



Original Research Article

A CROSS-SECTIONAL STUDY TO ASSESS PREVALENCE AND ASSOCIATED RISK FACTORS OF OBESITY AMONG SCHOOL GOING ADOLESCENTS OF AHMEDABAD CITY

Hely Patel¹, Disha Geriya¹, Dhruv H. Patel¹, Himanshu Nagar²

¹Assistant Professor, Department of Community Medicine, Dr. M.K. Shah Medical College & Research Center, Ahmedabad, Gujarat, India

²Statistician-Tutor, Department of Community Medicine, Dr. M.K. Shah Medical College & Research Center, Ahmedabad, Gujarat, India

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Corresponding Author:

Dr. Dhruv H. Patel,

Assistant Professor, Department of Community Medicine, Dr. M.K. Shah Medical College & Research Center, Ahmedabad, Gujarat, India.
Email: dhruvdp7596007@gmail.com

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ABSTRACT

Background: The World Health Organization (WHO) describes Obesity as one of today's most important 'Public Health Problems'. Rapidly changing dietary practices and a sedentary life-style have led to the increasing prevalence of childhood obesity (5-19 year) in developing countries recently. The present study conducted to assess prevalence and associated risk factors of obesity among school going adolescents of Ahmedabad city.

Materials and Methods: Cross sectional study was conducted in school going adolescents of Ahmedabad city. Total 1035 study participant was taken based on 10% prevalence of adolescent obesity from previous study. Out of 527 schools, fifteen schools were randomly selected based on probability proportion size (PPS) to school going adolescent's representing all 7 zones of Ahmedabad city. Thus 70 students from each school were included in present study to complete total sample size of 1035. Prior permission was taken from the District Education Officer and principal of the school. The data was entered into Ms excel. Appropriate statistical test to look for any association between various parameters were applied.

Results: The prevalence of overweight was 5.31% and obesity was 8.99% according to Indian classification of BMI. The Prevalence of overweight was 7.34% and obesity was 1.45% according to global classification of BMI. There were a statistically significant difference between obesity and factor affecting that like adolescents living at hostel, Muslim religious, having family history of obesity, vegetarian in diet, using vehicle to reach school to home and home to school.

Conclusion: The results of this study expose the percentage of obesity and overweight in Ahmedabad city. The increasing trend of obesity in adolescents indicates urgent need for targeted preventive measures.

Keywords: Adolescents, Obesity, Prevalence.

INTRODUCTION

Non-Communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviors factors. Children, adults and the elderly are all vulnerable to the risk factors contributing to NCDs, whether from unhealthy diets, physical inactivity, and exposure to tobacco smoke or the harmful use of alcohol.^[1] In India, there is a rising burden of NCDs accounting for

over 42 % of all deaths.^[2] Adolescence (10-19 years) is a period of transition from childhood to adulthood, it assumes critical position in the life cycle of human beings characterized by an exceptionally rapid rate of growth.^[3] WHO has designated Obesity as a 'Global Epidemic' and also one of today's most neglected Public Health Problems,^[4] A consistent increase in the prevalence of childhood obesity has been observed since 1971 in developed countries, however, its prevalence is increasing in developing countries as well.^[5] Obesity can be seen as the first

wave of a defined cluster of noncommunicable diseases called "New World Syndrome," creating an enormous socioeconomic and public health burden in poorer countries.^[4] It is caused by imbalance between calorie intake and calories utilized. Physical, psychological, and social health problems are caused due to childhood obesity.^[5,6] Body mass index (BMI) is a simple index used to classify overweight and obesity. An important step to prevent and control adolescent obesity is identification of risk factors contributing to rapid increase of adolescent obesity. Relevant research in particular field in India is minimal.^[7] Therefore, this study was carried out to determine the prevalence and determinants of overweight and obesity among adolescents in Ahmedabad.

Objectives:

1. To study the prevalence of obesity in adolescents in study area.
2. To study the risk factors associated with obesity in adolescents.
3. To study the association of socio demographic profile of adolescents with prevalence of obesity.

MATERIALS AND METHODS

A cross-sectional study was conducted among 1035 school going adolescents of Ahmedabad city. Total 1035 study participants were taken based on 10% prevalence of adolescent obesity from previous study.^[4] According to list given by DEO office, there were total 527 schools in Ahmedabad city at the time of study period. Out of 527 schools, fifteen schools were randomly selected based on probability proportion size (PPS) to school going adolescent's representing all 7 zones of Ahmedabad city. Thus 70 students from each school were included in present study to complete total sample size of 1035. Adolescents 11-19 years from schools located in the study area and who gave informed consent were included. Students who were absent on the day of school visit and participants were not fitting into the age group criteria were excluded.

Data Collection: A self-administered, semi-structured and pre-tested Questionnaire was used to collect data. Prior permission was taken from the principal of the school. At first the students were explained about the purpose of the study and after obtaining informed consent the questionnaire was given to them. Questionnaires include Socio-economic status, Diet, Family history of Obesity. After distributing Questionnaires, each question was explained to them in detail first and then they were asked to fill it. Anthropometric data like, Height was measured with Stadiometer (in centimeters) and weight was measured with digital weighing scale (in kg). Zero was ascertained before the study participant stepped on the scale. Body Weight and Body Height was measured with subjects wearing light clothing without shoes and Body mass index (BMI) calculate as weight in kilogram divided by the square of the

height in meters. Information about adolescents was kept confidential and privacy maintained.

Data Entry and Analysis: The data was entered into a computer from performa using Microsoft Office Excel. The data analysis was done using Jamovi software. Appropriate statistical tests to look for any association between various parameters were applied. The study protocol was reviewed and approved by the Institutional Ethical Committee.

RESULTS

A total of 1035 respondents were there in the present study which included 553 boys and 482 girls. In study majority 97.20% of study participant came to school from home compared to hostel and 94.88% study participant belonged from Hindu religion. In context to literacy status of parents, literacy rate among mothers were 78.74% and in fathers were 93.23%. Further among literate mothers, 39.61% had primary education that was majority than others. With regards to socio-economic status, 32.92% of adolescents belonged to class IV according to modified B.G. Prasad's classification followed by 28.91%, 19.75%, 10.04% and 8.37% from class III, class II, class V, and class I respectively. 23.57 % participants gave history of obesity in family.

In present study, the prevalence of overweight was 5.31% and obesity was 8.99% according to Indian classification of BMI (Table 1). The Prevalence of overweight was 7.34% and obesity was 1.45% according to global classification of BMI. According to the WHO cut offs, 29.29% adolescent boys had Waist Hip Ratio more than 0.90 and 18.46% girls had Waist Hip Ratio more than 0.85. Overweight and obesity was 5.79% and 7.41% for boys same as for girls 4.77% and 10.79% respectively. Majority numbers of participants 48.02% were engaged in walking, followed by cycling 25.80%. Activities in which least participants were engaged were swimming 1.16%. Out of all 19.81% were not engaged in any physical activities.

Maximum prevalence of obesity was in adolescents living at hostel and belonged to Muslim religion. Association between Residential status and religious to BMI was found statistically significant. ($p < 0.05$) Obesity was more in higher socio-economic class compared to lower class and had family history of obesity. The difference between the family history of obesity and BMI was highly statistically significant. ($p < 0.05$).

Among study population Prevalence of obesity was more in vegetarian. In present study it was observed that participants who were involved in yoga had minimum prevalence of obesity (6.41%) than not involved in yoga (10.36%). But the difference between BMI status and yoga was not statistically significant. In this study, Moreobesity was found in participants who not done any physical activity and who spent <60 minutes time in physical activity per day but not statistically significant with obesity. Low

prevalence (2.04%) was found in participants who not use of screen (mobile, phone, T.V) than using screen time. The type of transportation used to reach school from home was categorized into manual and automated. Manual includes walking and using cycle and automated includes two wheelers, auto rickshaw, bus and van. More prevalence of obesity (11.6%) was found in participants using automated type of transport to reach school from home and to home from school than manual type of transport. Statistically significant difference was obtained between BMI status in respect to transportation used to reach school. Out of 1035 study participant, 58(10.84%) subjects having <7 hours sleep duration at night were obese while 29(7.36%) subjects having

7-9 hours' sleep duration at night. The difference between BMI status in relation of sleep hours during night was not statistically significant.

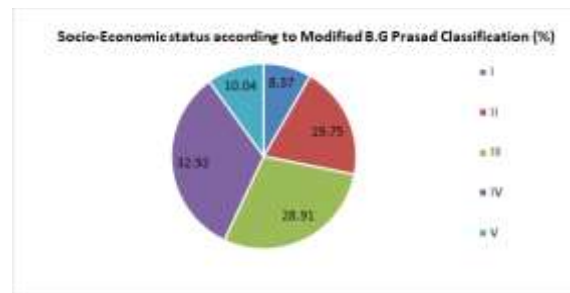


Figure 1: Distribution of study participants according to Socio-Economic status.

Table 1: Distribution of participants according to their BMI status

| Classification of BMI | Indian | | Global | |
|-----------------------|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Under weight | 567 | 54.78 | 567 | 54.78 |
| Normal | 320 | 30.92 | 377 | 36.43 |
| Overweight | 55 | 5.31 | 76 | 7.34 |
| Obese | 93 | 8.99 | 15 | 1.45 |

Table 2: Descriptive statistics of various physical activities in the study population

| Type of Physical activity | Frequency | % |
|---------------------------|-----------|-------|
| Walking | 497 | 48.02 |
| Running | 125 | 12.08 |
| Cycle | 267 | 25.80 |
| Swimming | 12 | 1.16 |
| Dance | 43 | 4.15 |
| Outdoor games | 100 | 9.66 |
| Not do Anything | 205 | 19.81 |

*One participant may be engaged in one or more activities.

Table 3: Association between Socio-demographic factors and BMI

| Variables | Underweight (%) | Normal (%) | Overweight (%) | Obese (%) | Total |
|--------------------------------------|-----------------|------------|----------------|-----------|-------|
| Residential status | | | | | |
| Home | 555(55.17) | 314(31.21) | 54(5.37) | 83(8.25) | 1006 |
| Hostel | 12(41.38) | 6(20.69) | 1(3.45) | 10(34.48) | 29 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=23.77$ p value=0.000027 DF=3 | | | | | |
| Religion | | | | | |
| Hindu | 539(54.89) | 308(31.36) | 54(5.5) | 81(8.25) | 982 |
| Muslim & Others | 28(52.83) | 12(22.64) | 1(1.89) | 12(22.64) | 53 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=14.1$ p value=0.0027 DF=3 | | | | | |
| Socio-economic status | | | | | |
| I | 34(45.33) | 30(40) | 3(4) | 8(10.67) | 75 |
| II | 85(48.02) | 55(31.07) | 13(7.35) | 24(13.56) | 177 |
| III | 151(58.3) | 73(28.19) | 13(5.02) | 22(8.49) | 259 |
| IV | 180(61.02) | 81(27.46) | 14(4.74) | 20(6.78) | 295 |
| V | 48(53.33) | 32(35.56) | 3(3.33) | 7(7.78) | 90 |
| don't know | 69(49.64) | 49(35.25) | 9(6.47) | 12(8.63) | 139 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=22.059$ p value=0.10 DF=15 | | | | | |
| Family History of Obesity | | | | | |
| Yes | 105(43.03) | 85(34.84) | 19(7.79) | 35(14.34) | 244 |
| No | 462(58.41) | 235(29.71) | 36(4.55) | 58(7.33) | 791 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=23.5$ p value=0.000031 DF=3 | | | | | |

Table 4: Association between BMI and life style related factors

| Variables | Underweight (%) | Normal (%) | Overweight (%) | Obese (%) | Total |
|-----------------------------------|-----------------|------------|----------------|-----------|-------|
| Type of Diet | | | | | |
| Vegetarian | 228(50.11) | 155(34.07) | 24(5.27) | 48(10.55) | 455 |
| Non vegetarian | 339(58.45) | 165(28.45) | 31(5.34) | 45(7.76) | 580 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=8.051$ p value=0.044 DF=3 | | | | | |

| | | | | | |
|-----------------------------------|------------|------------|----------|-----------|------|
| Yoga practice | | | | | |
| Yes | 202(56.26) | 111(30.92) | 23(6.41) | 23(6.41) | 359 |
| No | 365(53.99) | 209(30.92) | 32(4.73) | 70(10.36) | 676 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=5.524$ p value=0.137 DF=3 | | | | | |
| Physical activity | | | | | |
| Yes | 451(54.34) | 259(31.2) | 47(5.66) | 73(8.8) | 830 |
| No | 116(56.59) | 61(29.76) | 8(3.9) | 20(9.75) | 205 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=1.39$ p value=0.70 DF=3 | | | | | |
| Time for Exercise | | | | | |
| <60 min | 339(54.94) | 188(30.47) | 33(5.35) | 57(9.24) | 617 |
| >60 min | 112(52.58) | 71(33.33) | 14(6.57) | 16(7.51) | 213 |
| Total | 451(54.34) | 259(31.2) | 47(5.66) | 73(8.8) | 830 |
| $\chi^2=1.53$ p value=0.67 DF=3 | | | | | |
| Screen Time | | | | | |
| ≤2 hours | 255(52.25) | 156(31.97) | 27(5.53) | 50(10.25) | 488 |
| >2 hours | 280(56.22) | 150(30.12) | 26(5.22) | 42(8.43) | 498 |
| Don't use | 32(65.31) | 14(28.57) | 2(4.08) | 1(2.04) | 49 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=5.966$ p value=0.42 DF=6 | | | | | |
| Go School by | | | | | |
| Manual | 481(56.32) | 252(29.51) | 49(5.74) | 72(8.43) | 854 |
| Auto vehicle | 86(47.51) | 68(37.57) | 6(3.32) | 21(11.6) | 181 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=8.57$ p value=0.03 DF=3 | | | | | |
| Sleep Hours | | | | | |
| <7 Hours | 281(52.52) | 166(31.03) | 30(5.61) | 58(10.84) | 535 |
| 7-9 Hours | 228(57.87) | 117(29.69) | 20(5.08) | 29(7.36) | 394 |
| >9 Hours | 58(54.72) | 37(34.90) | 5(4.72) | 6(5.66) | 106 |
| Total | 567(54.78) | 320(30.92) | 55(5.31) | 93(8.99) | 1035 |
| $\chi^2=6.55$ p value=0.36 DF=6 | | | | | |

DISCUSSION

The present study was conducted to find out prevalence of obesity and associated risk factors affecting obesity among school going adolescents in Ahmedabad city. A total of 1035 respondents were there in the present study which included 553 boys and 482 girls. A cross sectional study conducted in Ahmedabad city by K. Brahmhatt et al. reported, Out of 900 study population, 439(48.8%) were females and 461(51.2%) were males.^[3] Majority of the subjects in the present study were Hindu i.e. 94.88% while 97.20% of study participant came to school from home. A study conducted by Meharda B et al shows 83.80% were belonged to Hindu religion.^[8] 80.5% of the students lived with their families and 19.5% lived in university dorms in study at Saudi Arabia by Etab S. Alghamdi et al.^[9] Based on distribution of subjects according to educations of parents' literacy rate among mothers were 78.74% and in fathers were 93.23% in our study. A study conducted at Lucknow city revealed that maximum number fathers of participants were literate.^[10] In our study 23.57 % participants have history of obesity in family. In another study carried out at Rajasthan by Meharda B et al in which 25.4% subjects were having family history of obesity.^[8] In present study, the prevalence of overweight was 5.31% and obesity was 8.99% according to Indian classification of BMI. The Prevalence of overweight was 7.34% and obesity was 1.45% according to global classification of BMI. Another study conducted by J Agrawal et al showed that the prevalence of overweight and obesity in

study population was 9.7% and 4.3%, respectively.^[11]

A study conducted in one public school of Delhi catering to the affluent segment of population found the overall prevalence of obesity was 7.4%. The study used international cut off point for BMI for classifying children as obese.^[12]

Association between Residency status and BMI was found statistically significant in our study. Similar to the findings of present study, John M. de Castro et al study results indicated that being at home or away from home has differential effects on BMI groups. Overweight/obese individuals eat more when they are away from home while normal weight individuals eat about the same at home as away.^[13] In our study, Obesity was found more in girls (10.49%) than boys (07.41%). Similar finding by Agarwal KN et al who reported the prevalence of overweight and obesity was higher in females than in males.^[14] The highest prevalence of obesity was found in Muslim. This finding due to Hindu dietary lifestyle, with a primary focus on vegetables rather than on meat, may be one of the contributing factors to this difference. There was statistically significant difference between BMI status and religion of study populations in our study. Similar finding shows in Karnataka by S Gautam et al that Hindu students were less likely to be overweight/obese relative to other religions.^[15-20]

In present study, maximum prevalence of overweight and obesity (13.56%) was found in class II, followed by class I (10.6%), class III (8.49%) and class V has 7.78% prevalence. A clear socioeconomic gradient in the prevalence of overweight and obesity was observed in study conducted by A Laxmaiah et al.

This could be for several reasons that are related to obesity, encountered to a greater extent in higher-income groups.^[21] The difference between family history and obesity was statistically significant in present study. This suggests family or genetic factor influencing childhood obesity. The prevalence of overweight and obesity was found to be significantly high among the students whose family history of overweight and obesity studies conducted at Kerala.^[16]

Among study population Prevalence of obesity was more in vegetarian in diet. Same to our study, Nawab T et al found that the adolescents having a vegetarian diet were more at risk of overweight than those with non-vegetarian diet.^[17] In this study, More prevalence of obesity was found in participants who not done any physical activity and who spent <60 minutes time in physical activity per day. The results clearly revealed that regular physical activity was an important factor in reducing overweight and obesity. Similar finding in Maharashtra reported higher prevalence of overweight/obesity in children playing less than 1 hour a day.^[18] In present study it was observed that a participant who was involved in yoga had minimum prevalence of obesity. Yoga is one of the effective ways to reduce stress which is one of the causes of obesity. Several schools of yoga have come up different modules of yoga practices that have shown a range of positive benefits on BMI in adults and children based on study of Development and Validation of Integrated Yoga Module for Obesity in Adolescents.^[19] Minimum prevalence (2.04%) was found in participants who not use of screen (mobile, phone, T.V) than using screen time in this study. A study conducted by Shete JS et al the risk of overweight was 7.3 times higher among those who reported watching television and playing games on the computer for ≥ 4 hours/day.^[20] Statistically significant difference was obtained between BMI status in respect to transportation used to reach school. Same finding also reported by A Laxmaiah et al that the prevalence of overweight was significantly lower among adolescents who either walked to school or came on bicycle than among the adolescents who used vehicular transport such as motor cycles or cars.^[21] Out of 1035 study participant, 10.84% subjects having <7 hours sleep duration at night were obese. Short sleep duration modulates the hormones such as leptin and ghrelin, the reduced levels of which increase hunger and appetite and its influence can cause weight gain. In another study by B Meharda et al majority of overweight and obese study subjects were those who were sleeping less than 8 hours in a day as compared to those who were sleeping more than and equal to 8 hours in a day.^[8]

CONCLUSION

We report prevalence of obesity has increased in urban adolescents in Ahmedabad. In addition, socio-

economic status, dietary habit, physical inactivity, family history, screen time and sleep duration affect the risk of developing overweight and obesity among school going adolescents.

Recommendations: The risk factors of today are the diseases of tomorrow. Identifying these risk factors in the population occupies a central place in the surveillance system because of the importance of the lag time between exposure and disease. Therefore, public health strategies have to be driven by the motive of identifying risk factors in population. As a part of primordial prevention, parents should promote healthy habits in their children. Awareness about the life style and related problems should be generated among school going adolescents.

REFERENCES

1. Noncommunicable diseases [Internet]. [cited 2020 Aug 10]; Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>
2. Directorate General Of Health Services [Internet]. [cited 2020 Aug 10]; Available from: https://dghs.gov.in/content/1363_3_NationalProgrammePreventionControl.aspx
3. Brahmabhatt KR, Oza UN. Obesity among adolescents of ahmedabad city, gujarat ,india- a community based cross-sectional study. *Int J Biol Med Res* 2012;3(1):1554–7.
4. WHO | Obesity: preventing and managing the global epidemic; Available from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/
5. Livingstone M. Childhood obesity in Europe: a growing concern. *Public Health Nutr* 2001;4(1a):109–16.
6. Karnik S, Kanekar A. Childhood Obesity: A Global Public Health Crisis [Internet]. *Sch. Nutr. Act.* 2015 [cited 2020 Aug 10];3–15. Available from: <http://www.crcnetbase.com/doi/10.1201/b18227-3>
7. Chhatwal J, Verma M, Riar SK. Obesity among pre-adolescent and adolescents of a developing country (India). 2004.
8. Meharda B, Sharma SK, Singhal G, Kumar L. D. Overweight and obesity: a rising problem in India. *Int J Community Med Public Heal* 2017;4(12):4548.
9. Alghamdi ES, Farrash MS, Bakarman MA, Mukhtar AM. Dietary Habits of University Students Living at Home or at University Dorm: A Cross-Sectional Study in Saudi Arabia. *Glob J Health Sci* 2018;10(10):50.
10. Vohra R, Bhardwaj P, Srivastava JP, Srivastava S VA. Overweight and obesity among school-going children of Lucknow city. *J Fam community Med* 2011;18(2):59–62.
11. Agrawal JP, Gupta VK, Jain M, Agrawal S. A study of prevalence of obesity among adolescents (10-19 years) in Jaipur city with special reference to lifestyle. *Int J Contemp Pediatr* 2017;4(4):1461.
12. Chatterjee P. India sees parallel rise in malnutrition and obesity. *Lancet* 2002;360(9349):1948.
13. de Castro JM, King GA, Duarte-Gardea M, Gonzalez-Ayala S, Kooshian CH. Overweight and obese humans overeat away from home. *Appetite* 2012;59(2):204–11.
14. Agarwal KN, Saxena A, Bansal AK AD. Physical growth assessment in adolescence *Indian Pediatr*. *Indian Pediatr* 2001;38:1217–23.
15. Sujan Gautam and Hyoung-Sun Jeong. Childhood Obesity and Its Associated Factors among School Children in Udupi, Karnataka, India. *J life time Med* 2019;9(1):27–35.
16. K R. Prevalence of overweight and obesity among high school students of Thiruvananthapuram City Corporation, Kerala, India. *Australas Med J* 2010;3(10):650–61.
17. Nawab T, Khan Z, Khan I, Ansari M. Influence of behavioral determinants on the prevalence of overweight and obesity

- among school going adolescents of Aligarh. Indian J Public Health 2014;58(2):121.
18. Ahmed M, Shah K, Kshirsagar V. Prevalence and risk factor for obesity in urban and rural school going children of Karad taluka, Maharashtra, India. Int J Contemp Pediatr 2016;3(4):1389-93.
 19. Rathi S, Raghuram N, Tekur P, Joshi R, Ramarao N. Development and validation of integrated yoga module for obesity in adolescents. Int J Yoga 2018;11(3):231.
 20. Shete JS, Wagh A V. A cross sectional study to estimate prevalence of obesity and its risk factors in adolescent school children in Western Maharashtra, India. Int J Res Med Sci 2018;6(9):3072.
 21. 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 2007;15(6):1384-90.