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# Composition of energy intake and consumption of snacks among overweight/obese adolescents

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**ABSTRACT**

World Health Organization (WHO) defines obesity as a condition of excessive fat accumulation in adipose tissue to the extent that health may be impaired. Overweight and obesity are defined by body mass index for gender and age. The problem of obesity is confined not only to adults but also to children and adolescents. An increased intake of sugar sweetened beverage is associated with higher energy intake, weight gain, obesity and diabetes. Restaurant foods especially fast foods contain more calories, more fat per calorie and less fiber than homemade foods. Since junk foods are high in energy, excessive consumption of junk foods, coupled with lack of adequate physical activity may contribute to obesity. The aim of present study is to find out the macronutrient composition of energy intake among selected overweight/obese adolescents and to estimate the snacking consumption of the selected overweight/obese adolescents.



## Introduction

World Health Organization (WHO) defines obesity as a condition of excessive fat accumulation in adipose tissue to the extent that health may be impaired (Anon, 2000). Overweight and obesity are defined by body mass index for gender and age (Manu et al.,2007). The problem of obesity is confined not only to adults but also to children and adolescents. Data from NHANES IV (National Health and Nutrition Education Survey) 1999-2000 indicates that 21 to 23% of children aged 6-17 years are overweight, based on the definition of $\geq 95^{th}$ percentile of BMI (Mohan et al.,2004). Result of a study from Punjab revealed that children in the age group of 11-17 years residing in urban areas were more overweight (11.6%) compared to children from rural areas (4.7%) (Kapil et al.,2001). A study in Delhi on affluent school children showed the prevalence of obesity to be 7.4% (Troiana et al.,1999). Caloric beverages have been recognized an important source of energy in children and have been associated with increased risk of overweight (Ludwig et al.,2001; Schulze and Hu, 2005). An increased intake of sugar sweetened beverage is associated with higher energy intake, weight gain, obesity and diabetes. (Malik et al.,2006; Vartanian et al.,2007). Restaurant foods especially fast foods contain more calories, more fat per calorie and less fiber than homemade foods (Lin et al.,1999; Guthrie et al.,2002). Since junk foods are high in energy, excessive consumption of junk foods coupled with lack of adequate physical activity may contribute to obesity (Sudershan and Subba, 2008). The aim of present study 1)To find out the macronutrient composition of energy intake among selected overweight/obese adolescents 2)To estimate the snacking consumption of the selected overweight/obese adolescents.

## Materials and Methods

### Selection of Samples

The present study was carried out at Salem block in Salem District, Tamil Nadu, India. Totally nine schools were located at Gorimedu in Salem. From that, six schools were selected by simple random sampling technique. Cross-sectional data were collected from December-2010 to March-2011. About 2254 students including 1142 boys and 1112 girls from $6^{th}$ to $10^{th}$ standard in the age group of 11+-15+ years were included for the study.

### Data Collection

### Anthropometric measurements

Anthropometric measurements including height and weight were used to assess the nutritional status of each subject. These were recorded by the standard techniques (Jelliffee, 1966). Height was measured by a portable steadiometer and weight was measured by an electronic weighing balance and BMI was calculated. Based on anthropometric measurements, overweight/obese adolescents (No.=101) were screened and included for depth study.

### Dietary Pattern

A 24hr dietary recall method was used to collect the food intake of the selected overweight/obese adolescents for three consecutive days. Nutritive value (energy, protein, fat, carbohydrate and fiber) of the food was calculated with the help of Nutritive Value of Indian foods. Total intake occasions including total number of main meals, light meals, snacks and drink-only, whereas eating occasions including all intake occasions except drink-only. Drink-only includes drink occasions both with or without energy. Total intake occasions, eating occasions and drink occasions were collected from the selected overweight/obese subjects.

Snacking behaviour was assessed by asking how often over per day they had snacked in the following contexts: While TV watching, while hanging out with friends, while doing home work and on the way to or from school, the possible responses were never, once or twice, frequently.

### Statistical Analysis

The software package SPSS version 16.0 was used for statistical analysis. Descriptive statistics was used to summarise

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the prevalence and dietary intake of the overweight/obese adolescents.

Linear regression was used to examine whether four different snacking contents (Predictor variable) were associated with BMI. Since snacking contexts were not mutually exclusive, adolescents could include the same snacking behaviour in more than one content (e.g: while TV watching and while hanging out with friends), and the linear regression analysis was performed separately for each snacking content. For each snacking context, adolescents were classified into one of three groups: never, once or twice and frequently per week.

**Results and Discussion**

**Prevalence**

Totally 3.77 and 0.67 percent of adolescents were found to be overweight and obese respectively. About 3.23 and 0.70 percent of boys were found to be overweight and obese respectively. Similarly 4.31 and 0.71 percent of girls were noticed as overweight and obese respectively. A similar study was done in Punjab showed that the prevalence of combined overweight and obesity is more in girls (16.66%) than in boys (12.48%) (Agarwal et al.,2001). Charma et al., (2008) who reported that 56.7 percent were overweight girls and 43.3 percent were overweight boys in various age groups ranging from 9 to 17 years.

**BMI, Energy intake, Macronutrients and Fibre intake**

Table-1 reported that the BMI of the overweight/obese girls (25.32) was higher when compared to overweight/obese boys (24.32). The overweight/obese girls had more energy (2058.71Kcal) and fibre (24.99g) intake than energy (2041.02Kcal) and fibre (23.73g) intake of the overweight/obese boys. The percentage of macro nutrients like protein, fat and carbohydrate intake of overweight/obese girls were higher than overweight/obese boys. Though nutrients intake were higher in girls, no significant difference was found in BMI, energy, fibre and percentage of macronutrients intake between overweight/obese boys and overweight/obese girls. Change in dietary patterns in the past few decades, such as an increase in the consumption of high fat and sugar foods, have been also implicated in the increase in obesity (WHO, 2003).

**Table-1**

**BMI, Energy intake, Macronutrients and Fibre intake of the selected overweight/obese adolescents (No. =101)**

| Variables | Boys (No.=45) Mean ± SD | Girls (No.=56) Mean ± SD | t value |
|---|---|---|---|
| BMI | 24.32 ± 2.33 | 25.21 ± 2.21 | 0.25 NS |
| Energy intake(Kcal) | 2041.02 ± 72.07 | 2058.71 ± 67.54 | 0.82 NS |
| E % Protein | 8.83 ± 0.74 | 9.05 ± 0.97 | 1.29 NS |
| E % Fat | 19.03 ± 2.26 | 19.63 ± 2.33 | 1.30 NS |
| E % Carbohydrate | 70.56 ± 9.86 | 72.48 ± 10.78 | 0.93 NS |
| Fibre(g) | 23.73 ± 5.49 | 24.99 ± 6.28 | 1.41 NS |

No. = Number, SD = Standard Deviation, E = Energy, % = Percent, NS = Not Significant, BMI-Body Mass Index

**Intake occasions and energy intake in boys Vs girls**

Table-2 shows that the mean number of intake occasions, eating occasions, snacks and drink only were higher in the overweight/obese girls than the overweight/obese boys. The main meals of the overweight/obese boys were similar to overweight/obese girls. No significant difference was observed in intake occasions, eating occasions, snacks and drink only between overweight/obese boys and girls. This result is similar with the study conducted by Berteus et al.,(2005) who reported that the mean number of intake occasions, eating occasions, snacks and drink only were higher in the obese group than in normal group ($p<0.001$) and drinks sweetened with sugar, which are major contributors to energy in all dietary patterns, are increased weight gain (Gills and Bar, 2004; Novotny et al.,2004).

**Table-2**

**Intake occasions and energy intake in boys Vs girls of the selected overweight/obese adolescents (No. =101)**

| Variables | Boys (No.=45) Mean ± SD | Girls (No.=56) Mean ± SD | t value |
|---|---|---|---|
| Intake occasions | 5.80 ± 0.69 | 5.86 ± 0.72 | 0.40 NS |
| Eating occasions (Without drink) | 4.62 ± 0.49 | 4.66 ± 0.48 | 0.39 NS |
| Main meals | 3.00 ± 0.00 | 3.00 ± 0.00 | 0.00 |
| Snacks | 1.67 ± 0.48 | 1.70 ± 0.46 | 0.31 NS |
| Drink only | 2.58 ± 0.50 | 2.66 ± 0.48 | 0.84 NS |

No.= Number, SD =Standard Deviation, NS = Not Significant, Intake occasions = Main meals +light meals + snacks + drink only, Eating occasions = Main meals +light meals + snacks, Main Meals = Breakfast +Lunch +Dinner.

**Snacking pattern of the overweight/obese girls**

The table-3 indicates that adjusted R square value was 0.443. It reveals that the four independent variables in this model account for 44.3% variance in the dependent variable-Body Mass Index. The P value for beta coefficient of snacking while TV watching was 0.088 (95% CI- 0.155 to 2.174), snacking while hanging with friends was 0.765(95% CI- 1.22 to 0.906), snacking while doing homework was 0.085(95% CI- 0.135 to 1.999), snacking on the way to or from school was 0.353(95% CI- 0.516 to 1.421). By using multivariate linear regression analysis, no significant difference was observed between the snacking pattern and BMI of the overweight/obese adolescents and the variance inflation factors of all the selected independent variables less than five, it indicated that the absence of multi collinearity (No correlation among the set of independent variables).

**Snacking pattern of the overweight/obese boys**

The table-4 indicates that adjusted R square value was 0.328. It reveals that the four independent variables in this model account for 32.8% variance in the dependent variable-Body Mass Index. The P value for beta coefficient of snacking while TV watching was 0.916 (95% CI - 1.747 to 1.941), snacking while hanging with friends was 0.496 (95% CI - 0.794 to 1.610), snacking while doing homework was 0.315 (95% CI - 0.582 to 1.758), snacking on the way to or from school was 0.349 (95% CI - 0.774 to 2.138). By using multivariate linear regression analysis, no significant difference was observed between the snacking pattern and BMI of the overweight/obese adolescents and the variance inflation factors of all the selected independent variables less than five, it indicated that the absence of multi collinearity (No correlation among the set of independent variables). It is observed in the study conducted by Gayle et al.,(2007) who reported that majority of the obese adolescents consumed snacks while viewing television among the six categories whereas a very less percent ranging from six to eleven did not consumed snacks while watching TV.

**Table-3**
**Multivariate linear regression analysis for the snacking pattern of the overweight/obese girls**

| Model | | Adjusted R square | Standardised coefficients | T | Sig | 95% confidence interval for B | | Collinearity statistics | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Beta | | | Lower board | Upper board | Tolerance | VIF |
| 1 | (Constant) | 0.443 | | 11.571 | 0.000 | 13.216 | 18.771 | | |
| | Snacking while TV watching | | 0.272 | 1.742 | 0.088 | -0.155 | 2.174 | 0.416 | 2.403 |
| | Snacking while hanging with friends | | -0.041 | -0.300 | 0.765 | -1.224 | 0.906 | 0.542 | 1.845 |
| | Snacking while doing homework | | 0.264 | 1.756 | 0.085 | -0.135 | 1.999 | 0.446 | 2.242 |
| | Snacking on the way to or from school | | 0.113 | 0.938 | 0.353 | -0.516 | 1.421 | 0.700 | 1.428 |

Dependent variable: BMI, VIF = Variables Inflation Factor

**Table-4**
**Multivariate linear regression analysis for the snacking pattern of the overweight/obese boys**

| Model | | Adjusted R square | Standardised coefficients | T | Sig | 95% confidence interval for B | | Collinearity statistics | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Beta | | | Lower board | Upper board | Tolerance | VIF |
| 1 | (Constant) | 0.328 | | 8.445 | 0.000 | 11.819 | 19.271 | | |
| | Snacking while TV watching | | 0.023 | 0.106 | 0.916 | -1.747 | 1.941 | 0.314 | 3.182 |
| | Snacking while hanging with friends | | 0.101 | 0.687 | 0.496 | -0.794 | 1.610 | 0.700 | 1.428 |
| | Snacking while doing homework | | 0.160 | 1.018 | 0.315 | -0.582 | 1.758 | 0.620 | 1.613 |
| | Snacking on the way to or from school | | 0.163 | 0.949 | 0.349 | -0.774 | 2.138 | 0.518 | 1.932 |

Dependent variable: BMI, VIF = Variables Inflation Factor.

It was reported that children who viewed television consumed high fat foods and fast foods and drink more soft drinks and consumed fewer fruits and vegetables.

**Conclusion**

This study concluded that the percentage of overweight/obese adolescents is growing in Salem district, Tamil Nadu. The highest prevalence rate of overweight/obese was seen among girls than boys. We found a link between composition of energy intake and consumption of snacks and obesity. Most of the overweight/obese adolescents had more frequent intake occasions and high energy intake. Food choice and snacking need to be considered in obesity treatment, prevention and general dietary recommendations.

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