Dietary pattern and nutritional deficiencies among urban adolescents

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Abstract

Introduction: Adolescents are considered to be a nutritionally vulnerable segment of the population. There is a greater need to look into the nutritional status of adolescents but unfortunately, precise estimates of their dietary intake, dietary practices as well as nutritional deficiencies have been the least explored area. The general objective for conducting this study was to assess the dietary pattern and nutritional deficiencies among adolescents. **Materials and Methods:** A cross-sectional study was conducted among adolescents in schools and colleges in the urban areas of Jhansi district in Uttar Pradesh. The study sample consisted of 400 school children in the age group of 10-19 years. Food consumption of the subjects was assessed using a 3-day food intake recall method. **Results:** Mean age of the adolescents was 14.16 years. More than half of the children studied had malnutrition (53.5%). Mean intake of calorie, protein, fat, iron, and vitamins A and C were lower than the Recommended Dietary Allowances (RDAs). The habitual dietary pattern indicated poor consumption of milk, liver, and leafy vegetables. In comparison to boys (31.5%), more girls (46%) were underweight. On seeing the association, nutritional status of these adolescents within the normal limits were found to be significantly higher in those from nuclear families ($P < 0.001$), those with better educated parents ($P < 0.000$), and those from families of higher socioeconomic status ($P < 0.000$). **Conclusion:** Overall, among the participants, there were both macro- and micronutrients deficiencies. Therefore, there is a need to encourage people to adopt small family norms, and a need for the sensitization of both adolescents and their parents through health and nutrition education (HNE) to improve the health and nutritional status of the adolescents.

Keywords: Adolescents, body mass index, macronutrients, micronutrients, Recommended Dietary Allowances, under nutrition

Introduction

A balanced diet during childhood and adolescence is crucial not only for the well-being and growth of the child,[1] but also for the establishment of sound dietary habits that will persist in later life.[2] For example, adequate intake of energy and macronutrients has an essential role in the overall physical growth of the adolescent. On the other hand, vitamins and minerals have specific individual and synergistic roles in supporting metabolic function (B vitamins), bone mineralization (calcium), hemoglobin production (iron), and growth (zinc). Micronutrient deficiencies (MNDs) such as vitamin A deficiency (VAD), iron deficiency anemia (IDA), and iodine deficiency disorders (IDDs) have been major nutritional problems in developing countries, adversely affecting adolescents' health and performance, and thereby becoming major impediments to economic development.[3] In India, these MNDs continue to be of public health significance.[4]

Nearly half of the world's micronutrient-deficient population is found in India.[5] Moreover, factors that sought to reduce the macro- and micronutrients intake of adolescents could be unequal intrafamilial distribution of food and adverse and harmful dietary practices including dieting, specific food taboos, and dietary restrictions. Poor nutrition among adolescents leads to short stature. Also, low lean body mass is associated with many concurrent and future adverse health outcomes.[6] Thus, achievement of optimum growth during this period should be of utmost importance for maintaining good health thereafter. Early detection of the morbidities through regular survey helps in prompt treatment and prevention of serious complications.[7] Therefore, keeping the magnitude of micronutrient malnutrition among the adolescents in view, the present study was carried out to assess the dietary pattern and nutritional deficiency disorders among the school-going adolescents.

Objectives

The specific objectives of the above study were the following:
- To evaluate the dietary intake and nutritional status of the adolescents

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- To assess the prevalence of nutritional deficiencies among the adolescents
- To determine whether the parents' education and socioeconomic status are associated with the nutritional status of the adolescents or otherwise.

Materials and Methods

This was a cross-sectional study conducted in schools and colleges in the urban areas of Jhansi district in Uttar Pradesh among adolescents (age group of 10-19 years). The study was conducted from September 1 to December 31, 2014. A predesigned and pretested 3-day food frequency intake questionnaire, along with examination schedule for recording information, was used by adopting the face-to-face interview method. The data obtained were collated and statistically analyzed by simple proportions and using the tests of significance (Chi-square test). To calculate the optimum sample size required, the current prevalence of nutritional deficiency that is common in both boys and girls was taken. The relevant literature suggested that 62% of school-going children, both boys and girls, are found to be deficient in Vitamin A.[8] For the above purpose, the formula $4PQ/L^2$ was used, where $P = 62$, $Q = 38$, and L = allowable error in P (12%), i.e., 7.4. Thus, the sample size was worked out to be 172. Considering the design effect to be 2, the required sample size was $172 \times 2 = 344$. To be on the safe side and for analytical convenience, it was increased to 400 adolescents (200 boys and 200 girls). Out of all the educational institutions in the urban areas of Jhansi, eight were selected by using the cluster sampling method.

Subject to permission from the Principal of each institution, each adolescent was then individually contacted. After explaining our objectives to them and obtaining the written informed consent from the parents of each adolescent, they were interviewed in person. Dietary intake in terms of calorie, protein, fat, vitamin A, vitamin C, iron, and calcium were assessed. Thereafter, the averages were compared with the corresponding Recommended Dietary Allowances (RDAs) recommended by the Indian Council of Medical Research (ICMR).[9] The socioeconomic class and the level of education of the parents were determined by Kuppuswamy's socioeconomic status scale. Ethical clearance was sought from the Ethics Committee of Maharani Laxmibai Medical College, Jhansi, Uttar Pradesh, India. Nutritional status of the adolescents was assessed through body mass index (BMI), according to the World Health Organization (WHO) Asian criteria.[10]

Results

Mean age of the adolescents was 14.16 years. Of the 400 participants, majority (53.5%) were malnourished, i.e. 38.6% were underweight, 10.1% were overweight, and 4.75% were obese. It was further seen that in comparison to boys (31.5%), more girls (46%) were underweight. This may be due to particular cultural practices where the well-being of the boys are preferred to that of girls. Late adolescents (51%) were found to be more in the normal weight category than early adolescents (44%).[11]

However, the early adolescents (42%) were found to be more susceptible to underweight problems compared to the late adolescents (37%). It has also been observed that a significant percentage of adolescents from nuclear families belong to the normal weight category in contrast to joint/extended families. With better education of the parents and higher socioeconomic status of the families, majority of the adolescents were able to retain their weight within the normal category, and the association was found to be highly significant [Table 1].

Majority of the participants consumed chapatti (94.5%) and rice (81.2%) as daily food. Most of them did not consume green leafy vegetables, milk products, fruits, and salad. Of the 400 participants, only 39.75% preferred to eat meat and fish [Table 2]. More than 50% of the participants had calorie consumption less than 80% of the RDA. Furthermore, it was also found that the consumption of macro- and micronutrients were below the par level of RDA [Figure 1]. It was further seen that the average calorie intake was 60.85% of the estimated RDA. For protein and fat, it was 71.46% and 52.10% of the estimated RDA, respectively. Vitamin A intake was only 29.30% of the estimated RDA. For calcium, iron, and vitamin C, the average intakes were 56.75%, 73.88%, and 45.00% of the estimated RDA, respectively, among the participants [Table 3].

Discussion

Despite the fact that several national nutrition programs are in operation for the benefit of adolescents, the prevalence of nutritional deficiencies among adolescents continues to be a public health concern. In the present study, selected school-going adolescents in the age group of 10-19 years were interviewed and examined. A significant difference between the nutritional status and gender (<0.05) was found. Moreover, the early adolescents are more vulnerable to malnutrition than the late adolescents. The study conducted by Dambhar *et al.* had comparatively similar findings with the present study, namely, that 48.3% of the adolescents were normal and 51.7% were undernourished.[12] Kumar *et al.*[13] reported that 32.3% of urban school adolescents were in the normal range while 65.3% were either overweight or obese. The extent of undernutrition is lower in the present study than that reported in one Indian study (53%)[14] by Kurz *et al.* and in two other Kenyan studies (61%)[15] and (57%).[16]

The present study shows that dietary deficiency of both macro- and micronutrients are alarming in the study area. For vitamin A and vitamin C, the intake is less than 45% of the estimated mean RDA. These facts are so glaring that for these nutrients, urgent intervention is required. Dietary deficiencies in adolescents have also been observed by Chaturvedi *et al.*[17] and Eglesadi *et al.*,[18] where they found the deficiency of vitamin A to be glaring in their respective study areas. A study published in British Nutrition Foundation (BNF) 9th section[19] has also reported that a large proportion of adolescents have low intakes of some vitamins and minerals (particularly vitamin A, riboflavin, iron, calcium, and magnesium), with more girls aged 11-18 years having low intakes compared to boys of a similar age. Another

Table 1: Nutritional status of adolescents and its association with sociodemographic determinants (*n*=400)

Sociodemographic determinants	No. (%)				Chi- square, *P* value	Total
	Underweight	Normal weight	Overweight	Obese		
Gender						
Boys	63 (31.5)	104 (52.0)	21 (10.5)	12 (6.0)	X^2=9.44,	200
Girls	92 (46.0)	82 (41.0)	19 (9.5)	7 (3.5)	df-3, *P*<0.023	200
Age (in years)						
Early adolescents (10-14 years)	89 (36.8)	106 (43.8)	33 (13.6)	14 (5.8)	X^2=11.05,	242
Late adolescents (15-19 years)	66 (41.8)	80 (50.6)	7 (4.4)	5 (3.2)	df-3, *P*<0.01	158
Type of family						
Nuclear	89 (32.8)	132 (48.7)	36 (13.3)	14 (5.2)	X^2=17.8,	271
Joint/extended	66 (51.2)	54 (41.9)	4 (3.1)	5 (3.9)	df-3, *P*<0.001	129
Educational status of mother						
Illiterate	78 (54.5)	43 (30.1)	15 (10.5)	7 (4.9)	X^2=62.7,	143
Middle/HS/Intermediate	55 (39.6)	55 (39.6)	22 (15.8)	7 (5.0)	df-6, *P*<0.000	139
Graduate/PG	22 (18.6)	88 (74.6)	3 (2.5)	5 (4.2)		118
Educational status of father						
Primary/Middle	75 (59.0)	28 (22.0)	18 (14.2)	6 (4.7)	X^2=83.17,	127
Secondary/HS	59 (43.4)	54 (39.7)	15 (11.0)	8 (5.9)	df-6, *P*<0.000	136
Graduate/PG	21 (15.3)	104 (75.9)	7 (5.1)	5 (3.6)		137
Socioeconomic status						
SES* I and II	67 (69.0)	26 (26.8)	4 (4.1)	0 (0.0)	X^2=104.7,	97
SES III	57 (53.3)	32 (29.9)	15 (14.0)	3 (2.8)	df-9, *P*<0.000	107
SES IV	19 (20.8)	56 (61.5)	11 (12.0)	5 (5.5)		91
SES V	12 (11.4)	72 (68.5)	10 (9.5)	11 (10.5)		105

*SES: Socioeconomic status; HS: High secondary; PG: Post graduate

Table 2: Dietary consumption pattern (*n*=400)

Food items	Number of participants	Frequency of intake		
		Once a day	Twice a day	Thrice a day or more
Chapatti	378	49 (12.96)	141 (37.30)	188 (49.73)
Rice	325	146 (44.9)	152 (46.7)	27 (8.3)
Meat	159	113 (71.1)	46 (28.9)	0 (0.0)
Fish	112	70 (62.5)	42 (37.5)	0 (0.0)
Egg	201	112 (55.7)	68 (17.0)	21 (5.3)
Milk	213	131 (32.8)	51 (12.8)	31 (7.8)
Milk products	195	156 (39.0)	33 (17.5)	6 (1.5)
Green leafy vegetables	185	145 (36.3)	37 (9.3)	3 (0.8)
Fruits	191	86 (45.0)	76 (39.8)	29 (7.3)
Tea	301	48 (15.9)	152 (50.5)	101 (33.6)
Pickles	231	43 (18.6)	111 (27.8)	77 (33.3)
Salad	144	35 (22.7)	88 (22.0)	21 (5.25)
Roasted cereals and grams	179	112 (28.0)	61 (15.25)	6 (1.5)
Sugar	346	91 (22.8)	151 (37.8)	104 (26.0)

Table 3: Average nutrient intake (*n*=400)

Nutrient	Nutrient intake (mean±SD)	Estimated mean RDA	% of RDA
Calorie (kcal/day)	1,521±406.28	2499.4	60.85
Protein	37±17.12	51.77	71.46
Fat	21±13.22	40.30	52.10
Calcium	454±398.62	800.00	56.75
Iron	20±19.56	27.07	73.88
Vitamin A	760±551.12	2593.50	29.30
Vitamin C	18±16.12	40.00	45.00

SD: Standard deviation; RDA: Recommended dietary allowance

study by Akkamahadevi *et al*.[20] also reported lower intake of energy and blood-forming micronutrients in adolescent girls.

In the present study, it was also found that the type of family, parents' education, and socioeconomic status of the adolescents play a pivotal role in their nutritional status. Parents with higher education show significant association with the nutritional status of the adolescents. It was also seen that higher the socioeconomic status, better the nutritional status of the adolescents [Table 4]. Documented findings in developing countries like India and Ghana report a positive association between socioeconomic status and BMI.[21] Importance of parental education in raising the nutritional status of the children is well-known.[22] Mothers' education has profound effect on preschool children, whereas fathers' education seems to have a greater importance in the care of adolescents.[23] Choudhury *et al.*, in their study, found that when the nutritional status of adolescents was examined against the highest education in the family, it was evident that with the increasing level of education decline in undernutrition was noticed among the subjects. In comparison to joint families, nuclear families were more able to maintain the normal nutrition status of the adolescents.[24]

The strength of the study is that it is able to show the poor nutritional status among the urban adolescents. It also reveals

that problem of malnutrition is multifaceted and has links with various socioeconomic and demographic factors. This study had a limitation, in that a 3-day food intake questionnaire was used instead of a 7- or 21-day one. The reason behind using a shorter version of the questionnaire was to exclude recall biases. This study also lacks biochemical assessment of the various nutrients that would have been able to give more accurate findings.

In the light of the findings, there is need and scope to design and implement adolescent nutrition education programs and establishment of operation research models.

Finally, gender differences in food habits should be taken into account, as school-based interventions aiming to improve health behaviors have been shown to influence boys and girls differently.[25-27] Future researches should emphasize the need for more systematic evaluation

of dietary habits, including studies of consumer behavior and the role of education on food intake. Moreover, future researches should evaluate which factors contribute to social inequalities in food habits, as a basis for future differentiation of interventions among the adolescents groups. Finally, we emphasize the need for future studies of trends in the consumption habits to evaluate how adolescent food habits continue to develop.

Conclusions

The overall nutritional status of the adolescents was not satisfactory. The health and nutritional status among the adolescents was found to be low, more in girls than in boys. The prevailing dietary practices of adolescents have not been up to the mark. Such practices may be due to differences in the food allocation at the family level and because of individual likes and dislikes. Overall, among the participants, there are both
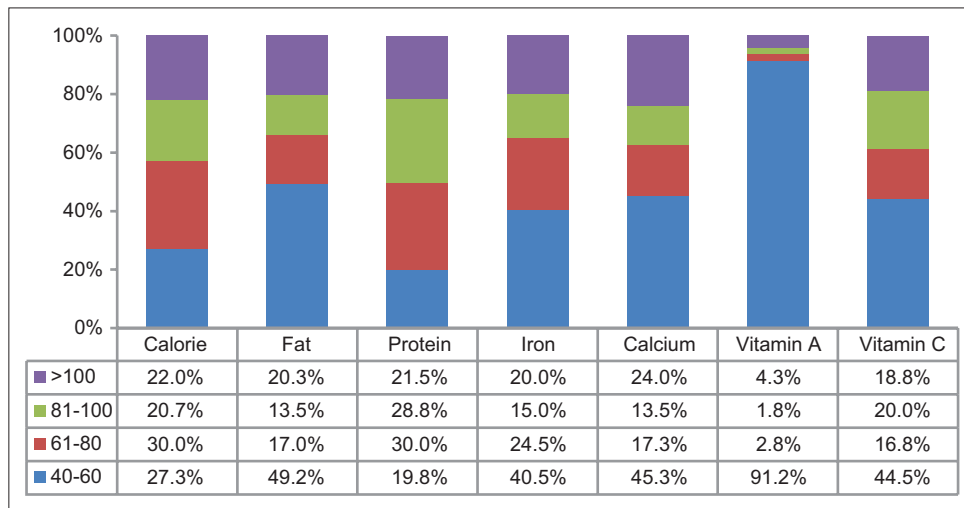

	Calorie	Fat	Protein	Iron	Calcium	Vitamin A	Vitamin C
>100	22.0%	20.3%	21.5%	20.0%	24.0%	4.3%	18.8%
81-100	20.7%	13.5%	28.8%	15.0%	13.5%	1.8%	20.0%
61-80	30.0%	17.0%	30.0%	24.5%	17.3%	2.8%	16.8%
40-60	27.3%	49.2%	19.8%	40.5%	45.3%	91.2%	44.5%

Figure 1: Nutrients intake in percentage to RDA (*n* = 400)

Table 4: Relation of BMI with family characteristics of adolescents (*n*=400)								
Variable	Underweight		Normal weight		Overweight		Obese		*P* value
	No.	%	No.	%	No.	%	No.	%	
Type of family									
Nuclear	89	22.3	132	33.0	36	9.0	14	3.5	X^2-16.01*,
Joint/extended	66	16.5	54	13.5	4	1.0	5	1.3	df-3, *P*<0.001
Educational status of mother									
Illiterate	78	19.5	43	10.8	15	3.75	7	1.7	X^2-9.26*,
Middle/HS/Intermediate	55	13.8	55	13.8	22	5.5	7	1.7	df-6, *P*<0.000
Graduate/PG	22	5.5	88	22.0	3	0.8	5	1.3	
Educational status of father									
Primary/Middle	75	18.7	28	7.0	18	4.5	6	1.5	X^2-83.17,
Secondary/HS	59	14.8	54	13.5	15	3.8	8	2.0	df-6, *P*<0.000
Graduate/PG	21	5.3	104	26.0	7	1.8	5	1.3	
Socioeconomic status									
SES I and SES II	67	16.8	13	3.3	4	1.0	0	0	X^2-78.43*,
SES III	57	14.3	16	4.0	15	3.8	3	0.8	df-9, *P*<0.000
SES IV	19	4.8	28	7.0	11	2.8	5	1.3	
SES V	12	3.0	36	9.0	10	2.5	11	2.8	

*Value with Yates' correction for continuity, df: Degrees of freedom, *P*<0.05 considered as statistically significant

macro- and micronutrients deficiencies. These deficiencies lead to a decrease in the growth spurt, for both physical and mental health.

Recommendations

A periodical and regular health check-up with concerted efforts toward their nutrition, along with focused health education will improve the health and nutritional status of these school-going adolescents. There is a need for the sensitization of adolescents and their parents through health and nutrition education (HNE), information education, and communication (IEC), and appropriate behavioral change communication (BCC) activities. Socioeconomic status of any family depends primarily on the per capita monthly income, which in turn is related to the family size; therefore, there is a need to encourage people to adapt small family norms to combat with nutrition deficiency.

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