.4	0.046
Females	26.2	24.9	0.316
Government funded school	25.8	26.3	0.469

In females, the prevalence of overweight decreased (26.2% to 24.9%; p=0.316) and though the prevalence of obesity in females was higher than males, there was only a small non-significant increase in its prevalence (14.1% to 15.0%; p=0. 752) (Table 3 & 4).

Table 4: Obese Adolescent

Category	Rural	Urban	P value
Males	11.2	14.3	0.008
Females	14.1	15	0.752
Government funded school	12.8	14.6	0.612

Male gender was associated with a higher risk of being overweight and obese than females in URBAN than Rural, after adjusting for age.

4. Discussion

Our study was limited by the volunteer nature of the respondents. Nevertheless, the response rate was approximately 50% which is comparable with most volunteer Surveys. However, the relatively small sample size of individual age group in our survey may introduce potential bias. Obesity is associated with significant morbidity and mortality[17]. There is now growing concerns on the increasing prevalence in childhood obesity and most obese children will grow up to become obese adults and most obesity related health problems are also applicable to children[18, 19]

This is the study on in the prevalence of childhood obesity in the Indian subcontinent. Our study demonstrated an increase in prevalence of both overweight and obesity and a decrease in prevalence of underweight in urban adolescents aged 14–16 years than rural school. Further, we report that this increase was significantly higher in males and children from affluent urban families. Emerging problem of childhood obesity is of high importance in developing countries like India. India is going through concurrent transitions related to epidemiological, demographic and nutritional factors. Further, India is currently in the fourth phase of nutritional transition which is the shift of nutritional intake from basic to diet related non-communicable diseases. These shifts are largely associated with behavioral changes in dietary profile and lifestyle and decreased indulgence in physical activity[20.]

The transitions are more rapid in young individuals. This increasing trend of childhood overweight and obesity may further increase the enormous burden of type 2 diabetes and cardiovascular diseases in India [21, 22]and impact the economy of the nation and its growth. Published literature on the prevalence of childhood obesity in India consists mainly of cross-sectional studies in different regions of the country, reporting its burden at a specified time. Studies from South India have reported an obesity prevalence of 3.6% in adolescents of age-group 13–18 years of Chennai in year 2002[23] and 3.4% in children and adolescents of age-group 5–16 years of Mysore in year 2009[24]

Several cross-sectional studies have been published from North India reporting the childhood obesity prevalence in the range of 3.6–7.0%[25, 26]. However, only one study, from Kerala (South India), has reported secular trend in the prevalence of childhood obesity. These authors reported a significant increase in the prevalence of overweight and obesity from 4.94% and1.26% in 2003 to 6.57% and 1.89% in 2005, respectively, in children aged 5–16 years.

Another significant observation of this study was the independent association of urban male gender and high socio-economic status with the risk of being overweight and obese in childhood. Both these groups showed a significantly increased prevalence and higher risk of being overweight and obesity. Hormonal, cultural and social factors may account for the observed gender differences[28],

especially in Indian context. Also, it has been seen that post-pubertal girls are more conscious towards their physical appearance and consequently may take active steps to control obesity as compared to boys.[29]

Socioeconomic status is another factor which has been linked to problem of overweight and obesity in many other studies[30, 31]. The assumption that type of school attended reflects the socio-economic status has been used and validated previously [32, 33]There may be several explanations for this observation. Being financially sound may allow the children to indulge in practice of purchasing calorie dense fast foods and a lifestyle involving less of physical activity and more in-door activities like playing games on computer, watching television, etc. Also, the cultural beliefs in this region of the world like being overweight being considered as a marker of prosperity and good health may play a major role. We also calculated in the prevalence of underweight in studied population. Historically, under-nutrition and underweight were considered to be mainly associated with childhood morbidity and mortality in India.

Our study has a few limitations. Firstly, the possibility of potential selection bias cannot be ruled out in across-sectional study spread across time and region.

However, we tried to minimize the sampling bias. We selected all students from randomly selected sections of a standard, with a 100% response rate from each section. Another limitation was that only BMI was used to determine overweight and obesity prevalence. Though recent studies have raised concerns unreliability of BMI as a measure of obesity in view of newer indices[34, 35], BMI still remains the most widely used measure in large population-based studies [36, 37, 38, 39]owing to its inherent simplicity to use, availability of population specific cutoffs and time tested reliability. Also, BMI has been shown to be comparable with other measures of obesity in risk assessment [41]. Other sophisticated measures of obesity like percentage body fat could further add insights into these trends.

However, using these measures require expensive instruments and necessary training to the field workers for their correct use[42] This limits their use in large scale studies, particularly in settings of developing countries like India, where financial and human resources are a significant limitation in clinical research. Abdominal obesity measures like waist circumference and waist-to-hip ratio, are simpler to employ and have been shown as an important and reliable index of obesity in variouspopulations[43] including one study on Asian Indians

In spite of these limitations in mind, our study had several strengths**.** We included one of largest samples in urban Asian Indian adolescents with good representation from different group including age, gender. Second, Urban children were included in study, with also representation from rural areas, which constitute quite a significant proportion of Indian population. In addition, we included age, gender and ethnicity specific BMI cut-offs to define childhood overweight and obesity, which may provide a more accurate estimate of their prevalence than previous studies.

5. Conclusions

In conclusion, we report that the prevalence of obesity has increased in urban adolescents aged 14–17 years in India. In addition, male gender and higher socioeconomic status is associated with a significant risk of being both overweight and obese. Large scale nationwide campaigns targeted at these specific groups are required to check the growing epidemic of childhood obesity in developing countries. Country wide awareness programs to spread healthy messages on good nutrition and good health for the prevention of obesity and its consequences need to be initiated. These shall not only promote good health, but shall also help in the prevention of non-communicable diseases as diabetes, heart problems, and other related diseases. On the long run, such programs shall act to reduce the burden on economic growth of the nation.

6. Acknowledgments

References

[1] WHO (2000) Obesity: preventing and managing the globalepidemic. Report of A WHO consultation. World Health OrganTech Rep Ser 894: i–xii, 1–253.
[2] Ford ES, Mokdad AH et al (2008). Epidemiology of obesity in the Western Hemisphere. J Clinndocrinol Metab 93: S1–8.
[3] Popkin BM, Doak CM et al(1998).The Obesity Epidemic Is a Worldwide Phenomenon. Nutr Rev 56: 106–114.
[4] Bhardwaj S, Misra A, Khurana L, Gulati S, Shah P, et al (2008).Childhood obesity in Asian Indians: a burgeoning cause of insulin resistance, diabetes and sub-clinical 1inflammation. Asia Pac J ClinNutr 17 Suppl 1: 172–175.
[5] Kelishadi R et al (2007). Childhood overweight, obesity, and the metabolic syndrome in developing countries. Epidemiol Rev 29: 62–76.
[6] Adlakha A et al (1996). Population Trends: India. International Brief U.S. Department of Commerce Economics and Statistics Administration, Bureau of Census. Available: http://www.census.gov/ipc/prod/ib-9701.pdf. Accessed 2011 Jan03.
[7] Goel K, Misra A, Vikram NK, Poddar P, Gupta N et al (2010).Subcutaneous abdominal adipose tissue is associated with themetabolic syndrome in Asian Indians independent of intra-abdominal and total body fat. Heart 96: 579–583.
[8] Misra A, Khurana L, Vikram NK, Goel A, Wasir JS et al (2007). Metabolic syndrome in children: current issues and South Asian perspective. Nutrition 23: 895–910.
[9] Misra A, Vikram NK et al (2004). Insulin resistance syndrome (metabolic syndrome) and obesity in Asian Indians: evidence and implications. Nutrition 20: 482–491.

[10] Hill JO, Peters JC et al (1998). Environmental contributions tothe obesity epidemic. Science 280: 1371–1374.

[11] Subramanyam MA, Kawachi I, Berkman LF, Subramanian SV etal (2010). Socioeconomic Inequalities in Childhood Undernutrition inIndia: Analyzing Trends between 1992 and 2005. PLoS ONE 5:e11392.

[12] Singhal N, Misra A, Shah P, Rastogi K, Vikram NK et al (2010).Secular trends in obesity, regional adiposity and metabolic parameters among Asian Indian adolescents in north India: a comparative data analysis of two selective samples 5 years apart (2003, 2008). Ann NutrMetab 56: 176–181.

[13] NFHS (2005) Key Findings Report, National Family Health Survey (NFHS-3). Ministry of Health and Family Welfare, Government of India. Available: http://www.nfhsindia.org/nfhs3.html. Accessed 2011 Jan 03.

[14] Cole TJ, Bellizzi MC, Flegal KM, Dietz WH et al: Establishing a standard definition for child overweight and obesity worldwide: international survey. Br Med J 2000, 320:1240-1243.

[15] Group of China Obesity Task Force: Body mass index reference norm for screening overweight and obesity in Chinese children and adolescents. Chin J Epidemiol 2004, 25:97-102.

[16] Ogden CL, Kuczmarski RJ, Flegal KM, Mei Z, Guo S, Wei R, Grummer-Strawn LM, Curtin LR, Roche AF, Johnson CL et al:Centers for Disease Control and Prevention 2000 growth charts forthe United States: improvements to the 1977 National Center for Health Statistics version. Pediatrics 2002, 109:45-60.

[17] Bray GA: Medical consequences of obesity. J ClinEndocrinolMetab 2004, 89:2583-2589.

[18] Swallen KC, Reither EN, Haas SA, Meier AM et al: Overweight, obesity, and health-related quality of life among adolescents: theNational Longitudinal Study of Adolescent Health. Pediatrics 2005, 115:340-347.

[19] Karnehed N, Rasmussen F, KarkMet al: Obesity in youngadulthood and later disability pension: a population-based cohortstudy of 366, 929 Swedish men. Scand J Public Health 2007, 35:48-54.

[20] Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, et al. (2005) Comparison of overweight and obesity prevalence inschool-aged youth from 34 countries and their relationships withphysical activity and dietary patterns. Obes Rev 6: 123–132.

[21] Wang Y, Chen HJ, Shaikh S, Mathur P et al (2009). Is obesitybecoming a public health problem in India? Examine the shift fromunder- to overnutrition problems over time. Obes Rev 10: 456–474.

[22] Wasir JS, MisraA et al (2004). The Metabolic Syndrome in AsianIndians: Impact of Nutritional and Socio-economic Transition inIndia. MetabSyndrRelatDisord 2: 14–23.

[23] Ramachandran A, Snehalatha C, Vinitha R, Thayyil M, KumarCK, et al. (2002) Prevalence of overweight in urban Indian adolescentschool children. Diabetes Res ClinPract 57: 185–190.

[24] Premanath M, Basavanagowdappa H, Shekar MA, Vikram SB, Narayanappa D et al(2010). Mysore childhood obesity study. IndianPediatr 47: 171–173.

[25] Gupta AK, Ahmad AJ et al(1990). Childhood obesity andhypertension. Indian Pediatr 27: 333–337.

[26] Mohan B, Kumar N, Aslam N, Rangbulla A, Kumbkarni S, et al.(2004) Prevalence of sustained hypertension and obesity in urban andrural school going children in Ludhiana. Indian Heart J 56: 310–314.

[27] Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK et al (2007).Obesity in Indian children: time trends and relationship withhypertension. Natl Med J India 20: 288–293.

[28] Blum WF, Englaro P, Hanitsch S, Juul A, Hertel NT, et al. (1997)Plasma Leptin Levels in Healthy Children and Adolescents:Dependence on Body Mass Index, Body Fat Mass, Gender, PubertalStage, and Testosterone. J ClinEndocrinolMetab 82: 2904–2910.

[29] Rasheed P et al (1998). Perception of body weight and selfreportedeatingandexercise behavior amongobese and non-obesewomenin SaudiArabia. PublicHealth112:409–414.

[30] Kaur S, Sachdev HP, Dwivedi SN, Lakshmy R, Kapil U etal(2008). Prevalence of overweight and obesity amongst schoolchildren in Delhi, India. Asia Pac J ClinNutr 17: 592–596.

[31] Gupta R, Goyle A, Kashyap S, Agarwal M, Consul R, et al. (1998)Prevalence of atherosclerosis risk factors in adolescent schoolchildren. Indian Heart J 50: 511–515.

[32] Mukherjee D et al (1999). Socio-economic Status and SchoolSystem Enrolments.Available:http://www.aeufederal.org.au/Publications/DMukherjeepaper.pdf.Accessed 2011 Jan 03.

[33] Pohlmann VC et al (1956).Relationship between Ability, SocioEconomicStatus andChoice of SecondarySchool.J EducSociol29:392–297.

[34] Romero-Corral A, Somers VK, Sierra-Johnson J, Thomas RJ, Collazo-Clavell ML, et al. (2008) Accuracy of body mass index indiagnosing obesity in the adult general population. Int J Obes 32:959–966.

[35] Okorodudu DO, Jumean MF, Montori VM, Romero-Corral A, Somers VK, et al. (2010) Diagnostic performance of body mass index to identify obesity as defined by body adiposity: a systematic review and meta-analysis. Int J Obes 34: 791–799.

[36] Flegal KM, Carroll MD, Ogden CL, Johnson CL et al (2002)Prevalence and trends in obesity among US adults, 1999-2000. JAMA288: 1723–1727.

[37] Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, etal. (2004) Prevalence of Overweight and Obesity Among USChildren, Adolescents, and Adults, 1999-2002. JAMA 291: 2847–2850.

[38] Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, etal. (2006) Prevalence of overweight and obesity in the United States, 1999-2004. JAMA 295: 1549–1555.

[39] Troiano RP, Flegal KM et al (1998).Overweight children andadolescents: description, epidemiology, and demographics. Pediatrics101: 497–504.

[40] Flegal KM, Carroll MD, Kuczmarski RJ, Johnson CL et al (1998)Overweight and obesity in the United States: prevalence and trends, 1960-1994. Int J ObesRelatMetabDisord 22: 39–47.

[41] Adams KF, Schatzkin A, Harris TB, Kipnis V, Mouw T, et al.(2006) Overweight, obesity, and mortality in a

large prospective cohort of persons 50 to 71 years old. N Engl J Med 355: 763–778.

[42] Flegal KM, Graubard BI, Williamson DF, Gail MH et al (2005).Excess deaths associated with underweight, overweight, and obesity. JAMA 293: 1861–1867.

[43] Neovius M, Linne Y, Rossner S et al (2004). BMI, waist circumference and waist-hip ratio as diagnostic tests for fatnessin adolescents. Int J Obes Relat Metab Disord 29: 163–169.