## **Original Research Article**

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# Dietary correlates of overweight and obesity among adolescents during the current nutrition transition: a cross sectional study in Kerala

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#### **ABSTRACT**

**Background:** Overweight and obesity during childhood is a matter of growing concern among many low and middle income countries. Obesity in the developing world can be seen as a result of a series of changes in diet, physical activity health and nutrition. This is collectively known as 'nutrition transition.

**Methods:** The present study was conducted in an urban area of Kottayam district in Kerala. The schools were stratified into government, aided and unaided categories. Cluster sampling technique was used and data was collected after informed consent.

**Results:** Obesity and overweight were found to be higher in children who consume butter/ghee, fried local foods, red meat/chicken and pizza/burgers frequently. The factors related to eating behaviour include time for finishing meals, parent force to eat, skipping of breakfast, family eats out and consumption of fast food.

Conclusions: Nutritional transition has contributed to the problem of adolescent obesity.

Keywords: Obesity, Overweight, Dietary factors, Eating behaviour, Adolescent

## INTRODUCTION

Childhood obesity is one of the most serious public health challenges of the 21st century. Many low- and middle-income countries are now facing a "double burden" of disease: as they continue to struggle with the problems of infectious diseases and under-nutrition; at the same time they are experiencing a rapid increase in risk factors of NCDs such as obesity and overweight, particularly in urban settings. <sup>2</sup>

Overweight and obesity is an important health concern in urban areas of Kerala also. The 'nutritional transition' and the lifestyle changes are becoming important among the adolescents in Kerala. 'Fast foods' are increasingly becoming popular and eating behaviors among the adolescents are also changing. This study was conducted to assess the dietary factors and eating behaviours related to obesity among adolescents.

## **METHODS**

Study design

Cross sectional study.

Study period

6months from July 2015 to January 2016

#### Study setting

High schools in urban area of Kottayam district.

## Sampling

There are 15 high schools in the municipal area of Kottayam. The schools were stratified as government aided and unaided schools. This includes 2 government schools, 11 aided schools and 2 unaided schools. Population of 8th, 9th and 10th standard of each school was ascertained and the total population was estimated, which was found to be 5840 students. One school was taken as one cluster and a total of 6 clusters were covered. Since there were only 2 schools, each in the government and unaided category, 1 government school and 1 unaided school were selected randomly. In the government school, only 29 high school students were there. All these students were selected for the study. The selected school in the unaided category had 204 students and all these students were also included. The cumulative population of high school students in the aided School category was 5212. Four clusters were identified from this population. The cumulative population was divided by the number of clusters (4) and the sampling interval was estimated. This was found to be 1303. A number less than this number was identified using a random number table (1097). The cluster which contained this number was taken as the first cluster. Then sampling interval of 1303 was added to this number to find out the next cluster. (1097+1303=2400). The cumulative population equal to 2400 was taken as 2nd cluster and this process was continued until 4 clusters are obtained. All the high school students in the selected cluster (school) were covered. By this way, 759 high school students were selected from the aided schools. So the final sample size came to be 992 high school students, (29 from government schools, 204 from unaided schools and 759 from Aided schools).

## Sample size

The sample size was calculated using the formula

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 (N-1) + z^2 \cdot p \cdot q} = 423$$

(N=5840, z=1.96, prevalence (p)=5%, q=1-p, and acceptable error of 2% at 95% confidence limits) where N is the total population, 'p' is the prevalence of the factor under study (obesity), 'q' is (1-p) and 'e' is the acceptable error. According to a study conducted by Unnithan et al among school going children in Thiruvananthapuram district, the prevalence of obesity was found to be 4.99%. So 'p' was taken as 5%. By applying the design effect of 2, the sample size is estimated to be 846 high school children.

#### Data collection and analysis

Consent was taken from the head of the institution. The data was collected using semi structured interview schedule. The weight of the student was measured using a weighing machine with a precision of 0.5 kg. For measuring the height, the student was made to stand on a level surface without shoes, then the height in cm was taken. Overweight and obesity among the study population was estimated using, BMI for age Z scores (WHO, 2007).<sup>4</sup> A child who's Z BMI for age between +1 and +2 standard deviations from the reference population was defined as overweight. Z BMI for age more than +2 standard deviations from the reference population was defined as obese. WHO AnthroPlus software version 1.0.2 was used for calculating Z scores. Further analysis was done using SPSS statistical software 16.0 version. Chi-square test was used for evaluating the level of significance.

#### Ethical considerations

The study was approved by the Institutional Ethics Committee. Consent for participation was obtained from school authorities in an informed written consent form.

#### **RESULTS**

The age distribution of the study population varied from 12 years to 18 years. The total number of males in the present study was 447 and the number of females was 545. The prevalence of obesity as per the present study was 5.1% and the prevalence of overweight was 10.8%.

Among the overweight and obese children, majority were taking non-vegetarian diet (16.10%).

Total percentage of children who were obese and overweight among those who take butter once in a week was 25.6% where as in the group who were taking once in a month it was 16.7%. It was 13.1% among the group who were taking butter and ghee rarely. This difference was found to be statistically significant.

Another variable which was taken into consideration is consumption of fried local foods like samosa, banana fry, cutlet etc. Total percentage of children who were obese and overweight among those who take fried local foods once in a week was 19.3% where as in the group who were taking once in a month it was 15.7%. This difference was also found to be statistically significant.

Other variables included in the present study were consumption of red meat and chicken. It was noted that total percentage of children who were obese and overweight among those who consume red meat once in a week was 23.5% where as in the group who were taking once in a month it was 14.4%. Similarly obesity and overweight were more among children who consume chicken once in a week.

**Table 1: Dietary factors.** 

	Z-BMI for age	Z-BMI for age	
	Obesity and overweight (%)	Not overweight (%)	P value
Type of diet			
Veg	5 (11.60)	38 (88.40)	0.431
Non veg	153 (16.10)	796 (83.90)	
Butter/ghee			
>Once in a week	45 (25.60)	131 (74.40)	0.000
Once in a month	30 (16.70)	150 (83.30)	
Rarely	83 (13.10)	553 (86.90 )	
Fried local foods			
>Once in a week	89 (19.30)	371 (80.70)	0.007
Once in a month	39 (15.70)	210 (84.30 )	
Rarely	30 (10.60)	253 (89.40)	
Red meat			
>Once in a week	55 (23.50)	179 (76.50)	0.001
Once in a month	49 (14.40)	291 (85.60)	
Rarely	54 (12.90)	364 (87.10 )	
Chicken			
>Once in a week	51 (20.10)	203 (79.90)	0.013
Once in a month	72 (16.90)	354 (83.10)	
Rarely	35 (11.20)	277 (88.80)	
Pizza/burgers			
>Once in a week	26 (28.60)	65 (71.40)	0.002
Once in a month	31 (16.70)	155 (83.30)	
Rarely	101 (14.10)	614 (85.90)	

Table 2: Eating behaviour.

	Z-BMI for age		Duolise
	Obesity and overweight (%)	Not overweight (%)	P value
Mid-time snacking			
Yes	115 (17.00)	561 (83.00)	0.172
No	43 (13.60)	273 (86.40)	
Time for finishing meals			
<5 minutes	30 (54.50)	25 (45.50)	0.000
5-10 minutes	58 (16.20)	300 (83.80)	
>10 minutes	70 (12.10)	509 (87.90)	
Parental force to eat			
Yes	125 (17.60)	585 (82.40)	0.022
No	33 (11.70)	249 (88.30)	
Skipping breakfast			
Once in a week or more	57 (22.40)	198 (77.60)	0.001
Rarely or never	101 (13.70)	636 (86.30)	
Family eat out			
Once in a week or more	56 (34.40)	107 (65.60)	0.000
Rarely or never	102 (12.30)	727 (87.70)	
Fast food			
Daily	6 (31.6)	13 (68.4)	0.005
Weekly	30 (23.8)	96 (76.2)	
Occasionally	122 (14.4)	725 (85.6)	

Obese and overweight children those who consume pizza/burger once in a week was 28.6%. In the group who were taking pizza/burger once in a month it was 16.7%.

This difference was also found to be statistically significant.

Among the students with mid time snacking, 17% were belonging to obese and overweight group where as it was 13.6% among children with no mid time snacking.

Fast eating is very common among obese and overweight children. Children who were obese and overweight among those who finish meals less than 5 minutes were 54.5% and those who complete meals within 5-10 minutes were 16.2% only. Among the group who complete meals with more than 10 minutes it was 12.1%. This difference was found to be statistically significant.

Parental force to eat is an important determinant of obesity and overweight. Percentage of children who were obese and overweight among whose parents forces them to eat was.17.6%. In the group where there is no parental force it was 11.7%. This difference was also found to be statistically significant.

Breakfast is the most important meal of the day. In the present study it is observed that the total percentage of children who were obese and overweight among those who skipped breakfast once in a week or more was 22.4%. In the group who were skipping breakfast rarely or never it was 13.7%.

Another eating behavior related factor considered was frequency of family eat out. The total percentage of children who were obese and overweight among those who eat out with family once in a week or more was 34.4%. Among the group who eat out rarely or never it was 12.3%. Similarly the percentage of children who were obese and overweight among those who consumed fast food daily was 31.6%. In the group who take fast food weekly, it was only 23.8%.

#### DISCUSSION

## Dietary factors

The most important difference between vegetarian and non-vegetarian diet is that the former contains large amount of dietary fibers. Diet rich in dietary fibers have low incidence of diseases like coronary heart diseases, obesity, and diabetes etc. Moreover non-vegetarian foods are high in cholesterol content. Studies conducted by Bas et al showed that low BMI and decreased prevalence of overweight were associated with vegetarianism in Turkish adolescents.<sup>5</sup>

Dairy products, particularly butter and ghee are rich in fat content. Frequent intake can lead to fat deposition in the body

Frequent consumption of fried local foods could be a risk factor for obesity. These fried food items are rich in transfatty acid which can lead do high LDL cholesterol and low HDL cholesterol. The relation between fried foods and obesity was noted in various studies as the one conducted by Gullalar et al in spain.<sup>6</sup>

Consumption of more red meat was suggested to be a factor contributing to body weight gain in China in a study conducted by Xu et al.<sup>7</sup> Moreover, frying with oil increases the fat content.

Pizza and burgers are rich in fat with high amount of cheese. This may be the reason for higher proportion of obesity and overweight among those who consume these items frequently.

#### Eating behaviour

Frequent snacking can adversely affect students' health status, due to the abundance of energy dense and high fat ingredients they contain. Studies conducted by Yahia et al reported higher proportion of snacking in obese Lebanese students.<sup>8</sup>

The present study shows that eating fast would lead to obesity. Similar results were reported in many previous studies like the one conducted by Otsuka et al in Japan. Another study by Barkeling et al on eating behavior showed that obese children ate faster. <sup>10</sup>

Another eating related factor considered in the present study was parental force to eat. Forcing the child to eat can result in overeating. Compelling a child to overeat tells them that it is socially acceptable to overeat. Later this overeating may become a habit which may be continued in adult life also.

The present study shows that the proportion of obesity is more among students who skip their breakfast. Similar results were reported from studies conducted by Berkey et al among adolescents. When breakfast is skipped metabolic rate slows down and blood sugar drops. This leads to eat extra servings or bigger portions at lunch or dinner. The skipping of breakfast has been associated with lower nutritional status and the risk of cardiovascular diseases. Regular meal patterns are important to ensure cycles of appetite and satiety.

Frequency of eating out has an impact on energy intake of children. The cumulative effects of an excess energy intake could in the long-term contribute to weight gain. Eating foods away from home have been implicated as a cause for increased energy intakes world-wide. Studies conducted by Swaminathan et al among urban school children in south India reported that increased frequency of eating out can result in increased daily energy intakes which can lead to obesity. Another study conducted by Aggarwal et al among affluent adolescents from Ludhiana also reported a significant association between obesity and eating out. 14

Fast food consumption is another eating behavior related variable taken into consideration in the present study. Fast food generally has a high-energy density, which, together with large portion sizes, induces over consumption of calories. Studies conducted by Crawford et al concluded that obesity is associated with fast food consumption.<sup>15</sup> Similar results were obtained in studies conducted by Jeffery et al in US.<sup>16</sup> Fast food in most countries contains unacceptably high levels of trans-fatty acids. Trans-fatty acids have powerful biological effects and may contribute to increased weight gain, abdominal obesity, type 2 diabetes and coronary artery disease.<sup>17</sup>

## CONCLUSION

Nutritional transition has contributed to the problem of adolescent obesity. As per the present study, obesity and overweight were found to be higher in children who consume the butter/ghee, fried local foods, red meat and chicken, pizza/burgers frequently. The eating behavior factors related to obesity were time for finishing meals, parent force to eat, skipping breakfast, family eats out and use of fast foods. This study shows that reduction in calorie rich foods and modification of eating behavior has got a role in reducing obesity among adolescents.

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