

ORIGINAL ARTICLE

Epidemiological determinants of obesity in adolescent population Maharashtra, India.Sanjeev Chincholikar¹, Amit Sohani²¹Professor, Department of Community Medicine, MIMER Medical College, Talegaon Dabhade, Pune – 410507;²Medical officer, Z.P. Kolhapur, India

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E Mail ID: aruna@mitmimer.com**Citation**

Chincholikar S, Sohani A. Epidemiological determinants of obesity in adolescent population, Maharashtra, India. Indian J Comm Health. 2016; 28, 2: 157-162.

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Background: For establishing effective intervention, it is important to identify major determinants in an early stage of life. Effective prevention of adult obesity will require prevention and management of childhood obesity. **Aims & Objectives:** To study the epidemiological determinants of obesity in adolescent girls. **Material & Methods:** All adolescent school going boys and girls in the age group between 10 to 19 years were included as per definition of adolescent. 585 students were selected by systematic sample i.e. every 3rd student was included in the study sample. A pretested standardized questionnaire which consisted of questions related to sociodemographic data was used to screen the population for obesity. **Results:** When body mass index was correlated with various socioeconomic variables, it was found that prevalence of obesity was more in males (overweight- 20.84%; obese- 5.43%) as compared to females (overweight- 16.92%; obese-3.14%), more in the upper socioeconomic status (27.27%) as compared to lower socioeconomic status(15%), more in subjects with more frequency of junk food(30.97%) as compared to having occasional junk food (20.93), more in subjects with more frequency of eating sweets (25.73%) as compared to occasional sweet eaters(13.59%). **Conclusion:** The dietary habits like more frequency of junk food, more sweet consumption, and socioeconomic status had a major impact on body mass index of children.

Keywords

Sex; Socioeconomic Status; Body Mass Index; Junk Food

Introduction

Obesity is widely regarded as a pandemic with potentially disastrous consequences for human health.(1,2) It is perhaps the most prevalent form of malnutrition. 65% of the world's population live in countries where overweight and obesity kills more people than underweight.

Available studies from Chennai and Delhi have shown prevalence of childhood obesity 6.2% and 7.4% respectively. (3) According to NHFS 3, in India 12.1% male and 16% female were either overweight or obese.(4) Many studies have shown that the prevalence of overweight among adolescent varies

between 10% to 30%. (5,6) For establishing effective intervention, it is important to identify major determinants in an early stage of life. Effective prevention of adult obesity will require prevention and management of childhood obesity. World Health Organization has also emphasized on urgent need of understanding the prevalence trend, factors contributing and developing strategies for effective intervention.

Aims & Objectives

1. To study the prevalence of overweight and obesity in adolescent population.

2. To determine the association of obesity with some epidemiological determinants

Material & Methods

It was a cross sectional observational study that was carried out in 4 institutions (3 schools and 1 college) of semi-urban area of Maharashtra from Jan 2013 to Jan 2014. A pilot study of 100 adolescents was carried out for determining sample size and validating the questionnaire.

Sample Size: It was found that the prevalence of obesity was 15%. Prevalence of obesity is between 10% to 30% in India as reported by various studies (10,11,12,13). Finding of pilot study confirm the prevalence as 15% in the reference population also. Therefore, considering prevalence of obesity in adolescent as 15%, with 95% confidence interval ($\alpha = 0.05$) power of test = 80% ($\beta = 0.2$), estimated sample size for adolescent population including 5% non-responsive error was 575. Actual study was carried out on 585 students.

Out of all the schools and colleges which provided education up to 10th standard or above 10th standard were considered as reference population. As there were no government schools or colleges providing teaching up to 10th standard or above, thus only private schools and colleges were represented in data. Thus, reference population consisted of 17 schools and 3 colleges, all private. 3 schools and 1 college were selected by simple random sampling. 585 students were selected by systematic sample i.e. every 3rd student was included in the study sample. A pretested standardized questionnaire was used.

Inclusion Criteria: All adolescent school going boys and girls in the age group between 10 to 19 years were included as per definition of adolescent.

Definition: Height and weight of each individual was measured with the help of fiber plastic measuring tape up to the nearest millimeters and weighing scale up to the 0.5 kg respectively. Height was measured by asking the subject to stand erect without footwear on flat surface with heels together and upper limbs hanging closely to the sides of the body with the investigator standing on the left side of the subject. By placing hard cardboard on the head of the subject marking was made on the wall and later with the help of measuring tape height was calculated to the nearest millimeters. Before making the markings the head of the subject was positioned in such a way that the imaginary line drawn from tragus of the ear to the infra-orbital margin was

parallel to the ground. For the weight measurement standardized calibrated spring balance was used and subject was made to stand on platform of the balance without footwear. The weight was recorded nearest to 0.5 kg. Body mass index was calculated by dividing the weight in kilogram by square of height in meter.

Ethical Clearance: The study was reviewed and approved by ethical committee of parent institute approved the study. It was also approved by the concerned committee of the Maharashtra University of Health Sciences Nashik. Permission for the study was obtained from respective in-charges of schools and colleges.

Results

It can be observed from [table I](#) that Prevalence of obesity was 4.5% while there were 20% overweight subjects. Prevalence of overweight and obesity was studied according to sex also and has been depicted in [table II](#). It was observed from the table that prevalence of obesity in a male population was more as compared to females. Similarly, prevalence of overweight was also found more in male population. Majority of the male and female were in the age group 10 to 13 years of age i.e. early adolescent.

Modified B.G. Prasad classification (2013), most widely used socio economic status classification, revealed that majority of the study population was from the upper socio economic status class. Only 6.49% subjects were from class IV. None belonged to class V. The table itself reflect the obvious reduction in obesity as socioeconomic class decrease. Owing to the unacceptable small value in one of the cells of the table, which would undermine the utility of chi-square test the data for class IV and class V were pooled for statistical analysis. As revealed from the [table III](#), there was a statistically significant difference between socioeconomic status and prevalence of either overweight or obesity.

$\chi^2 = 10.1504$, $df=3$, $p < 0.05$.

Type of diet and frequency of meal has been studied with respect to prevalence of overweight and obesity. When association between prevalence of obesity and overweight with type of diet of study subjects was studied, it was observed from [table IV](#) that there was no statistically significant difference between the two, meaning that type of diet may not be related to overweight and obesity.

$\chi^2 = 0.31$, $df= 1$, >0.05 .

It was observed that out of 165 students taking vegetarian diet, 21.82% students were either overweight or obesity. It was also found that 420 students were taking mixed diet but out of them only 24.29% were either overweight or obese. As mentioned in review of literature use of junk food is reported to be associated with obesity. Association of frequency of junk food with prevalence of overweight and obesity in study subjects is given in table.

It can be seen from [table V](#) that use of junk food frequently has a role in development of overweight and obesity. It was observed that overweight and obesity was relatively less in those who take junk food occasionally (once in a week or less). It can be seen that 30.97% overweight subjects had frequent junk food. There was a significant association between frequency of junk food and prevalence of overweight as well as obesity.

$\chi^2 = 4.865957$, $df=1$, $p < 0.05$.

From [table VI](#), It can be seen that consumption of junk food and sweets, frequently has a role in development of overweight and obesity.

$\chi^2 = 5.296657$, $df= 1$, $p < 0.05$.

Discussion

The detailed study brought out some salient features about demographic information, social status and nutritional status of the study subjects which has been discussed as below.

As revealed in table II, Prevalence of obesity in a male population was more as compared to females. Similarly, prevalence of overweight was also found more in male population. Goyal *et al*(7) in their study in 2010 found that age-adjusted prevalence of overweight was 14.3% among boys and 9.2% among girls. They also observed that prevalence of obesity was 2.9% in boys and 1.5% in girls. Kotian MS *et al*.(8) in their study in 2010, reported that, the prevalence of overweight among adolescents in both sexes was 9.9% and obesity was 4.8%. The prevalence of overweight was 9.3% among boys and 10.5% among girls; 5.2 and 4.3% were obese, respectively, which is comparable to our study. Arpita Mandal *et al*.(9) in their study recently, in Kolkata, India, evaluated 571 girls in the age group of 12 to 18 years. They observed that prevalence of overweight and obesity was 28.5% and 4.2% respectively. This prevalence of obesity in the above study is comparable to the prevalence of obesity among girls in our study. In a recently conducted study by Tabassum Nawab *et al*

(10) in Uttar Pradesh, it was found that prevalence of overweight and obesity was 9.8% and 4.8%, respectively. Prevalence of both overweight and obesity was higher among males. Similar findings are observed in our study.

Considering the different opinions among various researchers regarding which sex is more commonly affected group, it appears that a large representative sample will be required for settling this question. It appears that occurrence of obesity varies according to socioeconomic status; very few subjects are from class IV showed presence of either overweight or obesity. It would mean that subjects belonging to upper socioeconomic class may have more risk of becoming obese than those in lower classes. This confirms that socioeconomic status is one of the important factors in deciding the obesity among the adolescent population. Several studies in different part of the world including India showed that higher socioeconomic class have higher rate of overweight and obesity. In developing countries it has been observed that children from the upper socio-economic strata are more likely to be obese than children from the lower socio-economic strata.(11) Marwaha *et al*.(12) in a study carried out in Delhi, observed that, among the upper socio-economic status children, prevalence of overweight and obesity was 17% and 5.6% in boys and 19% and 5.7% in girls, respectively, whereas in the lower socio-economic status it was 2.7% and 0.4% in boys and 2.1% and 0.5% in girls, respectively.

Unnithan and Syamakumari (13) also reported that the prevalence of overweight and obesity were higher among urban children. Goyal RK *et al*.(7) in their study in western India, observed that prevalence of overweight among children was higher in middle socioeconomic status as compared to high socioeconomic status group in both boys and girls whereas the prevalence of obesity was higher in high socio-economic status group as compared to middle socioeconomic status group. The prevalence of obesity as well as overweight in low socioeconomic status group was the lowest as compared to other group.

One possible explanation for the different socioeconomic status - overweight and obesity relationship in developing countries such as India is that the influence of socioeconomic status on people's lifestyles such as diet, food consumption patterns, and public services such as health care and transportation and physical activity may differ.

Richer people have better access to meat and other energy-dense foods (which are much more expensive than other foods such as vegetables) than the poor. Middle socioeconomic status groups usually consume more vegetables and fruits. As revealed from table VI, there was statistically significant difference between frequency of eating sweets and prevalence of overweight as well as obesity. Obesity was more in study subjects who ate sweets frequently. 25.73% Students with overweight and obese subjects were frequent sweet eaters.

Caprio S. *et al* (14) from America reported a strong association between sugar-sweetened beverages and prevalence of childhood obesity. Andrew A (15) in his study observed that overweight and obesity decreases as sugar-sweetened beverage consumption is reduced.

Eating habits and prevalence of overweight and obesity:

According to the WHO expert committee (16), high intakes 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. Increased intake of energy-dense foods that are high in sugars and fat but low in proteins, micronutrients, vitamins and minerals play important role in childhood obesity. (17) A diet containing more energy than needed may lead to prolonged postprandial hyperlipidemia and deposition of triglycerides in adipose tissue resulting in obesity. (18) From a practical point of view all hypothesis concerning the genesis of obesity could be put down to over-nutrition, to a hyper energy food intake. This is a sound basis for preventive and therapeutic recommendations. (19) There was a significant association between frequency of junk food, sweets with prevalence of overweight as well as obesity. These results correlate well with previous reports which suggest that junk food (bakery items, pizza, burger, cheese, butter, oily items) chocolate intake tends to be more common among overweight and obese adolescents than among normal-weight adolescents. (20,21) Hanley JG *et al* (22) concluded that low consumption of fruits, green vegetables, and milk; increasing consumption of snacks, sweets, and soft drinks; and skipping breakfast; these eating habits result in continuous increase in adiposity among children. Tarek Tawfi, K Amin *et al* (23) in their study revealed that lean students consumed

more servings of fruits; vegetables; and dairy products, including milk, while overweight and obese children consumed significantly higher servings of egg, potato (especially fried), carbonated soft drinks, sugary drinks, and sweets per day. They also observed frequency of eating out was high among overweight and obese children.

Berkey CS *et al* (24) in their longitudinal study of preadolescent and adolescent boys and girls observed association between frequency of restaurant visit and obesity. Kotian MS *et al* (8) found that prevalence of overweight was higher in those adolescents who ate chocolates daily. Sameer H and Ghamdi AI (25) found a higher BMI in adolescent population who, ate more than three snacks per day. Goyal *et al*, (7) found a correlation between frequency of eating and overweight as well as obesity in adolescent population. They also observed correlation between junk food consumption and overweight as well as obesity

Conclusion

One thing that can be mentioned from the present study is that, as age increased gradually, students may have become cautious about their figure and health, and may have tried to consume less amounts of junk food, which was reflected in the lower prevalence rate of overweight, as well as obesity, in the higher age groups

It can be concluded that the dietary habits like more frequency of junk food, more sweet consumption, and socioeconomic status are the factors which had a major impact on body mass index of children. These risk factors may be considered as potential determinants of obesity.

Recommendation

Obese students should be counselled for nutrition, psychological changes, behavioural changes, pharmacological management and surgical intervention if necessary.

Limitation of the study

Out of all the schools and colleges which provided education up to 10th standard or above 10th standard were considered as reference population. As there were no government schools or colleges providing teaching up to 10th standard or above, thus only private schools and colleges were represented in data. Moreover, this being institutionalized study, community based studies on a larger representative sample of adolescent children will be needed for

confirming and quantifying the epidemiological determinants of obesity. The responses given by the study subjects at that were relied upon. Lastly, being a multifactorial disease all the associated risk factors could not be studied.

Authors Contribution

All the authors had made substantial contributions to conception, design, data collection, analysis and interpretation of data; drafting the article, revising it critically for important intellectual content; and final approval of the version to be published.

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Tables

TABLE I PREVALENCE OF OVERWEIGHT AND OBESITY IN STUDY SUBJECTS

BMI	Number of students	Percentage
Obese	26	4.44
Overweight	112	19.14
Normal range & below	447	76.41
Total	585	100

TABLE II PREVALENCE OF OVERWEIGHT AND OBESITY ACCORDING TO SEX

BMI	Male No. (%)	Female No. (%)	Frequency No. (%)
Students with normal weight and below	244 (73.71)	203 (79.92)	447 (76.41)
Overweight	69 (20.84)	43(16.92)	112 (19.14)
Obese	18 (5.43)	8 (3.14)	26 (4.44)
Total	331 (100)	254 (100)	585 (100)

TABLE III ASSOCIATION OF SOCIOECONOMIC STATUS PREVALENCE OF OVERWEIGHT & OBESITY

Socioeconomic status	Number of students No. (%)	Students with normal weight and below No. (%)	Students with overweight and obesity No. (%)
Class I	171(29.23)	119 (69.59)	52 (30.41)
Class II	214(36.58)	161 (75.23)	53 (24.77)
Class III	162(27.69)	136 (83.95)	26 (16.05)
Class IV	38 (6.49)	34 (89.47)	4 (10.53)
Class V	0(0)	0 (0)	0 (0)
Total	585(100)	447 (76.41)	138 (23.59)

$\chi^2 = 10.1504, df=3, p < 0.05.$

TABLE IV ASSOCIATION OF TYPE OF DIET WITH PREVALENCE OF OVERWEIGHT AND OBESITY

Type of diet	Number of students No. (%)	Students with normal weight and below No. (%)	Students with overweight and obesity No. (%)
Vegetarian	165(100)	129(78.18)	36(21.82)
Mixed	420(100)	318(75.71)	102(24.29)
Total	585(100)	447(76.41)	138(23.59)

$\chi^2 = 0.31, df= 1, p>0.05$

TABLE V ASSOCIATION OF FREQUENCY OF JUNK FOOD WITH PREVALENCE OF OVERWEIGHT AND OBESITY IN STUDY SUBJECTS

Frequency	Number of students No. (%)	Students with normal weight and below No. (%)	Students with overweight and obesity No. (%)
Occasional	430 (100)	340 (79.07)	90 (20.93)
Frequent	155 (100)	107 (69.03)	48 (30.97)
Total	585 (100)	447 (76.41)	138 (23.59)

$\chi^2 = 4.865957, df=1, p < 0.05.$

TABLE VI ASSOCIATION OF FREQUENCY OF EATING SWEETS PER WEEK WITH PREVALENCE OF OVERWEIGHT AND OBESITY

Frequency (per week)	Number of students No. (%)	Students with normal weight and below No. (%)	Students with overweight and obesity No. (%)
Occasional	103 (100)	89 (86.41)	14 (13.59)
Frequent	482 (100)	358 (74.27)	124 (25.73)
Total	585 (100)	447 (76.41)	138 (23.59)

$\chi^2 = 5.296657, df= 1, p < 0.05$