

Original Research Article

Prevalence of overweight and obesity amongst adolescents and identification of risk factors

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ABSTRACT

Background: Childhood overweight and obesity are global nutritional concerns that are on the rise. These are among the most prevalent nutritional problems in the developed and developing countries and are associated with increased consumption of processed and fast foods, dependence on television and computers for leisure and less physically active lifestyle.

Methods: The study has been conducted in the Department of Pediatric of Mahatma Gandhi Medical College of Mahatma Gandhi University of Medical Sciences and Technology, Jaipur. The study was a cross sectional analytical study conducted in schools of Jaipur. This study was done from August 2011 to November 2011 and 180 patients of aged between 10 to 18 years of age were enrolled.

Results: In this study, we found the prevalence of overweight to be 32.65 percent in males and 34.15 percent in females. It was seen that 33.67 percent males and 32.93 percent females belonged to the obese category. It was seen that majority of overweight (65 percent) and obese (73.33 percent) adolescents lead a physically inactive lifestyle. None of the overweight and obese adolescents were involved in physical activity for more than an hour. The observation was significant ($p=0.000$). Most of the overweight and obese adolescents had appropriate diet. However, 11 of the overweight and 27 among adolescents consumed calories more than the requirement. This observation was found to be significant ($p=0.000$). Out of 149 adolescents consuming fast food, 59 were overweight and 51 were obese. This observation was found to be significant ($P=0.015$).

Conclusions: The prevalence of overweight was 32 percent in boys and 34 percent in girls and the prevalence obesity was 33 percent in boys and 32 percent in the girls. There was no significant difference in overweight and obesity between boys and girls. Hours of physical activity, diet, consumption of fast food had a significant association with B.M.I. It was, therefore, concluded that reduced physical activity for less than 1 hour for less than 3 days a week, increased caloric intake and increased consumption of fast food have a significant association with BMI.

Keywords: Adolescent, Fast foods, Obesity, Overweight, Physical activity

INTRODUCTION

Childhood overweight and obesity are among the most prevalent nutritional problems in the developed and

developing countries and are on the rise. These problems are associated with increased consumption of processed and fast foods, dependence on television and computers for leisure and less physically active lifestyle.¹ Obesity

has serious long term consequences like hypertension, hypercholesterolemia, type 2 diabetes mellitus, left ventricular hypertrophy, non-alcoholic steatohepatitis, asthma, obstructive sleep apnoea, mental health concerns and orthopaedic disorders.²⁻⁴

Adolescent development proceeds in three distinct periods-early, middle, late, each marked by characteristics set of salient features.⁵ The process of growth and development adds to the vulnerability in this age group and can have adverse impact on their health. Challenges to adolescent health and development are numerous and often underestimated.⁶

Important health problems faced by adolescents include chronic infections, STIs, behavioral problems, substance abuse, eating disorders and improper nutrition.⁶

Adolescence is a crucial period of physical growth and sexual maturation. Adolescent growth and development is closely linked to the diet received during childhood and adolescence.⁷

Proper food and good nutrition are essential for physical growth, mental development, performance, health and wellbeing of adolescents. The adolescent growth spurt places extra demand on nutritional requirements. Inadequate nutrition in adolescence can potentially retard growth and sexual maturation.⁷ The adequacy of nutrition has been defined in Recommended Daily Allowance (RDA)*

Obesity is a global concern. Overweight and obesity are among the most prevalent nutritional problems in developed and developing countries.⁸ The increasing prevalence of overweight, obesity and its consequences prompted the World Health Organization to designate obesity as a global epidemic.⁹

The problem of obesity is confined not only to adults but also children and adolescents. According to WHO, 22 million children (under 5 years) are overweight.¹ Data from National Health and Nutrition Examination Services (NHANES) IV 1999-2000 indicate that 21 percent to 23 percent of children aged 6-17 yrs are overweight, based on the definition of >85th and <95th percentile of BMI, and 9 to 13 percent in this age group are obese, based on the definition of >95th percentile of BMI.¹⁰

Various studies also indicate that the prevalence of overweight and obesity amongst children of all ages is increasing in developing countries in the past few decades.^{8,9} Figures on the global prevalence of obesity have been compiled by the WHO, where countries like Brazil, Antigua, Zambia, Peru, show a prevalence of 2 percent. Jamaica and Chile show a prevalence of 10 percent in school children.¹¹

Various studies from India show the increased prevalence of obesity. Data from NFHS II (1998-1999) showed the

prevalence of obesity as 0.1 percent in the age group of 15 to 19 years.¹²

Another study conducted by the Nutrition foundation of India found among 5000 children aged 4 to 18 years in a Delhi private school, 29 percent were overweight.¹³ Obesity has a serious long-term consequences. Childhood obesity is not an immediately lethal disease itself, but has a significant risk factors associated with a range of non-communicable diseases in adulthood such as hypertension, type 2 diabetes mellitus, hypercholesterolemia, gall bladder diseases, cardiovascular diseases, asthma, mental health concerns and orthopedic disorder.²⁻⁴

Other common consequence of obesity is poor psychological functioning. Among adolescents, cross sectional studies have documented an inverse relationship between bodyweight and both self-esteem and body image.¹⁴

Various endocrinal disturbances are seen with obesity. Fat cells function as endocrine cells, producing many locally and distantly acting hormones, affecting hormonal patterns in obese patients.¹⁵ Commonly associated abnormalities are insulin resistance, increased insulin secretion, decreased testosterone levels in men, increased cortisol production and decreased growth hormone levels.¹⁶ Obesity is also associated with polycystic ovarian disease in adolescent females.¹⁷

Obese children also suffer from orthopedic disorders. The more serious of these include slipped capital femoral epiphysis¹⁸ and Blount disease.¹⁹

It was estimated that 50-80 percent of children with Blount disease were obese. Other minor problems associated are knocked knees, increased susceptibility to ankle sprains and flat feet.

Childhood obesity may be seen as the marker of high risk dietary and physical inactivity practices.²⁰⁻²³ Environmental and lifestyle factors are mainly responsible for promoting such practices.

It is hypothesized that television viewing causes obesity by one or more of the following ways:²⁴

- Displacement of physical activity,
- Increased calorie consumption and
- Decreased resting metabolism.

Consumption of fast food among children and adolescents seems to have an adverse effect on dietary quality in ways that possibly could increase the risk for obesity.²⁵

Consumption of diet high in sugar, saturated fat, salt and calorie content in children can lead to early development of obesity, hypertension, dyslipidemia and impaired

glucose tolerance. The ready availability, taste, marketing strategies and peer pressure make them popular with children and adolescents.²⁵

METHODS

Study design

The study was conducted from August 2011 to November 2011 under the Department of Pediatric medicine at Mahatma Gandhi Medical College, Jaipur. It was a cross sectional analytical study conducted in 180 school going children of Jaipur after getting approval from institutional ethical review board.

Study population

Subjects were adolescents in the age group of 10 years to 18 years studying in schools in the city of Jaipur.

Inclusion criteria

- Boys and girls in the age group of 10-18 years
- BMI < 85th percentile as normal, between 85th percentile and 9th percentile as overweight and > 95th percentile as obese
- Consent of parents
- Permission letter of principals of respective schools

Exclusion criteria

- Absence of consent of parents and / or principal,
- Children with active illness or chronic illness or having feature suggestive of genetic or endocrinal origin of obesity or on medication or any other factor that can alter the results.

Data collection

Appropriate data were collected using a pre-tested and validated questionnaire which includes data on socio-

demographic profile (age, sex, parents profile, physical activity, family history), dietary pattern and nutrient intake.

Measurements

Anthropometric measurements of height, weight, mean arm circumference, neck circumference, waist circumference and hip circumference, blood pressure were measured utilizing standard methodology.²⁶

Weight was measured by using SECA electronic weighing scale to the nearest 100gms. For measurement of height calibrated weight chart fixed on the wall was used and measurement was done to the nearest 0.1cm. The mean arm circumference, neck circumference, waist circumference and hip circumference were measured with the help of a non-stretchable fiber glass tape by cross tap technique to the nearest 0.1cm. BMI (body mass index) was calculated using the formula weight in kg divided by height in meter square [wt(kg)/ht(m)²].

Agarwal charts of BMI for age and sex were used as reference. Children with BMI above 95th percentile was considered as obese, children between 85th to 95th percentile were considered as overweight and below 85th percentile were considered as normal.

Statistical analysis

Statistical analyses were performed using SPSS software (SPSS version 13; SPSSInc, Chicago, IL). Chi square test was applied wherever needed and $P < 0.05$ was considered statistically significant.

RESULTS

A total of 180 students participated in the study. The study group included 98 boys and 82 girls. The students were grouped under early (10-13 years), middle 14-16 years) and late adolescence (17-18 years). The number of students in each group was 20, 58 and 102 respectively.

Table 1: Distribution of adolescents according their age and sex.

Stage of adolescence (age in years)	Male (%)		Female (%)		Total (%)	
	No.	%	No.	%	No.	%
Early (10-13)	11	11.22	9	10.98	20	11.11
Middle (14-16)	23	23.47	35	42.68	58	32.22
Late (17-18)	64	65.31	38	46.34	102	56.67
Total	98	100.00	82	100.00	180	100.00

Chi-square = 10.412, df=4, p=0.061

In this study, we found the prevalence of overweight to be 32.65 percent in males and 34.15 percent in females. It was seen that 33.67 percent males and 32.93 percent females belonged to the obese category. No statistically significant difference was observed between sexes

(p=0.978). We observed that the prevalence of overweight was 45 percent in early adolescence and 36.27 percent in late adolescence. However, the prevalence of obesity was 20 percent in early adolescence which increased to 27.45 percent in late adolescence.

It was seen that majority of overweight (65 percent) and obese (73.33 percent) adolescents lead a physically inactive lifestyle. None of the overweight and obese

adolescents were involved in physical activity for more than an hour. The observation was significant ($p=0.000$).

Table 2: Relationship of sex and obesity among adolescents.

Obesity (On the basis of BMI)	Male (%)		Female (%)		Total (%)	
	No.	%	No.	%	No.	%
Normal	33	33.67	27	32.93	60	33.33
Overweight	32	32.65	28	34.15	60	33.33
Obese	33	33.67	27	32.93	60	33.33
Total	98	100.00	82	100.00	180	100.00

Chi-square = 0.045, df=2, $p=0.978$

Table 3: Relationship of period of adolescence and BMI.

Obesity (On the basis of BMI)	Stage of Adolescence (Age in years)							
	Early [10-13]		Middle [14-16]		Late [17-18]		Total	
	No.	%	No.	%	No.	%	No.	%
Normal	7	35.00	16	27.59	37	36.27	60	33.33
Overweight	9	45.00	14	24.14	37	36.27	60	33.33
Obese	4	20.00	28	48.28	28	27.45	60	33.33
Total	20	100.00	58	100.00	102	100.00	180	100.00

Chi-square = 9.419, df=4, $p=0.051$

Table 4: Relationship of BMI and physical activity amongst adolescents.

Activity	Normal		Overweight		Obese		Total	
	No.	%	No.	%	No.	%	No.	%
0-30 mins (Minimal)	31	51.67	39	65	44	73.33	114	63.33
30 mins-1 hr (Moderate)	25	41.66	21	35	16	26.66	62	34.44
>1 hr (Good)	4	6.66	0	0	0	0	9	5.00
Total	60	100	60	100	60	100	180	100

Chi-square = 52.157, df=6, $p=0.000$

Table No. 5: Relationship of diet and BMI amongst adolescents.

Diet	Normal		Overweight		Obese		Total	
	No.	%	No.	%	No.	%	No.	%
Adequate	60	100	49	81.66	33	55	142	78.88
More	0	0	11	18.33	27	45	38	21.11
Total	60	100	60	100	60	100	180	100

Chi-square = 38.424, df=4, $p=0.000$

Table 6: Relationship of BMI and consumption of fast food amongst adolescents.

Fast food	Normal		Overweight		Obese		Total	
	No.	%	No.	%	No.	%	No.	%
Yes	39	65.00	59	98.33	51	85.00	149	82.77
No	21	35.00	1	1.6	9	15.00	31	17.23
Total	60	100	60	100	60	100	180	100

Most of the overweight and obese adolescents had appropriate diet. However, 11 of the overweight and 27 among adolescents consumed calories more than the requirement. This observation was found to be significant

($p=0.000$) Out of 149 adolescents consuming fast food, 59 were overweight and 51 were obese. This observation was found to be significant ($P=0.015$).

DISCUSSION

Study group profile

The present study included more boys than girls (54.44 percent vs. 45.55 percent) (Table 1) but the difference was not statistically significant ($p=0.061$). In a similar study conducted by Kapil et al from New Delhi had 64.5 percent boys²⁶ and in another study conducted by Chatwal and colleagues from Ludhiana included larger number of girls as compared to boys (52.1 percent vs. 47.9 percent, $p=0.00$).³⁰

Prevalence of overweight and obesity

The prevalence of overweight was 32.65 percent in boys and 34.15 percent in girls and the prevalence of obesity in our study was 33.67 percent in boys and 32.73 percent in the girls. A study conducted in New Delhi in 2001 reported the prevalence of overweight was 23.1 percent among boys and 24.7 percent among girls; while the prevalence of obesity was 8.3 percent among boys and 7.4 percent among girls.²⁶ However, in a study conducted in Ludhiana, Punjab estimated the overall prevalence of obesity to be 11.1 percent and overweight to be 14.2 percent.³⁰ The difference in the observation in our study is possibly due to smaller sample size.

Association of risk factors with overweight and obesity in adolescence

Age and Sex

The prevalence of overweight among adolescents was found to be highest in the age group of 10-13 years at 45 percent, decreasing to 24.14 percent in the age group of 14-16 years and then again increasing to 36.27 percent during 17-18 years of age (Table 3). However, the prevalence of obesity was highest in the middle adolescence at 48.28 percent. The study done in Delhi found that the maximum prevalence of obesity was in the age group of 10-12 years (38.7 percent).²⁷ Study conducted by Chatwal and colleagues has reported that prevalence of both overweight and obesity decreased significantly with increasing age till 14 years (from 21 percent to 10.6 percent for overweight and 18.5 percent to 7.6 percent for obesity) but tended to rise at 15 years (12.8 percent to 9.2 percent, respectively).²⁸

Both the above mentioned studies did not include adolescents in the age group of 17-18 years which have been included in our study.

The proportion of overweight and obese adolescents in the age group of 17-18 years was 54.16 percent, as observed in our study. Our study suggests that the high percentage in this group could possibly be because of increased intake of calories as among adolescents who consumed more than required calories, 57 percent were in their late adolescence. Also, of 149 fast food consumers,

61 percent were in their late adolescence. Physical activity was also found to be decreased in this age group. Among 114 adolescents who lead a physically inactive lifestyle, 70 belonged to the late adolescence stage.

It was also observed in the present study that the prevalence of overweight and obesity among boys was 32 percent and 33 percent, respectively, and the association of overweight was highest in the age group of 17-18 years (40.63 percent), while the prevalence of obesity was maximum in the age group of 14-16 years of age (52.17 percent). Similar trend was observed in another Indian Study from Hyderabad which found the highest prevalence of obesity to be 9.2 percent at 14 years of age decreasing to 5.3 percent at 17 years age.²⁹ Study done in New Delhi by Kapil and colleagues in 2001 observed that the prevalence of overweight and obesity decreased from 25 percent and 9.69 percent, respectively, during early adolescence to 20.5 percent and 6.58 percent, respectively, during middle adolescence.²⁷ This study did not include adolescents above 16 years of age.

Amongst girls, it was observed that 55.56 percent ($n=5$) of girls in their early adolescence were overweight decreased to 34.29 percent ($n=12$) during middle adolescence and further decreased to 28.95 percent ($n=11$) during late adolescence. It was also observed that the percentage of girls who were overweight increased from 33.33 percent ($n=3$) during early adolescence to 45.71 percent ($n=16$) during middle adolescence and later decreased to 21.05 percent ($n=8$) during late adolescence. The association of BMI with age amongst girls was significant ($p=0.023$). This decrease in prevalence of overweight and obesity amongst girls during late adolescence could be due to increased consciousness regarding body image and appearance. Similar trend was observed in the study conducted in Hyderabad where the prevalence of the overweight among girls decreased from 10.8 percent at the age of 15 years to 9.2 percent at 17 years.²⁹ This can be explained by the fact that there is an increase in adipose tissue and overall in children during puberty. Number of fat cells increased during periods of rapid growth till 16 years of age.²⁸ Also, in the study by Kapil and colleagues in New Delhi in 2001, the prevalence of overweight and obesity was observed to decrease from 28.02 percent and 6.5 percent, respectively during early adolescence to 27.2 percent and 4 percent, respectively during middle adolescence.²⁷ This study, however, did not include student above 16 years of age.

The difference of overweight and obesity observed between sex was not significant ($p=0.978$) (Table 2). The prevalence of overweight was 32.65 percent in boys and 34.15 percent in girls and the prevalence obesity in our study was 33.67 percent in boys and 32.73 percent in the girls. Similar insignificant difference between sex was observed in the study conducted in Hyderabad.²⁹ This study found 8.2 percent of girls were overweight while 6.2 percent of boys were found to be overweight. The difference was insignificant ($p>0.05$). Study done by

Chatwal and colleagues found that more boys were overweight (15.7 percent vs. 12.96 percent) as well as obese (12.4 percent vs. 9.9 percent) as compared to girls.²⁸ Kapil and colleagues also observed similar findings in their study in New Delhi²⁷. The study found on overall prevalence of overweight to be 23.1 percent among boys and 24.7 percent among girls, while the prevalence of obesity was higher in boys (8.3 percent vs. 7.4 percent) as compared to girls.

Diet

In our study, we observed a significant association between intake of calories and B.M.I. (Table 4). It was found that 18.33 percent of overweight and 45 percent of obese consumed excess calories. This observation was significant ($p=0.000$). No other Indian study under review has evaluated the association of diet and obesity.

Fast food

Consumption of fast food had a significant association with BMI (Table 6).

It was observed that 98.33 percent of overweight and 85 percent of obese adolescents consumed fast food. The observation was significant ($p=0.015$). Similar observations have been established in other studies. Study conducted in Hyderabad 2003 found that junk food (fast food) was liked by 21.7 percent of the study subjects.²⁹ Out of these student's 8.8 percent were overweight and 1.8 percent were obese.

Physical activity

This study reveals a positive association between physical activity and B.M.I. (Table 5.). Among the adolescence who performed physical activity for more than 1 hour for atleast 3 days per week, none was found to be either overweight or obese.

This group comprised of only 2 percent of the study population. Majority of overweight (65 percent) and obese (73.33 percent) adolescents belonged to the category of either no or less than 30 minutes of physical activity for less than 3 days per week.

Approximately 35 percent of overweight and 26 percent of obese indulged in physical activity for 30 minutes-1 hour. The association was found to be statistically significant ($p=0.000$).

The study conducted in Hyderabad in 2003 also analyzed the role of physical activity amongst adolescents.²⁹

The study revealed that the prevalence of overweight and obesity was significantly lower in the children who participated regularly in outdoor games and performed physical activity ($p < 0.001$). It was observed in this study that the prevalence of overweight and obesity among

students who participated in physical activity was 3.1 percent while among non-participants the prevalence of obesity and overweight was 9.7 percent.

CONCLUSION

From the observations of our study, it was concluded that; The prevalence of overweight was 32 percent in boys and 34 percent in girls and the prevalence obesity was 33 percent in boys and 32 percent in the girls. There was no significant difference in overweight and obesity between boys and girls. Hours of physical activity, diet, consumption of fast food had a significant association with B.M.I. It was, therefore, concluded that reduced physical activity for less than 1 hour for less than 3 days a week, increased caloric intake and increased consumption of fast food have a significant association with BMI.

Recommendations

Based on the observations of our study, it is recommended that; Adolescents should participate in at least 60 minutes of vigorous activity for at least 3 days per week. Consumption of fast food and excess calories should be avoided to prevent overweight and obesity. Therefore, strategies for obesity prevention, weight reduction, promotion of healthy lifestyles and regular monitoring are necessary during childhood and adolescence.

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