Original Article

Determinants of Overweight and Obesity in Affluent Adolescent in Surat City, South Gujarat Region, India

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ABSTRACT

Background: Obesity is a major global burden. Low levels of physical activity, TV watching, and dietary pattern are modifiable risk factors for overweight and obesity in adolescent. **Objective**: The objective of this study was to determine risk factors for overweight and obesity among affluent adolescent, in Surat city in south Gujarat. **Design**: Cross sectional from July 2009 to April 2010. **Setting**: Two private schools with tuition fees more than Rs. 2000 per month, were selected randomly using a random table. **Participants**: The participants were adolescents, 12 to 15 years of age. **Data collection**: Pre-designed and pre-tested questionnaire was used to elicit the information about dietary history and physical activity. **Measurement**: Height and weight was measured and BMI was calculated. Overweight and obesity were assessed by BMI for age. Student who had BMI for age >85th and <95th percentile of reference population were classified as overweight and BMI for age >95th percentile of reference population were classified as obese (IAP Growth Monitoring Guidelines for Children from Birth to 18 Year). **Result**: The overall prevalence of obesity and overweight was 6.55% and 13.9% (boys: 6.7% and 15.1%; girls 6.4% and 13.35%). Final model of multiple logistic regression analysis showed that important determinants of overweight and obesity were low levels of physical activity, watching television or playing computer games, and consuming junk foods, snacks and carbonated drinks. **Conclusion**: The magnitude of obesity and overweight among affluent adolescent of Surat city was found to be 6.55% and 13.9%, respectively. Low level of physical activity, watching TV or playing computer games, and dietary pattern predisposed the adolescent to overweight/obesity.

Keywords: Adolescent, India, obesity, risk factors

Introduction

Obesity is one of the most widespread and major problems affecting children and adolescents and is a global nutritional concern. An increased prevalence is found in many countries where the major nutritional disorder previously was malnutrition.[1] An increase in the prevalence of childhood obesity is associated with potential medical complications of obesity noted in adolescence and especially in adulthood, like hypertension, coronary artery disease, diabetes mellitus, dyslipidemia, cholecystitis, pancreatitis, sleep apnea, and osteoarthritis.[2,3]

In the last two decades, the prevalence of obesity has doubled in children and tripled in adolescents in the United States of America, the increase in childhood and adolescent obesity has resulted in an increase in obesity or overweight in adults. This has a profound public health consequence as 80% of overweight children become overweight adults.[4] In addition, obesity has a negative implication for long-term happiness and success in life. Finally, directed sessions that emphasize healthy eating and exercise habits for children and their families may have lasting effects on lifestyle of this patients.[5]

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Evaluation of obesity in childhood is important for several reasons. Firstly, it offers the best hope for preventing obesity and secondly preventing progression of disease which is associated with many diseases in adulthood. The present study was designed to determine risk factors for overweight and obesity among affluent adolescent, in Surat city in south Gujarat.

Materials and Methods

This cross-sectional study was conducted from July 2009 to April 2010 in two public schools of Surat catering to affluent adolescent. The schools tuition fees were more than INR 2000.00 per month. We wrote letter to 11 schools administration (7 co-ed and 4 girls' schools) for seeking their permission to conduct the study. Only two co-ed and two girl's schools provided the permission. Among two co-ed and two girls' schools, one girl school and one co-ed school were selected randomly using random number table keeping in view operational feasibility.

The sample size was estimated for infinite population by using the formula $4pq^2$ where the prevalence of overweight was taken as 10%.[6] The required precision of the estimate (d) was set at 20%. Using the above-mentioned formula, the sample size was estimated to be 900. After adding the non-response error of 10%, an additional 100 subjects were included. Thus, 1000 subjects were selected for this study.

The subjects were adolescents, 12 to 15 years of age, in the city of Surat in south Gujarat which is an important industrial center and well known for diamond and textile industries. The following subjects were eliminated from the study, those who (1) had been advised bed rest for more than 15 days during the last 6 months, due to any sickness (2), had any chronic systemic disease, (3) had any physical deformities, or (4) were absent during the time of conduction of the study due to any reason (5) unwilling for study.

The study protocol was approved by ethical committee of Government Medical College, Surat. A prior consent for the study was taken from school administration and from the parents. At the time of the initiating the study each participant were informed about the study protocol and written consent was obtained. The study could be conducted properly only from June to February as academic calendar existing for these books was the same and their exam months and vacations were to be excluded. As far as possible, the free time or physical activity periods were used for this study, so that their routine classes were unaffected.

In each class, with the help of class representatives, pre-designed and pre-tested questionnaire was distributed. The questionnaire was explained to students beforehand and the questionnaire consisted of 10 questions, which were to be answered by the students.

The dietary history was assessed by asking the students about main servings, number of junk food consumption at home/outside, and consumption of juices and carbonated drinks. The physical activity was assessed by asking frequency of exercise (walking briskly, swimming, running, jogging, race walking, and aerobics), outdoor games (volleyball, football, cricket, kabbadi, kho-kho, badminton, and lawn tennis), and mode of transport, and sedentary lifestyles was assessed by asking duration of watching television, computers, and day time sleep.

All anthropometric measurements were taken by trained investigators. Height and weight were measured, using "Seca" stadiometer (UNICEF) with beam balance, with a sensitivity of 0.1 cm and 0.1 kg, respectively. Zero error was set after every 10 measurements. Height was measured without any footwear. The student stood straight with heels, buttocks, back touching the vertical limb of the instruments, and stretching upwards to the fullest extent with arms hanging on the side. The head was aligned so that the lower rim of the orbit and the auditory canal were in the horizontal plane (Frankfurt plane). Mild upward pressure was exerted on the mastoid region bilaterally. Weight was measured without any footwear with minimal clothing (school uniform). BMI was calculated and children are identified as overweight if BMI was more than 85th percentile and obese if BMI was more than 95th percentile (IAP Growth Monitoring Guidelines for Children from Birth to 18 Year).[7]

Statistical analysis

Data was recorded on a pre-designed Performa and managed on Excel spread sheet. All the entries were double checked for any possible key-board error. Association of each of the categorical variable with overweight and obesity (outcome variables) is assessed with the Chi-square test and the strength of their association was computed by unadjusted odds ratio (95% confidence interval). Variables showing statistically significant association with the outcome variables ($P<0.05$) were considered as potential risk factors of overweight and obesity. Subsequently, these variables were simultaneously subjected to the stepwise multiple logistic regression model to determine the significant independent risk factor of overweight and obesity. Data analysis was performed using Epi Info 6 program (CDC Atlanta). In this study P value less than 0.05 was considered as statistically significant.

Results

Total 1209 students from two affluent high schools (one co-ed and one girl's school) who satisfied the inclusion criteria were enrolled in the study. Data of dietary and physical activity were found inadequate in 60 students and they were excluded. 1159 students were analyzed for overweight and obesity, out of which 816 (70.4%) were girls and 343 (29.59%) were boys. There were significantly more girls as compared to boys as one school selected in the study was girl's school. The overall prevalence of obesity and overweight was 6.55% and 13.9%. The prevalence of obesity and overweight was 6.7 and 15.1 in boys and 6.4 and 13.35 in girls, respectively. The prevalence of obesity and overweight was more in boys compared to girls but difference was very small and statistically non-significant.

Bivariate relationship of all the dietary and life style variables were statistically significant and were associated with an increase risk for obesity and overweight except day time sleeping [Table 1].

When the variables showing significant association at $P<0.05$ were simultaneously considered in a stepwise logistic regression model with overweight and obesity as a binary outcome it was observed that children consuming carbonated drink daily and more than three times per week were having 19.7 times (OR: 19.7; 95% CI=10.93–35.53) and 6.9 times (OR: 6.95; 95% CI=4.41–10.94) more risk of overweight and obesity. Similarly children taking snacks outside home daily and more than three times per week having 4.19 times (OR: 4.19; 95% CI=2.34–7.51) and 1.97 times (OR: 1.97; 95%

CI=1.24–3.11) more risk of overweight and obesity. More than two servings per week outside home increased the risk of overweight and obesity 7.97 times (OR: 7.97; 95% CI=5.23–12.15). The risk of overweight and obesity is twice when child consumed junk food more than once daily (OR: 2; 95% CI=1.30–3.08).

Eating while watching TV was associated with the risk of overweight and obesity 1.81 times (OR: 1.81; 95% CI=1.19–2.79) while watching TV or playing computer games for 1–3 h and more than 3 h increased the risk of overweight and obesity 1.84 (OR: 1.84; 95% CI=1.19–2.84) and 5.4 time (OR: 5.4; 95% CI=2.77–10.54), respectively. If child did not play outdoor game or play game only weekly risk of overweight and obesity increased by 4.29 (OR: 4.29; CI=2.46–7.47 and 2.93 times (OR: 2.93; 95% CI=1.78–4.84). Transport to school by bus or auto also associated with 2.81 times (OR: 2.81; 95% CI=1.41–5.61) increased the risk of overweight and obesity [Table 2].

Discussion

In the present study, the prevalence of obesity and overweight was 6.7 and 15.1 in boys and 6.4 and 13.35 in girls, respectively. Umesh Kapil *et al.*[8] showed the prevalence of obesity and overweight in boys 8.3% and 23.1% and in girls 7.4% and 24.7% among affluent adolescent school children in Delhi, while Agrawal *et al.*[9] observed the prevalence of obesity and overweight in boys 3.4% and 15% and in girls 3.4% and 10.2% in affluent adolescent school children from Ludhiana, Punjab. Khadilkar *et al.*,[10] from Pune, observed the prevalence of obesity and overweigh in affluent school boys 8.1% and 25%, respectively.

Table 1: Bivariate relationship between different variables: Obesity and overweight

Variables		Obesity and overweight				Odds ratio	95% CI	P value
		Yes	%	No	%			
Outside home servings per week	>2	161	67.9	145	15.7	11.35	8.19-15.71	0.000
	≤2	76	32.1	777	84.3	1.0		
Frequency of junk foods at home per day	>once	98	41.3	224	24.3	2.19	1.62-2.96	0.000
	once	139	58.7	698	75.7	1.0		
Frequency of snacks outside home per week	<2	75	31.6	508	55.1	1.0		
	>3	98	41.3	303	32.9	1.44	1.07-1.93	0.000
Carbonated drinks consumption per week	Daily	64	27.1	111	12.0	2.71	1.93-3.86	0.000
	<2	58	24.5	735	79.7	1.0		
	>3	86	36.3	149	16.2	2.95	2.15-4.06	0.000
	Daily	93	39.2	38	4.1	15.02	9.90-22.78	0.000
TV/Comp watching per day	≤1 h	84	35.4	553	60.0	1.0		
	1–3 h	86	36.3	323	35.0	1.05	0.078-1.421	0.000
	≥3 h	67	28.3	46	05.0	7.50	4.91-11.36	0.000
Outdoor games	Daily	46	19.4	439	47.6	1.0		
	Weekly	115	48.5	322	34.9	1.75	1.32-2.34	0.000
	None	76	32.1	161	17.5	2.23	1.61-3.07	0.000
Mode of transport to school	*W/C	18	07.6	138	15.0	1.0		
	Auto/ Bus	219	92.4	784	85.0	2.14	1.28-3.57	0.003
Daily exercise	Yes	36	15.2	216	23.4	1.0		
	No	201	84.8	706	76.6	1.7	1.4-2.5	0.018
TV watching while eating	Yes	99	41.7	320	34.7	1.34	1.01-1.80	0.043
	No	138	58.6	602	65.3	1.0		

Variables are arranged according to their significance *W/C means walking/cycling

Table 2: Risk factors for overweight and obesity using stepwise logistic regression analysis

Carbonated drink daily	19.7	10.9–35.53	0.000
Carbonated drink (>3 times/week)	6.95	4.41–10.94	0.000
Snacks outside home (>3 times/week)	1.97	1.24–3.11	0.000
>2 outside servings per week	7.97	5.23–12.15	0.000
TV/Computer games ≥ 3 h	5.40	2.77–10.54	0.000
Outdoor game weekly	2.93	1.78–4.84	0.000
No outdoor game	4.29	2.34–7.51	0.000
Junk food > once/day at home	2.00	1.30–3.08	0.001
Daily snacks outside home	4.19	2.46–7.47	0.003
Transport to school (Bus/auto)	2.81	1.41–5.61	0.003
TV watching while eating	1.81	1.19–2.79	0.005
TV/Computer game (1–3 h)	1.84	1.19–2.84	0.006
No exercise	1.84	0.80–2.33	0.24

Note: Variables are arranged according to their significance

Eating outside home was a significant risk factor in this study. It was attributable to the increased eating of high calorie food as many varieties available at restaurant. Those children buying lunch at school canteen and restaurants more likely to develop overweight and obesity.[9,11] Televisions' watching while eating increase the risk of obesity and overweight as it increases motivated responding for food and energy intake in children.[12] Eating during television watching may be triggered by cues presented in food-related advertisements. Research has shown that most commercials shown during children's television viewing are for food products[13] and that most foods advertised are of high energy density and poor nutritional quality.[14]

Junk food and snacks consumption at home and outside home is one of the risk factors for obesity and overweight. Junk food and snacks are more energy dense and higher in fat intake. It was observed that the prevalence of obesity and overweight grew from in children and adolescents with frequent snacking and consumption of junk food.[15,16]

Consumption of carbonated drinks was an independent significant risk factor for overweight and obesity. Consumption of these things increases weight as they add more calories and satiety is not addressed. Janes *et al.*[17] did a randomized control study which showed that decreasing consumption of these drinks decreased weight in obese and overweight. Moreno *et al.*[18] showed that drinking carbonated drinks increase obesity and overweight. Ravi and Truman[19] have also reported a high consumption of junk foods and carbonated beverages among overweight adolescents.

Mode of transport is one of the factors influencing the overweight and obesity. Penny Gordon-Larsen *et al.*[20] did similar studies in young adults where only 22% overweight were using active transport and 30% non-overweight were using active transport and they also found this factor is statistically significant.

Day time sleep was not significant contributor of overweight and obesity in our study as it is not supported by statistical analysis. There are not much study done to asses this factor but Gangwisch *et al.*[21] observed an increase in the prevalence of obesity with day time sleep and inadequate sleep during nights.

In the present study, TV watching more than 1 h found to be significantly associated with overweight and obesity. The association between TV viewing and overweight in youth, usually, is found to relate to snacking and physical inactivity during viewing time.[22]

Children not doing daily exercise are at risk for obesity and overweight in bivariate analysis but this was not an independent significant contributor in our study. As we did not measure time of daily exercise in our study so this might be the reason it was not found significant in logistic regression. Moderate daily exercises leads to a decrease in the prevalence of overweight and obesity.[23] The endocrinal society clinical practical guidelines recommend that schools should provide for 60 min of moderate to vigorous daily exercise in all grades.[24]

In the present study, it was found that children who did not play outdoor games had an increased risk of overweight and obesity. By encouraging children to play outdoor game not only increases their physical activity but also they remain fit.[25]

There were certain limitations in our study. As one of the schools selected was girl's school so there was disproportionate sex ratio. Therefore, larger samples are required to justify our results. Since we had to rely on the students for their physical activities and dietary patterns which may lead to many disadvantages like it was associated with a behavioral bias, relies on the memory, and recall of student and it was not very accurate. We took only qualitative data and didn't consider type of junk food and amount of soft drink and type of food consumed in canteen. There were fallacies in physical activity related questions as no details about type of exercise (moderate and vigorous) and details of outdoor games were taken.

The major conclusion drawn from this study is that low levels of physical activity, television watching or playing computer games, and consuming junk foods, snacks, and carbonated drink are associated with higher prevalence of overweight and obesity. Thus, participation in household activities and regular physical exercise could help in lowering the prevalence of overweight and obesity. Therefore, the role of physical activity, games, and sports should be emphasized, and facilities should be provided for outdoor games in schools, with

compulsory hours of sports and games. Government should take appropriate measure regarding control of food-related advertisement shown on television. There is an urgent need to educate the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects.

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