

Research Article

Determinants of Overweight and Obesity among School Children in Mehsana district, India

Poonam K. Patel*, Bhoomika K. Patel, Jigna S. Shah

Department of Clinical Pharmacy, Shri Sarvajanik Pharmacy College, Near Arvind Baug,
Mehsana-384001, Gujarat, India

Corresponding author Email: pr.poonampatel@yahoo.com

WHO refers obesity as a global epidemic because of rapid increase in the number of overweight and obese individuals in last 20 years. The objective of the study was to study the prevalence of overweight and obesity and determine their associated factors among school children aged 10-12 years in Mehsana district in India. A single centric epidemiological study was conducted among 200 school children selected at random in Mehsana district school in the period from July 2011 to September 2011. Overweight and obesity were assessed using height, weight, waist circumference and hip circumference of each student in the class. A predesigned and pretested questionnaire was used to interview the students to elicit the information on family characteristics like number of family members, education and occupation of parents, their usual physical activity, habit of watching TV and time spent with computer and for sleeping as well as the pattern of dietary intake. Significant difference in BMI for boys ($p < 0.0010$) as well as girls ($p < 0.0123$) was observed in all the three underweight, overweight and obese groups as compared to normal group. Significant difference in hip and waist circumference was observed only in the underweight group as compared to normal. Risk of overweight and obesity was significantly higher in children who spent time in television viewing and/or with computer. The present study highlights childhood obesity is an emerging health problem which need to be confirmed by large scale studies and effective preventive strategies should be developed to halt this epidemic at its beginning.

Keywords: Normal, underweight, overweight, obesity, school children, education

Childhood obesity is emerging as a major health problem in developing countries such as India, especially in urban populations (Shah et al., 2008; Shetty, 1999). The World Health Organization (WHO) has declared overweight as one of the top ten health risks in the world and one of the top five in developed nations (Kaur et al., 2008; WHO, 2002). The magnitude of overweight ranges from 9% to 27.5% and obesity ranges from 1% to 12.9% among Indian children (Ramachandran et al., 2002; Sharma et al., 2007). Existing WHO standards and data from 79 developing countries including a number of industrialized countries suggest that about 22 million children five years old are overweight worldwide (WHO Geneva, 1998). Once considered a problem of affluence, obesity is fast growing in many developing countries also (WHO, 2002). Even in countries like India, which are typically known for high prevalence of

under nutrition, a significant proportion of overweight and obese children now coexist with those who are under nourished ((Ramachandran et al., 2002).

Objectives

Although several studies have been conducted in metropolitan cities in India on overweight and obesity among children, no studies have been conducted in Mehsana district. The objective of the present study was to study the prevalence of overweight and obesity and determine their associated factors among school children aged 10-12 years in Mehsana district in India.

Study Protocol

Single centric epidemiological study was conducted from July 2011 to September 2011 in 200 school children aged 10-12 years of Mehsana district of Gujarat region regarding prevalence of overweight and obesity. Child suffering from fever, infectious disease, chronic disease, Genetic disorder or taking any medication were not included in the study. Written informed consent was obtained from the parents/guardian of the child participating in the study. The study was performed in accordance with ICH-GCP guidelines and schedule Y for the conduct of human research. The protocols and informed consent processes were reviewed and approved by Institutional Ethics Committee (SSPCIRB/11/6) prior to initiating research. The school children were explained the objective of the study.

A predesigned and pretested questionnaire was used to interview the study participants to elicit the information on individual characteristics like age, sex, pattern of dietary intake, time spent on television viewing and/or time spent with computer, time spent for sleeping were recorded. Socio-economic data were collected from the parents in the form of: mothers' educational status, mothers' occupation and number of family members.

Assessment of physical activity of children of the age of 10-12 years was undertaken. The activities like jogging, running, playing outdoor games (involve running), yoga, physical exercise and others like swimming, dancing etc were recorded in the questionnaire.

In our study, we took fast food consumption "yes" if the child was taking fast food more than three times a week. Similarly regular outdoor and indoor playing routinely >30 min/day was considered "yes." During data collection, school authorities were asked to accompany us to the respective classes.

Body weight was measured (to the nearest 0.5 kg) with the subject standing motionless on the weighing scale with feet 15 cm apart, and weight equally distributed on each leg.

Body mass index (BMI) was calculated as weight in kilograms/ (height in meter). Overweight and obesity was assessed by BMI for age. Children with BMI of 25 and above were considered overweight and children with BMI more than 30 were considered obese (WHO, 2000).

Statistical Analysis

Paired Student's t test and one way ANOVA test followed by Dunnett's test were applied for statistical analysis.

Results

A total of 200 school children of 10-12 years of age participated in the study for prevalence of overweight and obesity. Out of 200 there were 112 boys (56%) and 88 girls (44%). Only 55 (27.95%) were normal, 55 (27.47%) were underweight, 68 (33.88%) were overweight, and 22 (10.67%) were obese. (Table: 2)

The prevalence of overweight and obesity was higher in males than females. Significant difference in BMI for boys ($p < 0.001$) as well as girls ($p < 0.01$) was observed in all the three underweight, overweight and obese groups as compared to normal group. Overall prevalence rate of underweight students is 27.47%. Significant difference in hip and waist circumference was observed only in the underweight group as compared to normal. (Table: 3)

Table: 1 Classification of participants according to BMI^s

BMI	WEIGHT
Below 18.5	Underweight
18.5-24.9	Normal
25-29.9	Overweight
30& Above	Obese

Table 2: Number of normal, underweight, overweight and obese children according to BMI

Parameters	Normal N (%)	Underweight N (%)	Overweight N (%)	Obese N (%)	Total N (%)
Boys	27 (24.1%)	31 (27.67%)	39 (34.82%)	15 (13.39%)	112 (56%)
Girls	28 (31.81%)	24 (27.27%)	29 (32.95%)	7 (7.95%)	88 (44%)
Total	55 (27.95%)	55 (27.47%)	68 (33.88%)	22 (10.67%)	200

Table 3: BMI, Waist Circumference and Hip Circumference of the students

Parameters	Normal Mean± SD	Underweight Mean± SD	Overweight Mean± SD	Obese Mean± SD
BMI				
Girls	21.62±1.64	15.69±1.39*	26.3 ±2.29*	36.65±2.74*
Boys	21.15±1.67	14.94±1.48†	26.26±1.05†	34.33±2.95†
Waist Circumference				
Girls	30.98±3.28	26.66±2.33§	31±4.03	31.28±3.77
Boys	30.96±4.00	29.22±2.34§	31.55±3.97	32.53±4.03
Hip Circumference				
Girls	33.35±3.29	28.22±2.29§	33.49±3.55	34.21±2.67
Boys	32.8±3.75	30.06±2.54§	34.01±3.77	34.66±2.94

* $p = 0.004$, † $p < 0.001$, § $p < 0.05$

Risk of overweight and obesity was significantly higher in children who spent time in television viewing and/or with computer.

The frequency of intake of fast food had an impact on the prevalence of overweight. However, these observations were not statistically significant. (Table: 4)

Other factors like mother's education, mother's occupation, religion and type of family were also not found to be statistically significant. (Table: 5)

Table 4: Hours of physical activity, time spend with TV, Time spent with computer as well as time spent in sleeping in all four groups

Parameters	Normal	Underweight	Overweight	Obese
Physical activity (in Hours)	1.38±.45	1.41±0.48	1.23±0.40	1.00±0.00
TV/computer (in hours)	1.56±1.37	1.61±1.42	1.83±1.36#	1.72±0.69#
Sleeping (in hours)	7.18±0.39	7.57±0.73	7.41±0.71	7.08±.13

p = 0.05

Table 5: Total number of mother's education, mother's occupation, No. of family member in all four groups.

Parameters	Total N	Normal n (%)	Underweight n (%)	Overweight n (%)	Obese n (%)
Mother education					
Graduate	136	34 (25%)	40 (29.41%)	45 (33.08%)	17 (12.5%)
Nongraduate	57	16 (28.07%)	13 (22.80%)	23 (40.35%)	5 (8.77%)
Mother's occupation					
Homemaker	158	46 (29.11%)	43 (27.21%)	52 (32.91%)	17(10.75%)
Employed	37	8 (21.62%)	10 (27.02%)	14 (37.83%)	5 (13.51%)
No. of family members					
≤ 4	105	29 (27.61%)	27 (27.715%)	35 (33.33%)	14 (13.4%)
>4	92	26 (28.26%)	26 (28.26%)	33 (35.86%)	7 (7.06%)

Discussion

The prevalence of overweight and obesity in the students of Mehsana district was found to be 33.88% and 10.67%, respectively. The prevalence of overweight in an urban population of India, as found in National Family Health Survey during 2005-06, was 11.38% (Vadera et al., 2010, National Family Health survey (NFHS-3), 2005-06). The prevalence of obesity was 2.24% in the same survey. Though the prevalence found in the present study is higher than the national average, it is lower than that of developed countries. National Health and Nutrition Examination Survey US observed the prevalence of overweight to be 66.3% in 2004. General Household Survey in UK found the prevalence to be 61% in 2003. National Health Survey in Australia found the prevalence to be 49% in 2005 (WHO Global Infobase).

Gender is one of the biological factors affecting the weight status. It was evident in the present study that the prevalence of overweight and obesity is generally higher in females than males.

Findings of studies conducted in India by Gopinath *et al.*, 1994, Gopalan, 1998, Mohan *et al.*, 2001, Mishra *et al.*, 2001, Ramchandran *et al.*, 2001, Reddy *et al.*, 2002, Shukla *et al.*, 2002 and recent National Family Health Survey III (2005-06) also revealed a much higher percentage for obesity/overweight in females than in males. In females, extra energy gets converted into fat. This pattern of energy usage, or "nutrient partitioning," in females contributes to further positive energy balance and fat deposition (WHO Tech Rep Ser 2000). Due efforts should be undertaken to decrease overweight or obesity in females to make an impact on overall prevalence.

Risk of overweight and obesity was significantly higher in children who spent time in television viewing and/or with computer. Children with higher levels of television viewing and/or time spent with computer had greater BMI. These findings were consistent with existing literature citing television viewing as a contributing variable to the obesity epidemic in children. These findings further support the importance of developing intervention programs for obese children that target decreasing television viewing as well as increasing physical activity (Tami *et al.*, 2009). The prevalence of overweight was not significantly higher with higher frequency of intake of fast food. According to the WHO expert committee, high intake of energy-dense micronutrient-poor foods which is the case in most of fast food is convincingly related with unhealthy weight gain and there is a possible relation between the high proportion of intake of food prepared outside home and unhealthy weight gain (WHO Tech Rep Ser 2003).

Prevention of obesity in children is easier than the adults. Overweight/obese children were least active in physical activity at all times. These results support the increasing worldwide trend towards sedentary lifestyles leading to increased overweight prevalence among children/adolescents, possibly tracking to adulthood (Kruger *et al.*, 2006).

When the parent's occupations were compared with the children's weight status, overweight/obesity was prevalent in families in two occupation categories. The more overweight/obese children's parents were employed as domestic/contract workers, while less overweight/ obese children's parents had professional/business occupations. Other researchers reported a contradictory pattern whereby the prevalence of overweight/obesity increased when the parents were employed in the business sector, earning a higher family income compared with those working as labourers (Kruger *et al.*, 2006, Ramachandran *et al.*, 2002, Mo-Suwan *et al.*, 2000).

Family size showed an association with obesity prevalence. The highest level of overweight/obesity was found in smaller households with four or fewer family members. With fewer mouths to feed, the children from smaller families consumed the most energy as they had more food available per person (Mo-Suwan L *et al.*, 2000). The socio-economic level of the household is therefore linked to the occupation of the parents, ultimately influencing the food intake and activity patterns of a household (Kruger *et al.*, 2006).

The study also suggests that under nutrition rates remain high in the children. Overall prevalence rate of underweight students is 27.47%. In spite of increasing per capita income and reduced poverty and dietary diversity under-nourishment are also seen among the affluent children. The malnutrition in urban children may be mainly due to poor food habit, poor selection of food and other life style modification. The prevalence of underweight female students is 27.27%. As present study group consisted of students with 10-12 year of age, onset of

puberty may be one of the factors for this underweight status. Special attention has to be given for their overall nutrition. A separate study may be designed to investigate this issue in detail.

Childhood overweight is a serious problem and addressing this problem will require comprehensive interventions aimed at improving healthful food choices and increasing physical activity levels (Jehn ML et al., 2006). Based on the findings of this study it is recommended that consumption of high fat and high energy and snacking in between the meals should be avoided by children. Increase physical activity like playing outdoor games, walking; cycling should be encouraged in children. Health education should be given to parents, teachers and children regarding dietary habit and sedentary life style. Given the small sample size and exploratory nature of our study, we were not able to identify any significant nutrition- or physical activity-related predictors of overweight/obesity in this sample. Larger studies may help elucidate the relative contributions of children's health behaviors and their effect on overweight.

Conclusion

The present study highlights childhood obesity is an emerging health problem which needs to be confirmed by large scale studies. Spending more time on TV and Computer may be considered as predisposing factor for overweight. To halt this epidemic at its beginning, as a preventive strategy, application of health and nutritional education programs for inculcating healthy lifestyles, and incorporating more outdoor activities in Physical Education Department of school curriculum is need of the hour.

References

- Diet, nutrition and the prevention of chronic diseases. World Health Organ Tech Rep Ser 2003. 916:61-7.
- Dietz WH and Gortmaker SL. 1985. Preventing obesity in children and adolescents. Annual Review of Public Health. 22: 337-53.
- Fontvieille AM, Kriska A, Ravussin E. 1993. Decreased physical activity in Pima Indian compared with Caucasian children. International Journal of Obesity and Related Metabolic Disorders. 17:445-452.
- Gopalan c. 1998. Obesity in the Indian urban 'middle class'. NFI Bull. 191-5.
- Gopinath N, Chadha SL, Jain P, Shekhawat S, Tandon R. 1994. An epidemiological study of obesity in adults in the urban population of Delhi. J Assoc Physicians India. 42:212-5.
- Gordon-Larsen P, Adair L, Popkin BM. 2002. Ethnic differences in physical activity and inactivity patterns and overweight status. Obesity Research. 10:141-9.
- Jehn ML, Gittelsohn J, Treuth MS, Caballero. 2006. Prevalence of Overweight among Baltimore City Schoolchildren and its Associations with Nutrition and Physical Activity. Obesity.14 (6) June:989-993
- Kruger R, Kruger HS, MacIntyre UE. 2006. The determinants of overweight and obesity among 10- to 15- year-old schoolchildren in the North West Province, South Africa – the THUSA BANA (Transition and Health during Urbanization of South Africans; BANA, children) study. Public Health Nutrition: 9(3):351-358
- Misra A, Pandey RM, Devi JR, Sharma R, Vikram NK, Khanna n. 2001. High prevalence of diabetes, obesity and dyslipidemia in urban slum population in northern India. Int J Obes Relat Metab Disord. 25:1722-9.
- Mohan v, Shanthirani S, Deepa R, Premalatha G, Sastry NG, Saroj R. 2001. Chennai Urban Population Study (CUPS NO.4). Intra-urban differences in the prevalence of the metabolic

- syndrome in southern India—the Chennai Urban Population Study (CUPS NO.4). *Diabet Med.* 18:280-7.
- Mo-Suwan L, Tongkumchum P, Puetpaiboon A. 2000. Determinants of overweight tracking from childhood to adolescence: a 5y follow-up study of Hat Yai schoolchildren. *International Journal of Obesity and Related Metabolic Disorders.* 24(12): 1642–7.
- National Family Health survey (NFHS-3), 2005-06. Vol.1. India: Mumbai: IIPS; 2007;303-9.
- Obesity: Preventing and managing the global epidemic. Report of a WHO consultation, World Health Organ Tech Rep Ser 2000; 894:1-12, 1-1253.
- Obesity: Preventing and managing the global Epidemic. Report of WHO Consultation on Obesity. WHO Geneva1998.
- Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan v, Das AK, et al. 2001. High prevalence of diabetes and impaired glucose tolerance in India: National Urban diabetes Survey. *Diabetologia.* 44:1094-101.
- Ramachandran A, Snehalatha C, Vinitha R, Thayyil M, Kumar CK, Sheeba L, et al. 2002. Prevalence of overweight in urban Indian adolescent school children. *Diabetes Res Clin Prac.* 57: 185-190.
- Ramachandran A, Snehalatha C, Vinitha R, Thayyil M, Sathish Kumar CK, Sheeba L, et al. 2002. Prevalence of overweight in urban Indian adolescent school children. *Diabetes Research and Clinical Practice.* 57(3): 185–90.
- Reddy KS, Prabhakaran D, Shah P, Shah B. 2002. Differences in body mass index and waist: Hip ratio in north Indian rural and urban population. *Obes Rev.* 3:197-202.
- Shah C, Diwan J, Rao P, Bhabhor M, Gokhle P, Mehta H. 2008. Assessment of Obesity in school children. *Calicut Medical Journal:* 6(3):1-8.
- Sharma A, Sharma K, Mathur KP. 2007. Growth pattern and prevalence of obesity among affluent school children in Delhi. *Public Health Nutr.* 10: 485-491.
- Shetty PS. 1999. Obesity in children in developing societies: indicator of economic progress or a prelude to a health disaster. *Indian Pediatr:* 36:11-15.
- Shukla HC, Gupta PC, Mehta HC, Hebert JR. 2002. Descriptive epidemiology of body mass index of an urban adult population in western India. *J Epidemiol Community Health.* 56:876-80.
- Supreet Kaur, HPS Sachdev, SN Dwivedi, R Lakshmy, Umesh Kapil. 2008. Prevalence of overweight and obesity amongst school Children in Delhi, India. *Asia Pac J Clin Nutr:* 17 (4):592-596.
- Tami JT, Holm JE, McDonald D. 2009. Correlates of Overweight and Obesity in American Indian Children. *Journal of Pediatric Psychology.* 34(3) 245–253.
- Vadera BN, et al. 2010. Study on Obesity and Influence of Dietary factors on the Weight Status of an Adult Population in Jamnagar City of Gujarat: A Cross-sectional Analytical study. *Indian Journal of Community Medicine.* 35(4):482-486.
- WHO (World Health Organization), *The World Health Report: Reducing Risks, Promoting Healthy Life.* Geneva. 2002. World Health Organization.
- WHO Global Infobase: Search by country. World Health Organization. Available from: <http://www.who.int/infobase>.