

# Dietary Habits and Obesity among Adolescent School Children: A Case Control Study in an Urban Area of Kancheepuram District

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## Abstract

**Background:** Obesity is an important public health problem and is on the rise among adolescents in developed and developing nations. This case-control study was done to assess the dietary risk factors associated with obesity among school children of the adolescent age group. **Materials and Methods:** This study was done among age-matched 110 cases and 110 controls who were adolescent children between ages 10 and 17 years. Data were collected using a pretested, structured, interviewer-administered questionnaire and was analyzed using descriptive and analytical statistics. **Results:** About 52.7% of children belonged to the age group 13–15 years. Adequate fruits intake was reported by 42.7% of obese adolescents and 60% of nonobese adolescents. Adequate intake of vegetables was noted in 20.9% of cases and 24.5% of controls. The risk factors which were found to be statistically associated with adolescent obesity were increased fast food intake, sweets consumption, inadequate fruit intake, and the liberty given by the parents in purchasing snacks. **Conclusions:** Since adolescent obesity is rising at an alarming rate, the dietary determinants of obesity need to be addressed at the level of schools, families, and community. School health services should include education on healthy food habits and regular monitoring of the health status of children. Parents need to be aware on the significance of balanced diet, avoidance of junk foods, and ensure adequate intake of fruits and vegetables for their children to prevent early onset of noncommunicable diseases.

**Keywords:** Bodyweight, food habits, over nutrition, school-students

## INTRODUCTION

Obesity is a preventable risk factor and the prevalence of obesity is increasing in children including adolescents. Nearly 340 million children including adolescents were overweight or obese in the year 2016. Between 1975 and 2016, the rates of obesity have increased more than four-fold among children including adolescents.<sup>[1,2]</sup> Children living in low- and middle-income countries are more susceptible to poor antenatal nutrition, and inadequate infant and young child nutrition. At the same time, these children are exposed to food items with high fat and salt content, more calories but less micronutrients. These dietary patterns, in synergy with low levels of physical activity, result in the sharp rise in childhood obesity while undernutrition issues remain unresolved.<sup>[3,4]</sup>

The fundamental cause of obesity and overweight is an energy imbalance between calorie intake and output.<sup>[5]</sup> The etiology

of obesity is complex and multiple factors play a role in the development of obesity. Among them, modifiable risk factors are physical activity, socioeconomic status, eating habits, psychosocial factors and endocrine disorders.<sup>[6]</sup> In recent days, worldwide there has been an increase in intake of energy-dense foods that are rich in fat. This is coupled with the reduction in physical activity due to the sedentary nature of work, increasing urbanization, advances in science and technology, and changing modes of transportation.<sup>[7]</sup>

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Adolescent obesity is identified as an important risk factor for the development of various preventable non-communicable diseases (NCD's) later in adulthood. Hence, primordial and primary prevention activities among adolescents play a major intervention strategy to prevent NCD's in adulthood. Very few studies have been done in Tamil Nadu, using case-control study design to evaluate the various factors associated with the development of obesity in the adolescent age group. Children in the schools are the prime targets to assess the determinants for obesity and to plan preventive measures. Hence, we planned to do this study among adolescent school children to assess the nutritional factors associated with obesity among the cases and control groups.

## MATERIALS AND METHODS

### Study design and study area

This school-based case-control study was carried out in Chrompet, which is an urban residential area in Tambaram Taluk of Kancheepuram district, Tamil Nadu.

### Study population and study period

Chrompet is a calm residential locality in Tambaram taluk which has a total urban population of 3,56,322 where various schools and colleges are located. The study population covered in this study was school children between the ages 10 and 17 years, studying in V standard to XII standards. The study was conducted between October 2019 and January 2020.

### Sample size

The sample size for this study was calculated using the proportion of exposure among cases and controls based on a reference study done by Bhuiyan MU *et al.*<sup>[8]</sup> The formula used for sample size calculation was  $(N = [Z_{1-\alpha/2} + Z_{1-\beta}]^2 P q [r + 1] / [P_1 - P_2]^2 r)$ . With the proportion of exposed as 59% among cases and 40% among controls, taking 5% as type I error and 20% as type II error, ratio of controls to cases as 1:1, required sample size was calculated as 110 obese adolescents (cases) and 110 nonobese adolescents (controls).

### Inclusion and exclusion criteria

Students for the study were included based on the body mass index (BMI) for age and sex criteria.<sup>[9]</sup> Willing students who had a BMI for age and sex  $>+2$  SD of WHO growth reference median was taken as a case, and BMI for age and sex between  $-2$ SD and  $+1$ SD was taken as a control. Students who had a BMI for age and sex between  $+1$ SD and  $+2$ SD and those with a BMI for age and sex  $<-2$ SD were excluded from the study.

### Sampling method

Out of the 22 schools listed under the Directorate of Education in the study area, 16 of them were Higher Secondary Schools. From the list of Higher Secondary Schools, two schools were selected by using simple random sampling method. Permission was obtained from the head of the institution after explaining the aims and objectives of this study. From each school, information on the number of sections for each class and the number of students in each section was collected. From each

section, cases and controls were recruited using the purposive sampling method, based on the BMI for age and sex chart as given by the World Health Organisation. For the selection of controls, the group matching (frequency matching) method was adopted taking age as the factor for group matching.

### Ethics committee approval and informed consent

The Institutional Ethics Committee of Sree Balaji Medical College and Hospital approved the study. Written informed consent was obtained from each parent after explaining about the study in detail. Written or oral assent was obtained from children depending on their age.

### Data collection

The data were collected using a standardized, pretested, structured questionnaire. Data were collected on sociodemographic characteristics, family history of obesity, physical activity, and dietary intake. Parents were contacted over the phone to collect information regarding parents' education, occupation, income, parents' weight and height, sibling's weight and height, and dietary assessment. Information on meal frequency, patterns of meal skipping, frequency of consumption of fruits and vegetables were also noted. Frequency of eating out in restaurants, liberty by the parents in buying snacks, TV watching behavior while having food were also assessed.

### Statistical analysis

Data collected were entered in Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, N.Y., USA). The statistical analysis of the data was done using descriptive and analytical statistics. The descriptive statistics analyzed were presented as frequency distribution and percentage. The analytical statistics for categorical data used were Chi-square, odds ratio, 95% confidence interval (CI) and *P* value.

## RESULTS

A total of 110 obese adolescents (cases) and 110 nonobese adolescents (controls) group matched for age were included in this Case-Control study. Cases and controls were adequately matched to ensure comparability. The results of the study are presented below.

### Socio-demographic characteristics of cases and controls

Nearly 53% belonged to the age group of 13–15 years. About 55.5% were females among the cases and 51.8% were females among the controls. With regard to the educational status of the father, around 50.9% have completed graduate degree among cases and 60% among controls. Around 60% of mothers of both cases and controls have completed graduate degree.

Socio-economic status was categorized according to the Modified Kuppaswamy classification (updated February 2019). Nearly 54.5% of the cases belonged to upper-middle class, 30% to lower middle class, 10% to upper class, and 5.5% to the upper lower class. Similarly, among the controls, 70% were in upper-middle

class category, 16.4% in upper class and 13.6% in lower middle class. About 34.5% of cases and 4.5% of controls were the only child in the family. Nearly 84.5% of the children among cases and 73.6% among controls belonged to nuclear type of family.

### Comparison of dietary habits of obese and nonobese adolescents

The dietary patterns and their association with adolescent obesity are presented in Table 1. About 17.3% of cases and 10.9% of controls had the habit of skipping breakfast. Increased consumption of fast food was noted among 40% of cases and 21.8% of controls. Increased intake of chocolates or sweets was reported by 35.5% of cases and 11.8% of controls. Adequate fruits intake was reported by 42.7% of cases and 60% of controls. Adequate vegetables intake was noted in 20.9% among cases and 24.5% among controls. The habit of increased visits to restaurants was noted in 15.5% of cases and 10.9% of controls. Parents' restriction in allowing children to buy snacks was noted among 57.3% of cases and 81.8% of controls.

**Table 1: Dietary habits of adolescents and their association with obesity**

Factor	Frequency, n (%)		OR (95% CI)	P
	Cases (n=110)	Controls (n=110)		
Habit of skipping breakfast	19 (17.3)	12 (10.9)	1.7 (0.78-3.71)	0.17
Increased fast food consumption	44 (40.0)	24 (21.8)	2.39 (1.32-4.32)	0.0035*
Increased intake of chocolates/sweets	39 (35.5)	13 (11.8)	4.1 (2.04-8.24)	0.0001*
Inadequate Fruits intake	47 (42.7)	66 (60.0)	2.01 (1.17-3.45)	0.01*
Inadequate Vegetables intake	23 (20.9)	27 (24.5)	1.23 (0.65-2.33)	0.63
Increased visits to restaurants	17 (15.5)	12 (10.9)	1.49 (0.68-3.29)	0.32
Liberty to buy snacks without restriction by parents	47 (42.7)	20 (18.2)	3.34 (1.82-6.27)	0.0001*

\* $P < 0.05$  statistically significant at 95% CI. OR: Odds ratio, CI: Confidence interval

### Association between dietary factors and adolescent obesity

The risk factors which showed a statistically significant association with adolescent obesity were increased intake of fast food, increased intake of chocolates/sweets, inadequate intake of fruits and freedom given to adolescents in buying snacks without any restriction by parents. Other dietary factors such as breakfast skipping, inadequate vegetables intake and increased dining out in restaurants did not show a statistically significant association with adolescent obesity.

### DISCUSSION

This case-control study conducted in an urban area of the Kancheepuram district of Tamil Nadu, regarding the dietary habits and obesity among adolescent school children had given interesting results. Various dietary factors of the cases and controls were analyzed and the risk factors identified in this study were, increased fast food intake and chocolates/sweets intake, inadequate fruits intake and liberty given to adolescents by parents in buying snacks.

#### Intake of fast food

In this study, increased fast food intake was found to be associated with adolescent obesity. Similarly, in the case-control study by Rathnayake *et al.*, fast food intake more than four times a week was reported as risk factor for adolescent obesity.<sup>[10]</sup> Panda SC in a similar study from Eastern India reported taking fast food as risk factor for obesity in adolescents.<sup>[11]</sup> Vohra *et al.* in a study done among school-going adolescents in Lucknow, Uttar Pradesh reported consumption of fast food as a risk factor for the development of obesity.<sup>[12]</sup> Foods which are served in fast-food restaurants generally contain high number of calories with low nutritive values. This can be a major contributing factor for the development of obesity among adolescents.

#### Intake of chocolates/sweets

In this study, increased chocolates or sweets intake was found to be associated with adolescent obesity. Similarly, in the study by Rexlin *et al.* done in Madurai, unhealthy food habits like snacking on sweets and chocolates were reported as a risk factor for adolescent obesity.<sup>[13]</sup> Similar finding was noted in a study by Nisak *et al.* done in Surabaya, Indonesia.<sup>[14]</sup> Bo *et al.* in their study done in Italy analyzed the dietary habits of a cohort of 400 adolescents and reported increased frequency of intake of chocolates as a risk factor for adolescent obesity.<sup>[15]</sup> Intake of energy-dense foods coupled with minimal or no physical activity can contribute to the development of obesity among adolescents.

#### Inadequate fruits intake

In the present study, inadequate intake of fruits was found to be associated with adolescent obesity. In the case-control study by Rathnayake *et al.* in Srilanka, fruits intake <4 days a week was reported as risk factor for adolescent obesity.<sup>[10]</sup> Menezes *et al.* in a case-control study among adolescents in

Brazil, found that obesity had a significant association with less consumption of fruits.<sup>[16]</sup> Piryani *et al.* in a similar study done in Nepal noted that children who consumed fruits less than four times a week are at risk of developing obesity.<sup>[17]</sup> In the study by Rexlin *et al.*, intake of fruits was reported as a protective factor against obesity.<sup>[13]</sup> Epidemiological studies have shown that adequate intake of fruits and vegetables is beneficial in preventing the development of obesity, diabetes, cardiovascular diseases, and cerebrovascular accidents.<sup>[18,19]</sup>

### Parental control over children in purchasing snacks

Similar to this study, Li *et al.* in a study among adolescents in China reported a lack of parental control as a risk factor for the development of adolescent obesity.<sup>[20]</sup> Parents by restricting their children not to buy snacks on their own without permission would help in limiting the intake of unhealthy snacks. This is relevant in the present era where all forms of unhealthy snacks are readily available in shops and supermarkets. Parents should guide their children in choosing healthy food items by patiently educating them on the nutritive values of healthy snacks and the detrimental effects of unhealthy eating.

### Skipping breakfast

In the case-control study by Rathnayake *et al.*, skipping breakfast was found to be a potential risk factor for adolescent obesity.<sup>[10]</sup> Menezes *et al.* in a case-control study among adolescents in Brazil, found that obesity had a significant association with the habit of omitting breakfast.<sup>[16]</sup> However, in the present study, skipping breakfast didn't show statistical significance, though 17.3% among cases and 10.9% among controls had the habit of skipping breakfast. Studies have shown that having regular breakfast was found to be associated with lower levels of blood cholesterol and lower body weight.<sup>[21]</sup> The significance of having regular breakfast in improving their overall health and academic performance need to be taught to the students.

### Limitations of the study

The dietary pattern, lifestyle behavior, and physical activity of children in urban areas may be different when compared to children living in rural areas. Biochemical assessment was not done due to a lack of adequate funds. Recall bias is also one of the major limitations as there could be errors in recollecting the dietary intake.

### CONCLUSIONS

This case-control study assessed the dietary habits associated with obesity among adolescent school children in an urban area of Kancheepuram district, Tamil Nadu. As adolescent health will be reflected in adulthood, interventions during the period of adolescence will pave way for better quality of life in the future. A combination of interventions at various levels such as school, home, and community levels are required to address the dietary habits associated with adolescent obesity. School health services must include education of children on balanced diet intake. Canteens in schools should make healthy foods available to children and avoid junk foods. Parents should be motivated to send healthy snacks to children to schools.

They need to be educated on the selection of locally available, low-cost nutritious food items and the significance of molding good dietary habits of their kids from childhood.

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### Conflicts of interest

There are no conflicts of interest.

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