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Assessment of Nutritional Status of School Going Adolescents in Fatehabad District of Haryana

Research Article

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Abstract

Adolescents the future parent generation may be considered as the founder of better health of produced generation. Unfortunately, they have been considered a low risk group for poor health and nutrition and often receive scant attention. Two hundred school going adolescents (13-17y), comprising equal number of male and female and rural and urban adolescents were selected from the Fatehabad district. Nutritional status of adolescents was assessed in terms of anthropometric measurements and dietary survey. The information on dietary intakes of adolescents was collected using 24h recall method for two non-consecutive days. Average daily nutrient intake was compared with the Recommended Dietary Allowances (RDA) published by NIN, 2010. Nutrient Adequacy Ratio (NAR) for various nutrients was also calculated. Statistically data was analyzed using SPSS statistical package (version 14.0) for windows. *P* value less than 0.05 and 0.01 were considered statistically significant. Results showed that as per the scores of BMI for age 13 per cent of adolescents were wasted followed by overweight (8.5%) and as per the scores of height for age 14.5 per cent of them were stunted followed by severely stunted (3.5%). Prevalence of abdomen obesity among boys and girls was 2 and 49 percent, respectively (Table 2). The boys had significantly (chi-square 7.88; $p<0.001$) higher prevalence of wasting where as girls had significantly higher prevalence of overweight (chi-square 7.88; $p<0.001$), stunting (chi-square 6.46; $p<0.05$) and abdomen obesity (chi-square 27.49; $p<0.001$). The daily mean intake of energy, protein, calcium, iron, β-carotene, vitamin C and zinc in the diets of adolescents was significantly lower than their respective RDAs. The adolescents (13-17 y) of Fatehabad district were found to be at the risk of double burden of malnutrition they should be provided proper nutrition education.

Keywords: Adolescents; Stunted; Wasted recommended dietary allowances; RDA

Introduction

Nutritional status of adolescents is an important determinant of a nation's health. This stage of life is the foundation of better health of new generation which surpasses through parent generation. Unfortunately adolescents have been considered a low risk group for poor health and nutrition and often receive scant attention. Money and time may be the limiting factors about this concern. Nutritional status of a large number of adolescents can be quickly assessed by anthropometric measurements. Measurements of height, weight, body mass index (BMI), waist circumferences and hip circumferences are the reliable means to evaluate the nutritional status and it is very much in need as large sample size can be assessed and handled easily in less time and money. Estimation of the prevalence of overweight and obesity in population are typically based on BMI. Waist circumference measurement has been proved to be a useful tool for assessing risk for obesity-related diseases such as cardiovascular disease [1]. Waist circumference has been shown to correlate well with intra-abdominal fat mass [2], which in turn has been shown to be related to an atherogenic lipoprotein profile [3]. Another fast way of assessing nutritional status of a population is the estimation of dietary and nutrient intake. In present study 24hour recall method was used to collect the dietary information of adolescents. It is an easier, faster, and less expensive way to collect the dietary intake of any population and is less invasive, so that compliance is enhanced. Chances of errors are there in this method due to memory lapse as the subject has to answer about food consumed in the past 24 hours as much as remembered. This was reduced by using a standardized interview protocol that included probing questions and visual aids.

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Once information on nutrient intake is collected, it is compared with the recommended dietary allowances and the adequacy of different nutrients in the dietary intake of population is calculated which gives an estimation about the nutrients deficiency of sufficiency. The National Institute of Nutrition sets new guidelines of recommended dietary allowances (RDA) based on age, gender and life stage [4]. The United States Department of Agriculture's (USDA) while addressing the dietary guidelines for Americans urge the consumption of nutrient-rich food rather than the intake of supplements to meet these recommendations [5]. There are two stages in life time when eating patterns are established once early in life and second time during adolescence and this is of particular concern since food consumption patterns serve as the basis for nutrient adequacy. Researches done across the countries have shown that adolescents tend to have lower than desirable intakes of fruits, vegetables, dairy products, and whole grains but higher than desirable intakes of soft drinks, confectionery, and fast foods [6-10]. Consequently, many adolescents fall short of achieving optimal nutrient intakes for good health and development. It is evident that nutrition behaviour pursue from adolescence into adulthood [11]. Therefore, the adoption of healthy nutrition during adolescence has the potential to bestow significant long-term health benefits. Since the ultimate objective of nutritional assessment is the improvement of human health [12], there is a need to develop a database on nutritional status of adolescents so that government and non-governmental agencies can formulate and initiate specific policies and strategies for the well-being of adolescents.

Material and Methods

Study Area and Sample Size

The present study was carried out in Fatehabad district of Haryana state. Government Senior Secondary School from *Dhanger* village, Fatehabad and Government Senior Secondary School from Fatehabad city was selected randomly. Two hundred school going adolescents (13-17y) were selected for the study. Out of them 100 students were selected randomly from the rural Govt. Senior Secondary School of *Dhanger* village, *Fatehabad* and another 100 students were selected randomly from the urban Govt. Senior Secondary School of *Fatehabad* city. The proportion of male and female students was assigned equal while selecting the respondents.

Anthropometric Measurements

Prior to the take anthropometric measurements, all procedures were explained to the respondent. Under anthropometric measurements, height (cm), weight (kg), waist circumference (cm) and hip circumference (cm) were measured in duplicate while body mass index and waist to hip ratio were calculated.

Z-score for height-for-age (HAZ-score) and BMI-for age (BAZ-score) were calculated using the National Centre for Health Statistics (NCHS) reference data [13] and WHO Anthro Plus software (version 2014). The cut off values of Z-score for height-for-age and BMI-for age have been presented in Table 1. The associations between socio-economic status and z scores of height for age and BMI for age were also computed.

Nutrient intake measurements

The information on dietary intakes of adolescents was collected using 24h recall method for two non-consecutive days. The 24h recall is a method to determine the food intake of an individual during the immediately preceding 24 hours as remembered by the subjects [14]. Cooked foods were getting converted into their raw equivalent. The nutritive value of raw ingredients was calculated using Nutritive value of Indian foods [15]. The nutrient values of these food items were checked for quality by comparing these values with the range of nutrient values from the other food composition tables for the same foods. Mean nutrient intake was calculated by taking mean of the two non-consecutive days intake and compared with Recommenced Dietary allowances [4]. Daily nutrient intake for energy, protein, fat, β-carotene, vitamin C, iron, zinc, and calcium was calculated using VBS Food Calculation System version 4.0 (BaS Nutrition Software, The Netherlands, 2007).

Average daily nutrient intake was compared with the Recommended Dietary Allowances [4]. Nutrient Adequacy Ratio (NAR) was calculated by divided nutrient intake by RDA multiply by 100.

Statistical Analysis

Statistically data was analyzed using SPSS statistical package (version 14.0) for windows. Means of age, height, weight, BMI, waist and hip circumferences were compared area wise (rural vs. urban) using independent sample t-test. Association of gender with prevalence of wasting, stunting, overweight and abdomen obesity was found using chi-square test. *P* value less than 0.05 and 0.01 were considered statistically significant.

Table 1: Anthropometric measurements of adolescents.

	Total (200)	Boys (100)	Girls (100)
Age (y)	15.01 ± 1.28	15.27 ±1.37	14.75 ± 1.14
Weight (kg)	44.12 ± 8.22	45.86 ± 9.33	42.37 ± 6.54
Height (cm)	159.44 ± 9.28	165.98 ± 10.07	152.91 ± 5.49
BMI (kg/m²)	17.67± 2.27	17.28 ±2.15	18.07 ± 2.33
Waist circumferences (cm)	65.31 ± 6.73	66.77 ± 7.41	63.85 ± 5.66
Hip circumferences (cm)	83.15 ± 6.59	82.18 ± 7.44	84.11 ± 5.49

Values are mean ±SD

Table 2: Prevalence of wasted, stunted, overweight and abdomen obesity among adolescents.

	Normal	Wasted	Overweight
All (200)	157 (78.5)	26 (13)	17 (8.5)
Boys (100)	82	15	3
Girls (100)	75	11	14
	Normal	Stunted	Severely stunted
Total (200)	164 (82)	29 (14.5)	7 (3.5)
Boys (100)	88	10	2
Girls (100)	76	19	5
	Normal		Abdomen obesity
All (200)	149 (74.5)		51(25.5)
Boys (100)	98		2
Girls (100)	51		49

Values in parentheses indicate percentage

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Results

Anthropometric measurements

The mean values of age, weight, height, BMI, waist circumferences and hip circumferences recorded for boys were 15.27y, 45.86 kg, 165.98 cm, 17.28 (kg/m^2), 66.77 cm and 82.18 cm, respectively (Table 1). The values of same parameters in girls were 14.75y, 42.37kg, 152.91cm, 18.07(kg/m^2), 63.85cm and 84.11cm, respectively. The boys had significantly (p<0.01) higher values of weight, height and waist circumferences than girls, whereas the girls had significantly (p<0.05) higher values of BMI and hip circumferences.

Prevalence of wasting, stunting, overweight and abdomen obesity

The z scores of BMI for age showed that out of 200 adolescents 13 percent were wasted followed by overweight (8.5%). The rest of the adolescents (78.5%) were found to be normal. Prevalence of wasting and overweight in boys was 15 and 3 percent, respectively. The prevalence of wasting and overweight however, in girls was 11 and 14 percent, respectively. The z scores of height for age showed that out of 200 adolescents 14.5 percent were stunted followed by severely stunted (3.5%) (Table 2). The rest of the adolescents (82%) were found to be normal. The prevalence of stunting and severely stunting in boys was 1 and 2 percent, respectively. The prevalence of stunting and severely stunting however in girls was 19 and 5 percent, respectively. The analysis of waist to hip ratio showed that out of 200 adolescents 25.5 percent were at the risk of abdomen obesity. The rest of the adolescents (74.5%) were found to be normal. Prevalence of abdomen obesity among boys and girls was 2 and 49 percent, respectively (Table 2). The boys had significantly (chi-square 7.88; p<0.001) higher prevalence of wasting where as girls had significantly higher prevalence of overweight (chi-square 7.88; p<0.001), stunting (chi-square 6.46; p<0.05) and abdomen obesity (chi-square 27.49; p<0.001).

Nutrient intake

Daily mean intake of energy, protein, calcium, iron, β-carotene, vitamin C and zinc was significantly lower than their respective RDAs in the diets of both the male and female adolescents of both the age group (13-15y and 16-17y). However, the daily mean intake of fat was found to be higher than their respective RDAs (Table 3,4). The results of the nutrient adequacy ratio revealed that majority of the adolescent had marginally adequate intake of energy (58.5%), marginally inadequate intakes of protein (46.5%), adequate intakes fats (51%), marginally inadequate intakes of calcium (38%), inadequate intakes of β-carotene (50%), inadequate intakes of vitamin C (35.5%) and inadequate intakes of zinc (86%) (Table 5).

Discussion

The poor nutritional status of the adolescents, particularly girls, has important implications in terms of physical work capacity and adverse reproductive outcomes. These delicate consequences of under nutrition among adolescence were subsequently confirmed by the other researchers in different Indian communities [16]. Venkaiah *et al*. reported about 39.0 per cent of the rural adolescents

Table 3: Daily mean nutrient intake of adolescents (13- 15Y).

	RDA	Actual Intake		RDA	Actual Intake	
		Girls (78)	't' value		Boys (48)	't' value
Energy (kcal)	2330	1581.9±231.46 (67.89)	28.5**	2750	1983.62±288.72 (72.13)	18.3**
Protein (g)	51.9	38.55±10.15 (74.27)	7.2**	54.3	42.47±7.81 (78.21)	1.9*
Fat (g)	40.0	42.22±9.73 (105.5)	2.0*	45.0	52.69±9.20 (117.08)	5.7**
Calcium (mg)	800.0	551.0±165.58 (68.87)	13.2**	800.0	734.47±147.31 (91.80)	3.0**
Iron (mg)	27.0	12.18±2.04 (45.11)	63.9**	32.0	14.96±2.59 (46.75)	45.4**
B-carotene (µg)	4800	2722.14±1328.55 (56.71)	13.8**	4800	2631.03±1103.48 (54.81)	13.6**
Vitamin C (mg)	40.0	31.29±16.76 (78.22)	0.9**	40.0	30.62±19.15 (76.55)	0.8**
Zinc (mg)	11.0	4.02±0.65 (36.54)	9.3**	11.0	4.89±0.84 (44.45)	50.1**

Values are mean ±SD
* Significant at 5% level; ** Significant at 1% level
Values in parentheses indicate percentage (%RDA)

Table 4: Daily mean nutrient intake of adolescents (16- 17Y).

Nutrient	RDA	Actual Intake		RDA	Actual Intake	
		Girls (22)	't' value		Boys (52)	't' value
Energy (kcal)	2440	1607.80±219.02 (65.89)	17.8**	3020	2241.53±301.61 (74.22)	18.6**
Protein (g)	55.5	41.14±9.02 (74.12)	4.8**	61.5	49.07±8.94 (79.78)	2.07*
Fat (g)	35.0	41.68±6.69 (119.08)	4.6**	50.0	57.43± 8.28 (114.86)	6.4**
Calcium (mg)	800.0	598.25±135.20 (74.78)	6.9**	800	718.25±174.71 (89.78)	3.3**
Iron (mg)	26.0	12.20±1.99 (46.92)	32.4**	28.0	16.99±2.81 (60.67)	28.1**
B-carotene (µg)	4800	2421.74±1061.16 (50.45)	10.5**	4800	2577.13±1195.49 (53.69)	13.4**
Vitamin C (mg)	40.0	36.25±19.82 (90.62)	0.7	40.0	29.35±19.41 (73.37)	1.3**
Zinc (mg)	12.0	4.07±0.61 (33.91)	60.1**	12.0	5.49±1.02 (45.75)	45.8**

Values are mean ±SD
* Significant at 5% level; ** Significant at 1% level
Values in parentheses indicate percentage (%RDA)

Table 5: Nutrient Adequacy Ratio of adolescents.

Food groups	N = 200			
	I	II	III	IV
Energy (kcal)	2	58.5	38.5	1
Protein (g)	19	30.5	46.5	4
Fat (g)	51	25	23	1
Calcium (g)	23	28	38	11
Iron (mg)	-	38	3	59
β-carotene (µg)	4	24.5	21.5	50
Vitamin C (mg)	31	23	10.5	35.5
Zinc (mg)	-	14	-	86

I = 100% and above RDI (adequate)
II = 75 to 99.9% of RDI (marginally adequate)
III = 50 to 74.9% of RDI (marginally inadequate)
IV = below 50% of RDI (inadequate)

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to be stunted. However, low prevalence of stunting has also been reported in the existing literature [17]. Malhotra and Passi reported the prevalence of stunting to be 29.7 per cent among rural adolescent girls in North India. The basic reason behind stunting indicates the long term cumulative inadequacies of health and nutrition and an insufficient intake of nutrients during the early stage of childhood [18]. It had been opinioned by Measham and Chatterjee that one of the key causes of under nutrition among Indian communities is the lack of access to insufficient foods and resource amenities [19]. The prevalence of lower nutritional status among girls is another well known and accepted fact in almost every Indian community [18,20]. Numerous studies have already been documented the discriminations made against the girl child in India [21,22]. It has also been observed in case of thinness that adolescent boys were more affected than adolescent girls (59.4% versus 41.3%) [20]. The poor nutrients intake of adolescents may be due to non availability of diversified foods and low purchasing capacity of the study population. The other possible reason may be the poor nutritional knowledge and ignorance among the adolescents. It is difficult to compare these findings with earlier studies due to differing study methods. However, the patterns we identified showed some similarities with previous work among adolescents. In a previously conducted study among school going post- pubescent girls (n=208) from Namakkal district of Tamil Nadu, mean per day calorie intake was observed as 1905 Kcal against the RDA of 2060 Kcal. The percent adequacy for protein and calcium ranged between 80-90 per cent; whereas for iron percent adequacy varied between 60-65 per cent. Other studies among adolescent girls in the country have also reported lower consumption of most of the micronutrients especially iron with respect to RDA being carbohydrates the main source of energy [23-27].

Conclusion

It may be concluded that adolescents (13-17 y) of Fatehabad district were found to be at the risk of poor nutritional status. Besides low consumption of nutrients, 13 percent of the adolescents were wasted and 25.5 percent of them were found to be at the risk of abdomen obesity, which represented the double burden of malnutrition among them. The boys had significantly higher prevalence of wasting whereas girls had significantly higher prevalence of overweight, stunting and abdomen obesity. Daily mean intake of energy, protein, calcium, iron, β-carotene, vitamin C and zinc except fat was significantly lower than their respective RDAs in the daily diets of both the male and female adolescents of both the age group. The daily mean intake of fat was found more than their respective RDAs. Since balanced nutrients intake play significant role in overall health and as adolescence is the important stage of human life they should be strengthen with the proper nutrition education or nutritional counseling.

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