Original Research Article

A Study on the Extent of Overweight/Obesity, and Underweight and, Its Determinants among the School Going Children of Urban/Rural Areas of Ahmedabad District, Gujarat

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ABSTRACT

Aims and Objective: To assess the prevalence of Overweight/Obesity, and underweight among school children in the rural and urban areas of Ahmedabad district.

Material and Methods: It was the school based Cross – Sectional Epidemiological study, carried out during the period December 2012-December 2013, and conducted in Private, Government and Municipal schools of Ahmedabad city among School going children studying in 8th, 9th and 10th High school standard of Ahmedabad district in the age group 12-17 years of both sexes were included in this study. After taking the informed consent, the students were asked to fill the pre - validated questionnaire. Data entry was done in Microsoft Office Access Database and analysis was done by Epi Info 7.

Results: Out of 1486, urban 775 (52.1%) and rural 711 (47.9%) adolescents were included. Prevalence of Overweight/Obesity was significantly high in urban area 18(62.1%) as compared to in rural area 11 (37.9%). 8 (27.6%) of Overweight & Obese adolescents had positive history of obesity in father while 10 (17.24%) of adolescents had positive history of Overweight/obesity in mother. Out of 29 overweight/obese adolescents, 19 students gave positive history of outdoor activity while 10 gave negative history of outdoor activity. 950 (63.9%) children found underweight among them 536 (56.4%) were boys and, 414 (43.6%) were girls. Conclusion: The results of this study expose the fact that the percentage of Overweight/Obese, and underweight children are growing in Gujarat also like in other states of India & other parts of world. The increasing trend of the modern day epidemic of Overweight/Obesity in children calls for immediate action in both rural and urban areas.

Key words: Overweight/Obesity, Underweight, Adolescent, BMI

INTRODUCTION

According to WHO, Adolescent is a person between 10 to 19 years of age-period of life with rapid growth and development of body, mind and social relationship with behavioral changes like sexual maturity and self independence with more exposure to risk behavior like unsafe sex, risky driving and drug abuse etc. [1] Adolescents becoming overconscious of their body

image and exhibiting strange eating behaviour is no longer a myth but a harsh reality. For both socio-cultural and psychological reasons, considerable emphasis is being placed on weight and appearance. Obesity is also on the rise with excessive consumption of processed foods and high fat diets. [2] Obesity can be seen as the first wave of a defined cluster of most non communicable diseases called New World Syndrome creating an enormous socioeconomic and public health burden in poorest countries. [3] The World Health Organization has described obesity as one of today's neglected public health problems. Following the increase in adult obesity, the proportions of children and adolescents who are overweight and obese have also been increasing. [4] There is a paradigm shift in the quality of life in urban population resulting in substantial increase in childhood as well as adult obesity in the urban population. It is observed that 30% of obesity begins in childhood and out of that 50% to 80% become obese adults. [5] Underweight and malnutrition is also high and growing problems mainly in rural, urban slums and tribal areas of India. [3] The present study is therefore carried out in Urban and Rural schools of Ahmedabad district to see the extent of overweight/obesity and underweight among the children of Gujarat.

MATERIALS AND METHODS

The present study was carried out in urban and rural areas of the Ahmedabad city. Ahmedabad district spreads over the area of 7932.4 sq.kms, with the population of 6,03,83,628. (Census 2011) [6] The district has 569 villages with 11,52,896 rural populations.

Study design: The school based Cross – Sectional Epidemiological study was carried out during the period December 2012-December 2013.

Study area: This study was conducted in Private, Government and Municipal schools of Ahmedabad district.

1. Diwan Ballubhai Secondary School (Kankaria, Ahmedabad Urban)
2. Jayhind High school (Maninagar, Ahmedabad Urban)
3. Hirabai Kanya Vidyalaya (Isanpur, Ahmedabad Urban)
4. Geeta High school (Jetalpur, Ahmedabad Rural)
5. M.P. Pandya High school (Lambha, Ahmedabad Rural)
6. U.L.Patel High school (Aslali, Ahmedabad Rural)

Study population: School going children studying in 8th, 9th and 10th High school standard of Ahmedabad district in the age group 12-17 years of both sexes were included in this study.

Sampling design: Six schools were selected from rural and urban area of Ahmedabad district by Simple Random Sampling method. From each school all the students of 8th, 9th and 10th standards were selected. After taking the informed consent, the students were asked to fill the pre - validated questionnaire including information on parameters like - socio - economic status, family history of Obesity, Hypertension, dietary habits and exercise pattern, measurement of height, body weight, waist circumference, hip circumference and Blood Pressure of each student were recorded by the standard technique.

Sample size: For selection of schools, the list of all schools was obtained from all zones of Ahmedabad city and rural areas from the directorate Government of Gujarat of School education. We have included

Private, Government and aided schools. Considering the prevalence of Obesity of 5.9% as reported by Subramanyam *et al,* [7] alpha error of 5%, 1% absolute allowable error and 10% non response rate, sample size calculated was 1486.

Study variable: General information regarding the name, age, sex, address, name of School, standard and religion were asked. Family details regarding the type of the family, total number of family members, total income of the family, occupational and educational status of the mother and father were asked. Family history of obesity, HT (Hypertension), DM (Diabetes Mellitus), and any other cardiovascular diseases were asked. Personal history regarding the watching TV or Computer use and about the type of transportation were asked. Questions on physical activity were also asked. Dietary history and general examination (Nutritional and Physical) regarding the thyroid enlargement, angular stomatitis, pallor, discoloration of teeth, disability , difficulty in vision, and history regarding any stress were also asked. Height, Weight, Waist Circumference, Hip Circumference and BP was measured and recorded.

Data analysis: Data entry was done in Microsoft Office Access Database and analysis was done by Epi Info 7. Chi square was used for comparison of frequency a P value below or equal to 0.05 was considered to be statistically significant for a 95% confidence Interval. Pearson correlation analysis was undertaken to estimate the p value for the difference in prevalence of overweight/Obesity and, underweight in different socio economic group.

RESULTS

Table 1: Socio demographic profile of adolescents in urban (n=775) & rural (n=711)

	Urban	Rural
Religion*		
Hindu	686 (88.5)	698 (98.2)
Muslim	67 (8.6)	4 (0.6)
Christian	5 (0.6)	4 (0.6)
Other	17 (2.2)	5 (0.7)
Socio –economic class**		
Class-I	383 (49.4)	36 (5.0)
Class-II	138 (17.8)	119 (16.7)
Class-III	86 (11)	126 (17.7)
Class-IV	108 (13.9)	284 (39.9)
Class-V	60 (7.7)	146 (20.5)
Father's occupation@		
Businessman	48 (6.2)	60 (8.6)
Farmer	1 (0.1)	127 (18.1)
Laborer	69 (9.1)	115 (16.4)
Skilled	648 (84.6)	398 (56.9)
Mother's occupation#		
Housewife	525 (67.8)	652 (91.7)
Laborer	3 (0.4)	2 (0.3)
Skilled	246 (31.8)	57 (8.0)
No of family members$		
<5	485 (62.6)	413 (58.1)
<10	245 (31.6)	269 (37.8)
<15	36 (4.6)	25 (3.5)
<20	9 (1.2)	4 (0.6)

*Figures in parenthesis show percentage. *χ^2=60.02, df=3, p=0.00; **χ^2=409.25, df=4, p=0.00; @χ^2=194.04, df=3, p=0.00; #χ^2 =129.35, df=2, p=0.00; $$\chi^2$ =8.06, df=3, p=0.04 (Yate's corrected value)*

Table 1 depicts that in urban area out of 775, majority of adolescents 686 (88.5%) were Hindu, 67 (8.6%) were Muslim, 5 (0.6%) were Christian & 17 (2.2%) were Jain. According to the Socio-economic class 383 (49.4%) belongs to Class I, 138 (17.8%) belongs to Class-II, 86 (11%) belongs to Class-III, 108(13.9%) belongs to class-IV & 60 (7.7%) to class-V. It was observed that majority of adolescents' father 648(84.6%) were doing skilled activity, 69 (9.1%) were laborer, 48 (6.2%) were businessman. It was observed that majority of adolescents' mother were housewife 525 (67.8%), 246 (38.1%) were doing skilled activity.

Table 2: Distribution of adolescents according to their Socio Economic Class

Soc-Eco Status@	Urban*			Rural**			Total
	Boys	Girls	Total	Boys	Girls	Total	
SE – I	210 (54.8)	173 (45.1)	383 (49.4)	19 (52.7)	17 (47.3)	36 (5.0)	419 (28.1)
SE –II	88 (63.7)	50 (36.3)	138 (17.8)	66 (55.4)	53 (44.6)	119 (16.7)	257 (17.3)
SE -III	35 (40.6)	51 (59.4)	86 (11.00)	75 (59.5)	51 (40.5)	126 (17.7)	212 (14.2)
SE -IV	41 (37.9)	67 (62.1)	108 (13.9)	174 (61.2)	110 (38.8)	284 (39.9)	392 (26.4)
SE –V	25 (41.6)	35 (58.4)	60 (7.7)	87 (59.5)	59 (40.5)	146 (20.5)	206 (13.8)
Total	399 (51.5)	376 (48.5)	775 (52.1)	421 (59.2)	290 (40.8)	711 (47.9)	1486 (100)

Figures in parenthesis show percentage. *χ^2= 24.27, df=4, p= 0.0001; **χ^2= 1.8, df=4, p= 0.76.
@According to Modified Prasad Classification

Table 2 revealed that in urban area majority of boys 210 (54.8%) & girls 173 (45.1%) belongs to Socio economic Class I while in rural area majority of boys 174 (61.2%) & girls 110 (38.8%) belongs to Socio economic Class IV. Average income in urban & Rural area = Rs. 3721 Male average income = Rs. 3423. Female average income=Rs. 3361.848

Table 3: Distribution of adolescents according to BMI as per who recommendations

Classification according to BMI	Urban	Rural	Total
<18.5 (Underweight)	500 (64.5)	450 (63.3)	950 (63.9)
18.5-24.99 (Normal)	257 (33.2)	250 (35.2)	507 (34.1)
25-29.99 (Overweight)	17 (2.2)	9 (1.2)	26 (1.8)
>30 (Obese)	1 (0.1)	2 (0.3)	3 (0.2)
Total	775 (52.1)	711 (47.9)	1486 (100)

Figures in parenthesis show percentage. χ^2= 1.785, df=3, p= 0.62 (Yate's corrected value)

Table 4: Distribution of adolescents in relation to the food habits

Type	Type of Diet (n=1486)				
	Vegetarian	Mixed	Total	H/O Junk Food Present	H/O Junk Food Absent
Underweight	811 (85.4)	139 (14.6)	950 (63.9)	699 (73.6)	251 (26.4)
Normal	432 (85.2)	75 (14.8)	507 (34.1)	390 (76.9)	117 (23.1)
Overweight	20 (73.9)	6 (26.1)	26 (1.7)	26 (100)	0 (0.0)
Obese	3 (100)	0 (0.0)	3 (0.3)	2 (66.7)	1 (33.3)
Total	1266 (85.2)	220 (14.8)	1486 (100)	1117 (75.2)	369 (24.8)

Figures in parenthesis show percentage. χ^2=6.12, df=1, p<0.01 (Yate's corrected value)

Table 3 depicts that 950 (63.9%) of adolescents are undernourished, 507 (34.1%) are normal, 26 (1.8%) are overweight & 3 (0.2%) are obese. in urban

area out of 775, 17 (2.2) & 1 (0.1) adolescents were Overweight and Obese respectively. In rural area out of 711, 9 (1.2) and 2 (0.3) were Overweight and Obese respectively.

Table 4 shows that out of 1486 adolescents 1266 (85.2%) were on vegetarian diet & 220 (14.8%) were on mixed diet. Three fourth adolescents had positive history of junk food, one third had negative history. Majority of the undernourished children 811 (85.4%) were on vegetarian diet & 699 (73.6%) of them were eating junk food. Majority of the normal adolescents 432 (85.2%) were on vegetarian diet out of them 390 (76.9%) were eating junk food. All Overweight 26 (100%) adolescents were on junk food while 2 (66.7%) obese out of 3 were eating junk food. H/O Junk food was statistically found significant in Overweight and Obese adolescents.

Table 5: Relation with physical outdoor activity

Type	No. of adolescents		Total
	H/O Outdoor activity Present	H/O Outdoor activity Absent	
Under weight	688(72.4)	262(27.6)	950(63.9)
Normal	354(69.8)	153(30.2)	507(34.1)
Overweight	18(69.2)	8(30.8)	26(1.7)
Obesity	1(33.3)	2(66.7)	3(0.3)
Total	1061(71.4)	425(28.6)	1486(100)

Figures in parenthesis shows percentage, χ^2=8.6, df=3, p<0.1 (Yate's corrected value)

Table 5 shows that out of 1486, 1061 (71.4%) adolescents had history of outdoor activity. It was observed that obese adolescents are doing less outdoor activity as compared to normal 354 (69.8%) adolescents. It is seen that only 1 (33.3%) obese adolescent was doing outdoor activity. This difference is statistically significant.

Table 6: Distribution of adolescents according to sedentary activity

Type	Urban*		Rural**		Total
	Watching TV		Watching TV		
	Present	Absent	Present	Absent	
Underweight	457 (91.4)	43 (8.6)	423 (94)	27 (6)	950 (63.9)
Normal	236 (91.8)	21(8.2)	233 (93.2)	17 (6.8)	507 (34.1)
Overweight	15 (88.2)	2 (11.8)	9 (100)	0 (0.0)	26 (1.7)
Obesity	1(100)	0 (0.0)	2 (100)	0 (0.0)	3 (0.3)
Total	709 (91.5)	66 (8.5)	667 (93.8)	44 (6.2)	1486 (100)

Figures in parenthesis shows percentage.χ^2=2.22, df=3, p=0.53; χ^2=1.3, df=3, p=0.73 (Yate's corrected value)*

Table 6 depicts that Majority of the Overweight 24 (91.3%) out of 26 & all 3 (100%) Obese were watching TV which is risk factor for Overweight & Obesity. More than 90% of adolescents were watching TV in both urban as well as rural area.

Table 7: Distribution of adolescents according to their Waist-Hip Ratio (WHR)

Waist Hip Ratio (cm)*		Urban**			Rural***			Total
Girls	Boys	Boys	Girls	Total	Boys	Girls	Total	
<0.81	<0.93	387 (96.9)	176 (46.8)	563 (72.6)	417 (99)	175 (60.3)	592 (83.3)	1155 (77.7)
0.81-0.89	0.93-1	9 (2.3)	180 (47.8)	189 (24.3)	3 (0.7)	101 (34.8)	104 (14.6)	293 (19.7)
>0.89	>1	3 (0.8)	20 (5.3)	23 (2.9)	1 (0.1)	14 (4.9)	15 (2.1)	38 (2.6)
Total		399 (51.5)	376 (48.5)	775 (52.1)	421 (59.2)	290 (40.8)	711 (47.1)	1486 (100)

Figures in parenthesis show percentage. *Criteria as per Nutritional Foundation of India, 2004
χ^2=241, df=2, p<0.1; *χ^2=179, df=2, p<0.1 (Yate's corrected value)*

Table 7 depicts that in urban area 387(96.9%) boys had <0.93 cm waist hip ratio while in rural area 417(99%) had. 176 (46.8%) girls & 175(60.3%) girls had waist hip ratio < 0.81 cm in urban and rural area respectively.9 (2.3%) boys & 3(0.7%) boys had Waist hip ratio in between 0.93 cm to 1 meter in urban and rural area respectively. Among urban subjects 2.3% of boys were overweight/obese according to WHR, where as in girls subjects 47.8% were overweight and 5.3% were obese. In rural subjects, 99% of boys had normal WHR while 34.8% girls were overweight & 4.9% were obese.

Table 8: Prevalence of overweight by standard weight for height (n=1486)

Age	Number	Mean weight in Kg+-SD	Underweight* No. (%)	Normal** No. (%)	Overweight*** No. (%)
12-14	1172	41+-8.89	755 (64.4)	394 (33.6)	23 (1.9)
15-17	311	42+-8.88	192 (61.7)	113 (33.8)	6 (4.5)
18+	3	42+-6.19	3 (100)	0 (0.0)	0 (0.0)
Total	1486	41.6+-7.99	950 (63.9)	507 (34.1)	29 (2.0)

Figures in parenthesis show percentage.<90% Standard weight for height;
90-110% Standard weight for height;   *>110% Standard weight for height

Table 8 revealed out of 1486 students, overall 29 (2%) of the students had greater than 10% standard weight which could be considered as overweight.

DISCUSSION

The present study was conducted in 6 schools of urban and rural areas of Ahmedabad district to assess the prevalence of Overweight/Obesity and underweight. Present data was analyzed statistically and tried to correlate it with other similar studies in all over the globe.

In the present study, out of 1486, urban 775 (52.1%) and rural 711 (47.9%) adolescents were included. Majority of adolescents 1067 (71.8%) were in 13 to 14 years of age. There were total 820 (55.1%) boys and 666 (44.9%) girls, which were similar in study done by S. Shyamakumari. [8] It was observed that in urban area majority of adolescents 383 (49.4%) belongs to Socio economic Class I while in rural area majority of them 284 (39.9%) belongs to Socio economic Class IV. Prevalence of Overweight/Obesity was significantly high in urban area 18 (62.1%) as compared to in rural area 11 (37.9%). It is clear that BMI was significantly higher among high income group. This finding was similar with the study done by Rajkumari Bishwalata [9] and also similar with the study done by Supreet Kaur. [10] School surveys done by Mudur [11]

have also showed that 30% of the adolescents from India's higher economic group were Overweight, and 14% of them were from urban schools. Findings are similar with study done by M Shashidhar Kotian. [12]

In present study prevalence of Overweight and Obesity was 29 (2%), T Aggrawal, et al [13] reported prevalence of Obesity 3.4% and Overweight was 12.7%. Kapil et al [14] reported a 7.4% prevalence of Obesity in affluent school children in Delhi where as Khadikar, et al [15] reported a prevalence of obesity to be 5.7% and Overweight 19.9% among affluent school boys in Pune. The National Nutrition Monitoring Bureau surveys in 2002, in rural areas, reported the prevalence of as little as 0.6%. [16] A study done in USA during 2001-2002 showed the prevalence of Overweight and Obesity as 31.5 and 16.5% respectively, for the 6 to 19 year age group. [17] Overweight and obesity were marginally higher in the pubertal age groups of 13 to15 years, perhaps because of increased adipose tissue and overall body weight in children during puberty. One of the major reasons for childhood Obesity was watching television

or using computers as shown by another studies. [17]

It was revealed from sex wise distribution of adolescents that out of 1486 , Proportion of Overweight/obesity is more common in girls 17 (58.6%) as compared to males 12 (41.4%). There was no statistical significance in sex wise distribution of adolescents. This finding was similar with study done by Rajkumari Bishwalata [9] which also shows Overweight were more prevalent among girls. The higher prevalence of Overweight among girls could be due to differences in physical activity or body fat composition. [18] The findings were similar with Study done by S Kumar [19] found Prevalence of obesity was more in girls (8.82%) than boys (4.42%).

In present study prevalence of overweight and obesity was higher 18 (62.1%) among urban students as compared to 11 (37.9%) in rural students. Gross and Monterio [20] had reported that overweight and obesity was more prevalent in urban population, particularly among higher socioeconomic groups. Study done by S Shayamakumari et al [8] found similar findings.

In present study out of 1486, 56.4% boys and 43.6% girls were found to be underweight. In a study conducted in rural Haryana on adult population by Reddy et al, [21] found 38% of males and 36% of females were actually 'underweight' by BMI standards. Study done by S Shyamakumari et al [8] found 18.6 % to be underweight. Study done by Shah C [21] found 70.37% prevalence of underweight.

It was observed that activities that involve less physical work may lead to overweight and obesity. Sedentary life style particularly sedentary occupation and inactive recreations like watching Television and indoor games promotes weight gain. [1] In my study, I found that out of 29 overweight/obese adolescents, 19 students

gave positive history of outdoor activity while 10 gave negative history of outdoor activity. Studies done by Supreet Kaur et al [10] found the association between BMI and physical activity in children revealed that as the amount of physical activity increased, the BMI decreased. Studies done by Ramchandran, [23] by Laxmaiah [24] and by Shah C [22] also found the similar results.

It was observed that 9 (2.3%) boys & 3 (0.7%) boys had Waist hip ratio in between 0.93 cm to 1 meter in urban and rural area respectively. Among urban subjects 2.3% of boys were overweight/obese according to WHR, where as in girls subjects 47.8% were overweight and 5.3% were obese, which was compared in a study conducted in Delhi on Obesity amongst affluent adolescent girls, central obesity was present in 54.5% where criteria of WHR were >0.85. [14]

CONCLUSIONS

Obesity can be seen as the first wave of a defined cluster of most non communicable diseases called New World Syndrome creating an enormous socioeconomic and public health burden in poorest countries. [3]

Out of 1486, 775 adolescents were from urban area and 711 adolescents were from rural area. Girls were more Obese than boys. There was no statistical significance in sex wise distribution of adolescents. Family history of Obesity in father and mother were found statistically significant. It was found that those who are more involved in outdoor activity having less BMI as compared to those who are not involved. The results of this study expose the fact that the percentage of Overweight and Obese children are growing in Gujarat also like in Kerala and other states of India & other parts of world. Exposure to risk factors for Overweight and Obesity is initiated from the birth and continues in childhood and adolescence. In

India about 22% of population are adolescents and are at major risk for developing Overweight and Obesity in adult life. Sedentary life style, altered dietary patterns and stress are already described as risk factors for Overweight and Obesity in adult as well as in adolescent age groups. The results of the area wise comparison of boys and girls indicated that in rural area the rate of underweight were higher compared to overweight and obesity respectively. In short, the present study showed an increasing trend of overweight in children particularly in girls of urban areas. The increasing trend of the modern day epidemic of Overweight/Obesity in children calls for immediate action in both rural and urban areas to reduce the incidence of malnutrition (Overweight and underweight) through appropriate nutritional intervention programs involving school children, their parents and school authorities. If immediate measures are not taken the condition can lead to serious problems beyond repair.

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