

Anthropometric Measurements and Nutrient Intake of Adolescent Girls

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ABSTRACT Recognizing the importance of anthropometric measurements among adolescent girls, this study was undertaken to view the anthropometric measurements and to explore the nutrient intake of the selected adolescent girls. A cross-sectional study was carried out targeting 208 school going post-pubescent girls. Using the body mass index as an index of adiposity, 33.7 and 15.9% of government and matriculation school girls respectively were found to be severely undernourished. Further, 17.4 and 25% were found to be normal and 20 and 37 % of them were obese. Anthropometric measurements of the selected girls were lower when compared with National Centre for Health Statistics as a reference population. A significant difference was observed between selected girls and Indian adolescent girls with respect to weight, except girls in the age group between 15 and 16 years from matriculation school. Mean nutrient intake of the selected government school girls was significantly lower when compared with Recommended Dietary Allowance of Indians. Nutritional inadequacy is one of the main causes of prevalence of malnutrition that can lead to higher incidence of diseases among adolescents.

INTRODUCTION

Adolescence is a vulnerable period in human lifecycle when nutritional requirements increase due to the adolescent growth spurt. This period is characterized by rapid increase in height, weight and hormonal changes resulting in sexual maturation (Gupta 1990). Most girls begin a rapid growth spurt between the ages of 13 and 19 years. Nearly every organ in the body grows faster during this period which lasts about 3 years. Adolescence, one of the nutritional stress periods of life with profound growth, comes with increased demands for energy, protein, minerals and vitamins (Gopalan et al. 2001). In India, poor nutrition, early bearing and reproductive health complications compound the difficulties of physical development in adolescent girls (Manford and Picciano 2000). Increased physical activity combined with poor eating habits and the onset of menstruation contribute to accentuating the potential risk for adolescent's poor nutrition (Bhaskaran 2001). In India, reproductive health of adolescent girls is very poor and they suffer from nutritional deficiency. Dietary habits of adolescent girls in slum areas are very poor (Parimalavalli et al. 2007). Anthropometric measurements can be used to monitor changes in growth of adolescents. Research on anthropometric measurements of adolescents is an important determinant of a nation's health.

Measurements of height, weight and nutrient intake are the reliable means to evaluate the nutritional status and it is very much in need. The purpose of this study was to conduct the anthropometric measurements and to explore the nutrient intake of the selected adolescent girls.

METHODS AND MATERIALS

Namakkal is one of the districts of Tamil Nadu in India. The study was carried out in the year 2007. About 78 per cent of the population of Namakkal were adolescents. About 47 percent of the adolescents were girls in the age group of 13-18 years. Government and matriculation schools in Namakkal were randomly selected. The target population was 4655 adolescent girls who studied in the selected government and matriculation schools. A total of 208 post-pubescent girls (Government = 86, Matriculation = 122) in the age group of 13-18 years who had menstruation for more than two years were selected from both the government and the matriculation schools. The selected adolescent girls were briefed on the objectives of the study and all of them gave consent to take part in the study. A questionnaire was used to collect background information such as age, type of house, family size, age at menarche and monthly income of their family from the respondents. The anthropometric

measurements included height and body weight. Height was measured while the subject was standing without foot wear, to the nearest 0.1 cm, using a portable Steadiometer. Weight was measured with the subject standing and wearing light clothes to the nearest 0.1kg using an electronic scale. Body Mass Index (BMI) is a widely used parameter and it is moderately associated with height among adolescents. BMI reflects the positive association between height and weight (Khan et al. 2004). The formula weight (Kg)/ height (m²) was used to calculate Body Mass Index (BMI). The results were compared with NCHS standards (Jelliffe 1966). Precise information of food consumption pattern of the subjects was gathered through 24 hours recall method using an interview schedule. Intake of nutrient was computed using the values given in the nutritive value of Indian foods (Gopalan et al. 2001). The collected data were processed and statistically analyzed. Student 't' test was used for analyzing the data. A P value <0.01 was fixed as the cut off level of significance.

RESULTS AND DISCUSSION

Table 1 shows that the socio-economic background of the two hundred and eight girls revealed that nearly 70 to 83 percent of them were in the age group of 16 - 18 years. Nearly 50 percent of the respondents resided in semi-pucca house.

In government school, 23.3, 56.9 and 19.8 percent of them had small, medium and large size family respectively. In matriculation school, 63.1, 31.9 and 5 percent of them lived in small, medium and large size family respectively. About 78 and 67 per cent of the selected girls in the government and the matriculation school respectively attained menarche in the age group of 13 - 15 years. Fifty-eight per cent of the girls in government school belonged to low income group whereas fifty-seven percent of the girls in the matriculation school belonged to high income group. A recent study on adolescent girls in urban slum area of Andhra Pradesh stated that 67.7 percent of girls belonged to large family size, that is family size more than 5 members (Prashant and Chandan 2009). Educational status and socio-cultural level of parents strongly influence the nutritional status of adolescent girls (Singh and Mishra 2001).

Table 2 shows that the mean weight of the

Table 1: Socio-economic distribution of adolescent girls (N=208)

Particulars	Government school	Matriculation school
<i>Age in Years</i>		
13 -15	15 (17)	34 (28)
16-18	71 (83)	88 (72)
<i>Type of House</i>		
Kutcha	27 (13.4)	0
Semi-Pucca	46 (53.5)	52 (42.6)
Pucca	13 (15.1)	70 (57.4)
<i>Family Size</i>		
Small (1 - 4)	20 (23.3)	77 (63.1)
Medium (5 - 6)	49 (56.9)	39 (31.9)
Large (above 7)	17 (19.8)	6 (5)
<i>Age at Menarche</i>		
10-12 years	3 (3.5)	17 (13.9)
13-15 years	67 (77.9)	82 (67.2)
16-18 years	16 (18.6)	23 (18.9)
<i>Monthly Income in Rupees</i>		
Below 4500	50 (58.1)	4 (3.3)
4500-7500	21 (24.5)	48 (39.3)
Above 7500	15 (17.4)	70 (57.3)

post pubescent girls of the government school was significantly ($p < 0.01$) lower than NCHS reference value. In matriculation school, no significant difference was found between standard height and mean height of the girls between 15 and 16 year ages only, whereas significant difference was found among the age of 13, 14 and 18 years. Anand et al. (1999) reported that the study in rural north India among adolescent school children recorded a prevalence of stunting (height for age) as 41 and 19.9 percent as per NCHS and Indian standards respectively.

Table 3 shows that the majority of the girls from the government school were under-weight showing the highest in the age group of 15-18 years and were statistically significant. In matriculation school, no significant difference was noticed between standard weight and mean weight of the samples at the age of 15 and 16 years, whereas significant difference was observed at the age of 13, 14, 16 and 18 years. The anthropo-metric measurements of adolescent girls were not satisfactory. The height ranged between 123 and 162 cm with a mean of 146.19 cm. Weight of the adolescent girls were somewhat similar to those of height which fell below the NCHS standard values (Kumar et al. 2006).

It is evident from the Table 4 that the Body Mass Index of the selected adolescent girls revealed that 33.7 and 15.9 per cent of the girls

Table 2: Age wise height of the selected subjects (N = 208)

Age in years	Number of samples	NCHS* (height in cm)	Mean $\pm$ Standard deviation				
			Government school	't' value	Number of samples	Matriculation school	't' value
13	-	155	-	-	5	145.29 $\pm$ 8.15	2.6 ^S
14	3	159	146.21 $\pm$ 6.91	3.1 ^S	12	150.9 $\pm$ 7.5	3.6 ^S
15	12	161	147.7 $\pm$ 5.25	8.6 ^S	17	152.29 $\pm$ 7.91	4.5 ^S
16	18	162	150.34 $\pm$ 8.4	5.8 ^S	25	155.1 $\pm$ 9.67	3.6 ^S
17	45	163	153.09 $\pm$ 8.05	8.2 ^S	52	157.32 $\pm$ 7.55	5.4 ^S
18	8	164	156.12 $\pm$ 7.57	2.9 ^S	11	159.21 $\pm$ 8.81	1.7 ^{NS}

NCHS* - National Centre for Health Statistics N-Number of samples

NS- No Significant S-Significant at 1% level

Table 3: Age wise weight of the selected subjects (N = 208)

Age in years	Number of samples	NCHS* (weight in Kg)	Mean $\pm$ Standard deviation				
			Government school	't' value	Number of samples	Matriculation school	't' value
13	-	44	-	-	5	38.64 $\pm$ 5.98	1.9 ^S
14	3	48	39.64 $\pm$ 5.98	2.4 ^S	12	41.71 $\pm$ 6.38	3.3 ^S
15	12	51.4	42.47 $\pm$ 5.4	5.7 ^S	17	52.72 $\pm$ 8.42	0.6 ^{NS}
16	18	53	44.26 $\pm$ 6.11	6 ^S	25	53.89 $\pm$ 8.25	0.5 ^{NS}
17	45	54	45.81 $\pm$ 5.98	9.1 ^S	52	52.6 $\pm$ 9.57	1.3 ^S
18	8	54.4	46.9 $\pm$ 6.1	3.5 ^S	11	53.1 $\pm$ 9.12	0.6 ^S

* NCHS - National Centre for Health Statistics

NS- No Significant S-Significant at 1% level

from government and matriculation school respectively were severely undernourished, 17.4 and 25 per cent of them were noted to be normal and 20 and 37 percent of them were identified as obese. Comparing the anthropometric measurements of the selected girls with National Centre for Health Statistics as a reference population, there was a significant ($P < 0.01$) difference observed with respect to weight except in girls at the age of 15 and 16 years from matriculation school. A similar study conducted in an urban slum of Varanasi depicted that 70 per cent of the adolescent girls had BMI < 20 ; 51.43 percent of the study subjects were suffering from Chronic Energy Deficiency while stunting was present in 10 percent of the adolescent girls

(Singh and Mishra 2001). In the third National Health and Nutrition Examination survey (NHANES III), over 50 percent of girls and 25 percent of boys reported themselves as overweight while they had an age and height adjusted body mass index of $< 85^{\text{th}}$ percentile (Carmona et al. 2002). Ferro-Luzzi and Sharma (2005) concluded that there is a relationship between BMI and an independently assessed measure of socio-economic status was also seen in communities in India.

Table 5 shows that the mean nutrient intake of the selected adolescent girls was less when compared with RDA. The mean energy intake of the government (1905 k.cal.) and the matriculation (2034 k.cal.) school girls were sig-

Table 4: Mean body mass index of the selected subjects (N = 208)

Body Mass Index	Government school		Matriculation school		Total	
	Number	Percent	Number	Percent	Number	Percent
Severe under nutrition	29	33.7	4	3.2	33	15.9
Moderate under nutrition	11	12.8	8	6.5	19	9.1
Mild under nutrition	14	16.3	13	10.6	27	13.0
Normal	15	17.4	37	30.4	52	25.0
Obese I	13	15.2	54	44.4	67	32.2
Obese II	4	4.6	6	4.9	10	4.8
Total	86	100.0	122	100.0	208	100.0

Table 5: Mean nutrient intake of the adolescents

Nutrient	RDA	Government school			Matriculation school		
		Mean Nutrient	Percent excess/deficient	't' value	Mean Nutrient	Percent excess/deficient	't' value
EnergyK.Cal	2060	1905	-7.5	3.8 ^S	2034	-1.3	0.5 ^{NS}
Protein (g)	63	48.9	-22.4	3.2 ^S	56.4	-10.5	2.9 ^S
Fat (g)	22	19.3	-12.2	7.16 ^S	21.8	-0.9	1.12 ^{NS}
Calcium (mg)	500	400.7	-19.9	7.9 ^S	439.3	-12.1	1.48 ^{NS}
Iron (mg)	30	17.8	-40.6	11.4 ^S	19	-36.7	12.9 ^S
Vit.c (mg)	40	29.1	-27.3	4.3 ^S	33.6	-16	2.0 ^{NS}

RDA- Recommended Dietary Allowance

S - Significant at 1% level. NS - No Significant

nificantly lower than RDA. Intake of nutrients such as proteins (48.9g), fat (19.3g), calcium (400.7 mg), iron (17.8mg) and vitamin C (29.1mg) were found to be significantly far below the RDA. Diet survey analysis of the matriculation school girls indicated that the nutrient intake such as protein (56.4 g) and iron (19 mg) were significantly lower than the RDA whereas fat (21.8g), calcium (439.3g) and vitamin C (33.6g) was not significantly less than the RDA. Varsha et al. (2008) stated that the rural adolescent girls of Marathwada region were consuming all nutrients below the recommended, revealed gross deficiency of nutrients. Compared to other nutrients, fat intake was found to be slightly satisfactory as the intake was almost one-third of the requirement. The anthropometric measurements were not satisfactory in the selected girls and these were the reflection of less nutrient intake of the adolescent girls were reasons. Similar findings were obtained by Sriyaya and Jhansirani (2003) and Tatia and Taneja (2003). Low intake of different food items was related to poor economic status (Venkateswaralu 2003). Brache et al. (2003) stated that reasons for malnutrition of adolescent girls such as misinformation about food values, eating in fast food restaurants, skipping meals, consuming snacks, and foods high in sugar and going on fad dieting.

CONCLUSION

The result shows that majority of the samples were in the age range of 16-18 years with small and medium size family and most of them had attained their menarche in the age range of 13-15 years. Regarding the anthropometric measurements, height and weight of the selected

individuals were found to be significantly different when compared with the standard which would be due to faulty dietary habits. During the period of puberty, the body requires high calories and nutrients like protein, calcium, iron, folate and zinc. Iron and calcium are particularly important nutrients during adolescence. Nutritional status of adolescent girls contributes to the nutritional status of the community. Hence, there is a need to create an awareness among adolescents about nutrition and health.

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