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Correlation of food habits with the prevalence of overweight and obesity among adolescents in Jorhat town, Assam

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Abstract

The present investigation was undertaken to assess the food habits of overweight and obese adolescents of Jorhat town, Assam and thereby correlate with the prevalence of overweight and obesity. A total of 1007 high school boys and girls from seven different schools of Jorhat town constituted the basic frame of sampling, out of which 44 adolescents were screened out as overweight and obese based on their BMI. Standard techniques and pre-tested and structured schedules were used to elicit information on different parameters of food consumption behavior. Most of the overweight and obese adolescents followed a 3-4 meal pattern with majority of them (95.45%) being non-vegetarians. Significantly higher intake of cereals, fats/oils and non-vegetarian items were reflected in their dietaries. Consumption of fruits, vegetables and milk were significantly low for both the genders, pulse consumption being significantly low for girls and nearly adequate for boys. The mean macro nutrient intakes were significantly high at 0.01 level of significance. Frequency of fast food consumption of boys was higher than the girls with not much difference in the commonly consumed food items by boys and girls. Also a positive correlation with significant association ($r=0.5394$) was documented between the intake of meat/fish/egg with elevated BMI of the overweight boys.

Keywords: overweight, obesity, BMI, macro nutrient

1. Introduction

Overweight and obesity is fundamentally a problem of energy balance. It develops when the energy intake is in excess of energy expenditure, difference in input and output being buffered primarily by changes in the fat stores. Understanding the basis of how the balance between intake and expenditure is regulated has been a long standing challenge in fundamental biology. The simplicity of the energy balance equation has led to an appropriate focus on obesity as being either a problem of food intake control or of energy expenditure.

Overweight/obesity used to be understood in fairly simple terms and it was believed that excess body weight results from too much eating and exercising too little. Adolescence is a transitional stage in the life cycle linking childhood with adulthood - a crucial period of life. This important physiological group deserves attention of their health and nutritional status particularly in terms of overweight and obesity. The overweight teenager is now a visual urban phenomenon. The problem has become almost an epidemic and obesity has become globesity. It is universally known that high fat diet is associated with body fatness or gain in weight, studies have revealed that at an early age of three years, children of obese parents demonstrated an increase preference for high fat food. Data available also suggest that food preferences developed in childhood tend to track into adulthood. Dietary behaviour and nutritional status are closely interlinked. Now-a-days, junk foods replacing the other types of healthy foods results in obesity (Tiwari and Sankhala, 2007) [7].

Common causes of weight gain are eating large portions of food (more than the recommended intake for a particular age and sex based on the nature of work), frequent consumption of food, eating fried and junk foods, using chocolate as a reward and eating while watching TV. These affect the physical activity of children (Singh *et al.* 2006) [6].

Therefore the present investigation was undertaken with an aim to study the dietary pattern of the overweight and obese adolescents of Jorhat town emphasizing on the food habits, meal pattern, food consumption pattern and the food and nutrient intake and thereby correlating the

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food habits with the prevalence of overweight and obesity among the screened subjects.

2. Materials and Methods

The study was undertaken on selected samples from seven high schools, both English and Assamese medium situated in Jorhat district of Assam. The sample population consisted of adolescent boys and girls in the age group of 13-15 years studying in class VIII – IX. Overweight and obese adolescents were screened out for detail investigation using BMI criteria, from the basic frame of 1007 samples.

The 24-hour dietary recall method was used to assess the nutritional status of the subjects in the present study. This method was adopted due to convenience of the researcher, as everyday visit to each sample household was not possible.

Dietary subject was conducted on the subjects and their mothers were interviewed to recall the amount of foods/beverages consumed by the subject during 24-hours in the preceeding day. Additionally, they were asked to maintain

a diary for three consecutive days recording the daily activities and food intake at each and every hour of the day. Thereafter, the information collected through diet survey and maintenance of diary were cross checked to reveal results on the following aspects.

Food habits

Meal patterns

Frequency of food consumption at school

Food intake

Nutrient intake

The cooking methods along with the ingredients used were recorded. The individual food consumption were recorded by comparing standardized set of containers with their household measures. The cups and other utensils used in the survey for estimation were standardized in the laboratory both for volume and raw equivalents.

The raw equivalents were calculated from intake of cooked amounts in the following way –

$$\text{Individual intake in terms of raw equivalents (g)} = \frac{\text{Total raw amount of each preparation (g)}}{\text{Total cooked amount (g)}} \times \text{Individual intake } \times \text{ of cooked amount (g)}$$

Individual nutrient intakes were calculated by using food composition tables of Nutritive Value of Indian Foods (ICMR, 2004). Prior to this, the quantity of individual foods consumed were recorded in data sheets.

3. Results

A total of 1007 school children were included in the study out of which 44 children were screened out as overweight and obese adolescents.

Overall prevalence of overweight and obesity in the total population was found to be 4% and 0.4% respectively. Prevalence of obesity being very nominal is contributed by only 0.3% class I and 0.1% class II obese sample.

3.1 Food habits of overweight and obese adolescents

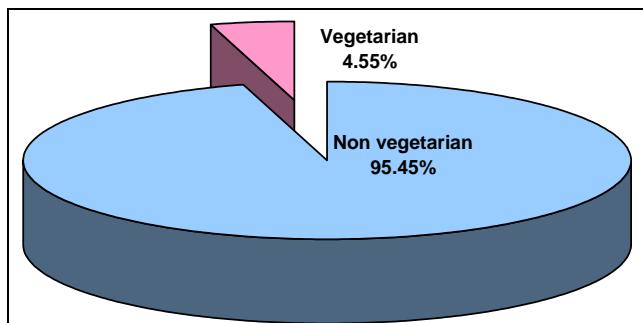


Fig 1: Percentage distribution of screened samples according to food habit

Diet survey on food habits (Fig. 1) indicates that 95.45 per cent of the overweight and obese samples were non-vegetarians and only 4.54 per cent were vegetarians. Most of the inhabitants in this part of the country being non-vegetarian, majority of them habitually consume non-vegetarian foods during their major meals. Moreover, boys generally preferred to consume non-vegetarian items while eating out and thus contributing more number of non-vegetarians to total respondent. This trend reflects in the food habits of adolescents where majority were non-vegetarian lovers.

3.2 Meal pattern of overweight and obese adolescents

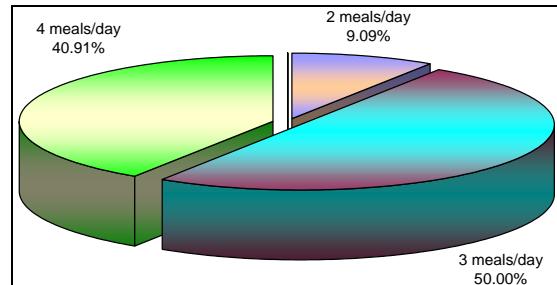


Fig 2: Percentage distribution of overweight and obese adolescents according to meal pattern

Fig. 2 depicts the meal pattern of the overweight and obese adolescents. It was seen that majority of the respondents (50%) followed a three meal pattern consisting of lunch before school lunch after school and dinner. About 41 per cent of sample respondents followed a four meal pattern and only 9.09 per cent of them followed a two meal pattern.

Large number of the overweight and obese adolescents adhering to a three meal pattern may be due to fixed academic schedules, as a result of which children do not get time to consume more than three heavy meals a day. On the other hand, children consuming four meals a day is due to consuming a heavy packed lunch at school. About 9 per cent children consumed two meals a day while none of the overweight or obese adolescent consumed more than four heavy meals per day. However, it was observed that those who consumed two meals, took several snacks and other light items in between.

3.3 Frequency of food consumption at school

Frequently consumed food items by boys of all the age groups were paratha, chappati or puri along with some vegetables followed by chowmein and maggi noodles (Fig. 3). Sandwiches and french toasts were consumed less frequently. Sometimes they also carried rolls and flaked rice pulao prepared at home. Cakes/ pastries were consumed minimally by boys of all age groups. Snacks like channa, bhujia etc. were also less frequently consumed by the boys. Sweets were

not favourite school tiffins among the boys. Thus, it can be opined that majority of the overweight and obese adolescent boys preferred heavy snacks and salty items rather than sweets at school. None of them were found to consume fruits at school.

Similarly it was observed that paratha/ chappati/ puri with vegetable preparation were consumed most frequently by girls followed by maggi noodles and chowmein. The frequency of consumption of snacks like bhujia, channa and other mixtures

along with these items were high among girls. In addition, girls also consumed flaked rice pulao, cakes/ pastries and varied sweets and desserts more frequently than boys. Thus, it can very rightly be opined that girls too preferred snacks and salty items along with some sweets and desserts. The analysis thus reveal that the frequency of food consumption among boys and girls did not vary greatly excepting for consumption of sweets and savouries and light items like channa mixture, bhujia etc (Fig. 4).

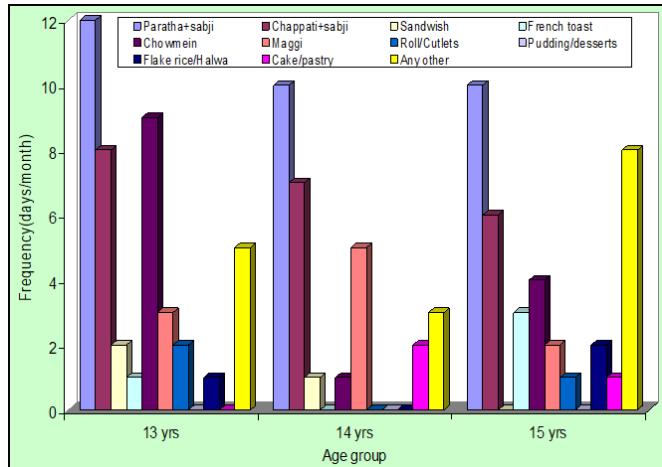


Fig. 3: Frequency of different food consumed by overweight and obese adolescent boys (13-15 Years)

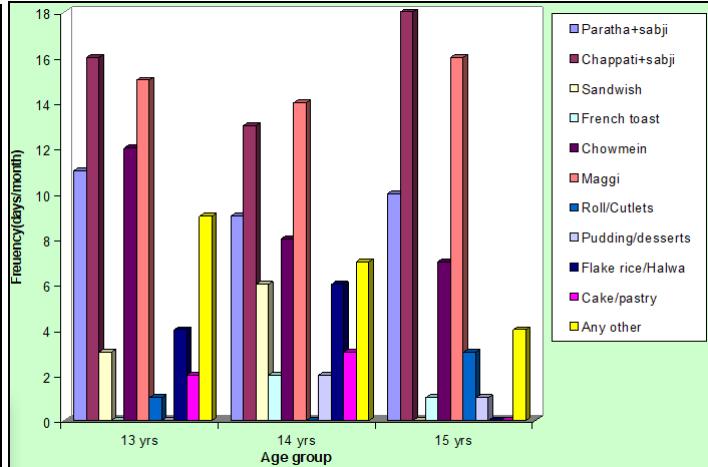


Fig 4: Frequency of different food consumed by overweight and obese adolescent girls (13-15 Years)

3.4 Food and nutrient intakes

The adequacy of food intake in terms of different food groups were calculated separately for boys and girls. From the mean food intakes, nutrients adequacy was calculated for further analysis. The mean food intakes for boys and girls were compared with recommended balanced diet given by ICMR. Since, 13 to 15 years are grouped together for both the genders in the balanced diet and RDA table of ICMR, the mean food and nutrient intake were calculated considering all three age as one group.

3.4.1 Food intakes

The food intake of overweight and obese adolescent boys, (Table 1) were surplus in terms of cereals (+54.65 g), fats/oils (+15.78g) and meat/fish/egg (+72.22 g) which was statistically significant at 0.01 level of significance. Sugar consumption was also found to be higher. On the other hand, other vegetables (-29.63 g) and green leafy vegetables (-37.01 g) were slightly deficient while milk (-221 ml), roots and tubers (-107.15 g) and fruits (-54.29 g) met only half of the recommended balanced diet, which can also be said to be grossly deficient.

Table 1: Mean food intake of overweight and obese adolescent boys (13-15 years).

Food stuff (g/day)	Mean intake (g/day)	SD	RDA#	Excess/ Deficit	t value
Cereals	474.65	53.25	420	54.65	5.43**
Pulses	54.25	18.76	60	-5.75	1.62ns
Green leafy vegetables	62.99	16.76	100	-37.01	11.68**
Other vegetables	70.37	20.19	100	-29.63	7.77**
Roots and tubers	92.85	43.49	200	-107.15	13.04**
Fruits	45.71	18.19	100	-54.29	15.79**
Milk	278.57	93.64	500	-221.43	12.51**
Oil	40.78	11.47	25	15.78	7.28**
Sugar	37.28	9.35	35	2.28	1.29ns
Meat/fish/egg	122.22	51.99	50	72.22	7.35**

* Significant at 0.05 level of significance

** Significant at 0.01 level of significance ns Non significant

#Dietary guidelines for Indians, NIN, ICMR publication 2003

Similar observations were also made in case of girls (Table 2). Consumption of cereals (+62.56 g), oil (+12.79 g), sugar (+5 g) and meat/fish/egg (+57.5 g) were higher than the recommended balanced diet. Remaining food groups i.e., milk (-246.61 g), green leafy vegetables (-44.31 g), fruits (-43.70

g), other vegetables (-36.60 g), and pulses (-14.37 g) were grossly deficient meeting approximately half of the requirements than the recommended dietary allowances (RDA).

Table 2: Mean food intake of overweight and obese adolescent girls (13-15 years).

Food stuff (g/day)	Mean intake	SD	RDA#	Excess/ Deficit	t value
Cereals	362.56	50.97	300	62.56	6.50**
Pulses	45.63	12.75	60	-14.37	5.96**
Green leafy vegetables	55.69	18.77	100	-44.31	12.49**
Other vegetables	63.62	18.78	100	-36.38	10.25**
Roots and tubers	85.53	28.98	100	-14.47	2.64*
Fruits	56.30	20.95	100	-43.70	11.04**
Milk	254.39	69.01	500	-245.61	18.83**
Oil	37.79	11.09	25	12.79	6.10**
Sugar	35.00	9.94	30	5.00	2.66*
Meat/fish/egg	107.56	37.69	50	57.56	8.08**

* Significant at 0.05 level of significance

** Significant at 0.01 level of significance

#Dietary guidelines for Indians, NIN, ICMR publication 2003

In spite of the fact that overweight and obese adolescents consumed a larger portion and variety of food, the diet was grossly deficient in important food items like fruits, vegetables and milk than the recommended balanced diet for overweight and obese adolescent boys and girls. Studies on comprehensive view of adolescents eating habit reported that it is characterized by missed meals, fast food, frequent snacking, lack of essential nutrients, high in fat and salt content etc. (Dennison and Shepherd, 1995) [2]. In the present study also, most of these characteristics were apparent

reflected in the food habit of the overweight and obese adolescents.

3.4.2 Nutrient intake

The mean nutrient intake with reference to energy contribution was completed from the food intake for both overweight and obese adolescent boys and girls and is presented in Table 3. In addition, iron intake was also computed as adolescents are vulnerable group for iron deficiency anaemia.

Table 3: Mean nutrient intake of overweight and obese adolescent boys and girls (13-15 years).

Sex	Nutrients	Mean	SD	RDA#	Excess/deficit	t values
Boys (n=16)	Energy (Kcal)	3119	494	2450	669	5.42**
	Protein (g)	106.536	41.779	70	36.536	3.50**
	Iron (mg)	36.559	11.926	41	-4.441	1.49ns
	Fat (g)	76.685	33.716	22	54.685	6.49**
Girls (n=28)	Energy (Kcal)	3007	419	2060	947	11.95**
	Protein (g)	83.502	31.268	65	18.502	3.13**
	Iron (mg)	25.344	12.013	28	-2.656	1.17ns
	Fat (g)	76.964	47.856	22	54.964	6.08**

* Significant at 0.05 level of significance

** Significant at 0.01 level of significance

#Nutritive Value of Indian Foods, NIN, ICMR publication 2004

It can be seen that the mean nutrient intakes for overweight and obese adolescents (13-15 years) were excess in terms of energy, protein and fat, whereas iron was found to be deficient for both boys and girls (Table 3).

A surplus of 669 kcal and 947 kcal energy were observed for boys and girls respectively. A significantly higher protein intake was recorded for boys (+36.53 g) which may be due to higher intake of non-vegetarian items. The protein intake was also higher (+18.50 g) for girls. On the other hand, the excess of fat intake were almost similar for boys and girls being 54.68 g and 54.96 g respectively. Although iron was seen to be deficient for both boys and girls, but it was not significantly deficient when compared with RDA.

The higher intake of energy contributed by all the macronutrients including protein and fat for both girls and boys, was due to greater consumption of cereals and cereal based products. It is clear that carbohydrate intake was quite high in the dietaries of all adolescents.

The consumption of major protein rich foods like pulses and milk were highly deficient for both boys and girls, but the surplus in protein intake may be due to higher consumption of proteins from animal sources (meat/fish/egg). In addition cereals also contributed a good portion of protein to the diet.

The deficit in iron intake may be due to surfeit in consumption of protective foods like fruits and vegetables which are rich stores of iron.

3.5 Correlation between prevalence of overweight and obesity with food habits

An attempt was thereby made to correlate the occurrence of overweight and obesity in terms of BMI with food habits to assess the degree of association between them, the results of which are presented below.

3.5.1 Correlation between prevalence of overweight and obesity with food intake

It was also observed that the fast foods which the overweight and obese adolescents consumed were mostly cereal based with high amounts of fast/oil and sugar. Moreover, the diet survey revealed that these foods were consumed in excess of the recommended balanced diet. Therefore, a correlation was done between the prevalence of overweight and obesity in terms of BMI with the food intake.

Table 4 presents the correlation between prevalence of overweight and obesity of screened samples in terms of BMI with food intake.

Table 4: Correlation between BMI and food intake of overweight and obese adolescents (13-15 years)

Food intake	Boys (n=16)		Girls (n=28)	
	r values	t values	r values	t values
Cereals (g)	0.4730	2.009	0.1715	0.888
Oil (g)	0.1751	0.666	0.0219	0.112
Sugar (g)	0.0739	0.277	0.0292	0.149
Meat/fish/egg (g)	0.5394	2.397*	0.0565	0.288

* Significant at 0.05 level of significance

Correlation study with food intake were computed only for those food groups which were consumed in excess amount i.e., cereals, oil, sugar and meat/fish/egg. A positive correlation was existed between BMI of boys and food intake, cereals ($r= 0.4730$), oils ($r=0.1751$, sugar ($r=0.0739$) and meat/fish/egg ($r= 0.5394$). A significant association was observed between the BMI of boys with the intake of meat/fish/egg.

In case of girls too, a positive correlation was evident where 'r' value of cereals, oils, sugar and meat/fish/egg are 0.1715, 0.0219, 0.0292 and 0.0565 respectively. No significant association was observed between the BMI of girls and food intake.

From a study conducted by Singh *et al.* (2006) [6] a strong positive correlation between food intake and dietary practices in terms of inappropriate consumption of protective foods and higher consumption of fast foods was observed. In another study by Aggarwal and co-workers (2008) [1] found a significant positive correlation between obesity and consumption of fast foods outside home, which has now become a life-style factor among adolescents. Lee *et al.* (2008) [4] in a similar study on 61,582 Chinese men observed a positive association between increasing prevalence of obesity with high energy intake and less daily physical activity.

Therefore, it can be highly justified from the positive association between BMI of overweight and obese adolescents and food intake that, an increase in consumption of the above foods may contribute in increasing the weight of the screened samples.

4. Conclusion

Diet survey on food intake through 24 hour recall method pictured an excess of cereals, fats/ oil, sugar and meat/ fish/ egg consumption significantly for both boys and girls thereby depicting a surplus of energy, protein and fat when compared with recommended dietary allowances (RDA) by ICMR. Statistical correlations between the prevalence of overweight and obesity in terms of BMI with food habit in terms of cereals, oils/ fat, sugar and meat/ fish/ egg consumption revealed a positive association with significant association ($r=0.5394$) between the intake of meat/fish/egg with elevated BMI of the overweight boys.

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