ISSN: 2279 - 0594

Available Online at www.jbpr.in

Journal of Biomedical and Pharmaceutical Research 2 (4) 2013, 20-25

RESEARCH ARTICLE

NUTRIENT INTAKE AMONG SCHOOL GOING ADOLESCENT GIRLS IN LUCKNOW DISTRICT, INDIA

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Received 20 June 2013; Revised 30 June 2013; Accepted 04 July 2013

ABSTRACT

Background: Adolescent girls form an important vulnerable sector of population. Under-nutrition among adolescents is a serious public health problem internationally, especially in developing countries.

Aim: To assess nutrient intake among adolescent girls in Lucknow district, India.

Material and methods: A cross-sectional descriptive study was carried out in urban as well as rural schools of Lucknow district from October 2008 to September 2009.Multistage random sampling was used to select the requisite number of girls. A total of 847 school going adolescent girls between 10-19 years of age were interviewed and examined. A 24 hour recall method was used to assess dietary intake. Nutrient intake was compared with Indian Council of Medical Research (ICMR) Recommended Dietary Allowances (RDA). Nutritional status was assessed by Body Mass Index (BMI) for age.

Results: average daily intakes for energy, protein, iron and calcium were less than ICMR Recommended Dietary Allowances and these differences were statistically significant. Overall prevalence of thinness was found to be 17.0% (101/593)and 11.4%(29/254) (BMI <5th percentile according to National Center for Health Statistics-Centers for Disease Control and Prevention reference (NCHS-CDC) among urban and rural school going adolescent girls respectively.

Conclusions: The findings indicate that the diets of these girls tended to be inadequate for Energy, Protein, Iron and Calcium. The indications are that the nutritional status of adolescent girls should not be overlooked and suitable approaches designed to improve their nutrition should be considered. Whether, the approach is through education, or more direct interventions such as a school lunch programme.

KEY WORDS: Nutrient intake, Adolescent girls, Lucknow district, Nutritional status.

INTRODUCTION:

Adolescents are those between the ages of 10 and 19 years old and Adolescence is a transitional phase between childhood and adulthood characterized by marked acceleration in growth.[1] Dietary requirements for girls increase during adolescence because of pubertal growth and menarche.[2] Nutrient needs parallel the rate of growth, with the greatest nutrient demands occurring during peak growth velocity.[3] At the peak of growth spurt, the nutritional requirements may be twice as high as those of the remaining period of adolescence.[4] However, malnutrition has been observed among many adolescent girls in developing countries.[5]

Ahmad, et al., (2004),[6] in their study of nutritional status of adolescent school students in Lucknow district, observed that regarding energy, protein, iron and calcium intake/day in all the three age groups, daily intake was less than RDA as per ICMR guidelines in most of the girls. Saibaba, et al., (2002),[7] in their study among adolescent girls in Hyderabad, showed that the mean protein and energy intake among girls of 10-17 years age group were 39 ±17.28 gms and 1600 ±531.12 kcal respectively, both of which were much lower than the RDA. The recommended amounts were also not met, for iron, calcium and vitamin A. Prashant, et al., (2009),[8] in their study on nutritional status of 223 adolescent girls in an urban slum in south India, reported that Prevalence of underweight among adolescent girls was 42.6% (as per NCHS standards).

To design appropriate strategy to tackle the poor nutrition among adolescent girls, it is essential to study the nutrient intake. Hence, the present study was undertaken among school going adolescent girls, with the objective to

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assess nutrient intake among adolescent girls in Lucknow district.

MATERIAL AND METHODS:

The study protocol was submitted to the Institutional Ethical Committee of Chhatrapati Sahuji Maharaj Medical University, Uttar Pradesh, Lucknow, India and clearance was obtained. Informed consent of the principals of schools was taken before the study and assent from the selected adolescents was also obtained, before initiation of the study.

The present cross-sectional study was carried out among school going adolescent girls in Lucknow district, India from October 2008 to September 2009. An optimum sample size of 847(593 urban and 254 rural) school going adolescent girls of Lucknow district, India aged 10-19years, were interviewed and examined. In Lucknow district urban area proportionate to the population approximately 70% and rural 30%. So sample size is divided according to this proportion.

Multi-stage random sampling technique was used to select the requisite number of eligible girls.

First stage: Lucknow district is divided into urban and rural areas. The urban area is spread equally on both sides of Gomti River known as Cis Gomti and Trans Gomti. According to Nagar Nigam Lucknow, urban area is divided into six zones. From Cis Gomti two zones were randomly selected and similarly from Trans Gomti two zones were randomly selected.

Second stage: At the second stage, from each zone one senior secondary school was selected randomly from the listed senior secondary schools. Similarly two blocks were selected randomly from eight blocks of the rural Lucknow. From each block, one senior secondary school was randomly selected from listed senior secondary schools.

Third stage: At the third stage, students from classes VI to XII of age group 10-19 years were selected. Students within the class were selected through systematic random sampling. In some schools of rural area, the numbers of students in the classes were not enough therefore all the students of the class were invited to participate in the study as systematic random sampling was not possible.

A total of six senior secondary schools, four schools from urban area and two schools from rural area were randomly selected from listed senior secondary schools. From these schools 593 adolescent girls from urban schools and 254 adolescent girls from rural schools were selected for the study.

A structured interview schedule was developed and pre-tested on adolescent girls of a school other than the ones selected for the study. The pre-tested schedule was modified after pre-testing and finalized. Data regarding height, weight and average daily intake were collected using pre-tested and finalized interview schedule.

DIETARY ASSESSMENT:

Dietary intake was assessed by 24-hr recall method using an oral questionnaire for 2 consecutive days. Care was taken to avoid fasting and festival days while noting the intake. The intake of energy, protein, iron and calcium were calculated using the Nutritive Value of Indian foods and evaluated using Indian council of medical research recommended dietary allowance (ICMR-RDA).[9]

Anthropometric measurements:

i) Weight: Body weight was measured by weighing machine (Atco, Jebel Ali Freezone, Dubai), with student standing motionless on the weighing scale, feet about 15 cm apart, and weight equally distributed on each leg. The scale was set to zero before each reading. Students were instructed to wear minimum outerwear (as culturally appropriate) and no footwear while their weight was being measured.

ii) Height: Height was measured, to the nearest 0.5cm, with the student in an erect position against a vertical surface, and with the head positioned so that the top of the external auditory meatus was at level with the inferior margin of the bony orbit. A hard board was put horizontal to the wall, just above the head and height marked on the wall and measured with an ordinary measuring tape.

iii) BMI: Body Mass Index (BMI) was computed using the standard equation: BMI (kg/m^2) = Weight (kg)/Height^2 (m^2). The cut off value for thinness was the <5th percentile of NCHS-CDC standards and for overweight it was >85th percentile of NCHS-CDC standards.

INCLUSION CRITERIA:

Adolescent school girls aged 10-19 years who were enrolled in the selected senior secondary schools and agreed for interview, examination & anthropometric measurements.

EXCLUSION CRITERIA:

No exclusion criteria was applied during sampling

STATISTICAL ANALYSIS:

Statistical analyses were performed using windows version of SPSS 16.0. (2007, SPSS Inc, Chicago, USA) Data was organized into three 3 adolescent age groups, specifically 10-13, 14-16 and 17-19. Mean and standard deviation of the energy and nutrient intake and anthropometric data, obtained on 10–19 years old adolescent girls were calculated for each adolescent age -

group. Student t test was also used for analyzing the data. The level of significance was taken at P value <0.05.

RESULTS:

Table 1 shows the average daily intake of energy, protein, iron and calcium classified by specific adolescent age-group.

In general and across age groups, urban girls had higher energy and nutrient intakes than their rural counterparts. However, intakes of both rural and urban girls are below the ICMR-RDA guidelines. A maximum of 18.3% and 30.2%, energy deficit from RDA was in 14-16 years age group in both urban and rural girls respectively.

In both urban and rural school girls, a maximum of 35.2% and 52.1%, protein deficit from RDA was in 14-16 age group schools girls in both urban and rural schools respectively.

A maximum of 24.7%, calcium deficit from RDA was in 14-16 years age groups in urban girls and a maximum of 67.4%, calcium deficit from RDA was in 14-16 years age group in rural girls.

In age groups 14-16 and 17-19 years the average daily intake of iron was higher among rural girls than urban girls, while in 10-13 years age group it was more in urban girls than rural girls, although it was less than RDA as per the ICMR guidelines in all age groups in both urban and rural girls. A maximum of 62.8%, iron deficit was in 17-19 years age group in urban girls while in rural girls a maximum of 57.5%, iron deficit was in age group 14-16 years.

There was a statistically significant difference (p value<0.01) regarding average daily intake of energy, protein, iron and calcium in both urban and rural girls.

Table 2 shows age wise distribution of adolescent school girls by the prevalence of thinness and overweight. In urban and rural girls the prevalence of thinness was 17.0% (101/593)and 11.4% (29/254)respectively ('BMI for age'< 5th percentile). In urban girls the prevalence of overweight was higher, 5.4%(32/593) than in rural girls, 3.9%(10/254) ('BMI for age' ≥85th percentile). Highest prevalence of thinness, i.e., 38.1% (8/21)was in 18 years aged girls in urban schools.

Table 1: Distribution of adolescent girls by age group and average daily intake of energy, protein, iron & calcium

	Age group (yrs)	RDA	Urban			Rural		
			Mean nutrient intake/day	% deficit from RDA	p value	Mean nutrient intake/day	% deficit from RDA	p value
K.cal (kilocalories)	10-13	1970	1783(261)	9.5	<0.001*	1609(349)	18.3	<0.001*
	14-16	2060	1684(239)	18.3	<0.001*	1437(333)	30.2	<0.001*
	17-19	2060	1741(230)	15.5	<0.001*	1450(221)	29.6	<0.001*
Protein (gms or g)	10-13	57	42.2(7.4)	25.9	<0.001*	32.9(4.11)	42.2	<0.001*
	14-16	65	42.1(6.3)	35.2	<0.001*	31.1(4.5)	52.1	<0.001*
	17-19	63	42.8(6.6)	32.0	<0.001*	31.8(3.70)	49.4	<0.001*
Iron (mg)	10-13	19	10.6(1.3)	44.1	<0.001*	10.5(1.28)	44.9	<0.001*
	14-16	28	10.9(1.7)	61.0	<0.001*	11.9(2.33)	57.5	<0.001*
	17-19	30	11.2(1.3)	62.8	<0.001*	14.1(2.64)	52.6	<0.001*
Calcium (mg)	10-13	600	468(68)	21.9	<0.001*	228(47)	62.0	<0.001*
	14-16	600	452(65)	24.7	<0.001*	196(40)	67.4	<0.001*
	17-19	500	440(66)	12.0	<0.001*	210(44)	58.0	<0.001*

*P value<0.05 has been taken as significant.

Table 2: Distribution of Adolescent school girls by age and body mass index

Age (yrs.)	Urban (n=593)						Rural (n=254)					
	No.	BMI± S.D.	<5th percentile*		>85th percentile*		No.	BMI± S.D.	<5th percentile*		>85th percentile*	
			No.	%	No.	%			No.	%	No.	%
10	44	15.9(2.4)	9	20.4	2	4.5	8	14.5(1.5)	3	37.5	0	0
11	47	15.6(2.0)	15	31.9	1	2.1	5	16.5(1.9)	0	0	0	0
12	79	17.3(2.8)	14	17.7	6	7.6	33	16.7(1.7)	3	9.1	0	0
13	83	17.9(2.5)	6	7.2	5	6.0	32	18.2(2.4)	1	3.1	0	0
14	106	18.4(2.3)	13	12.3	2	1.9	47	18.4(2.4)	8	17.0	0	0
15	85	18.4(2.4)	14	16.47	2	2.4	29	19.8(2.1)	2	6.9	1	3.4

16	77	19.6(2.8)	12	15.6	12	15.6	41	23.8(21.6)	3	7.3	3	7.3
17	45	19.1(2.7)	9	20.0	2	4.4	38	19.9(2.5)	3	7.9	1	2.6
18	21	18.6(2.1)	8	38.1	0	0	17	19.6(2.6)	4	23.5	5	29.4
19	6	19.7(1.5)	1	16.7	0	0	4	18.6(2.8)	2	50.0	0	0
Total	593	18.0(2.7)	101	17.0	32	5.4	254	19.3(9.1)	29	11.4	10	3.9

*<5th percentile for thinness and >85th percentile for overweight by age according to NCHS-CDC reference growth chart

DISCUSSION:

In the present study, it was observed that the daily intake of energy was less than the RDA as per ICMR guidelines in all age groups both in urban and rural school girls. There was statistically significant difference (p=0.0001) with the RDA as per ICMR guidelines in both urban and rural girls. Mathur, et al.,[10] in adolescent girls in Mehrauli, Delhi, also had similar findings, that energy consumption in all age groups was lower than RDA. Similar findings were also observed by Chaturvedi, et al.,[11] Saibaba, et al.,[7] Goyle, et al.[12] and Kaur, et al.[13]

In the present study it was observed, that the percent deficit of protein intake from the RDA was the highest among 14-16 years old girls in both urban and rural schools. The deficit was 52.1% from RDA in rural school girls, which was higher than urban schools while this deficit was 35.2% of RDA, While Chaturvedi, et al.,[11] in their study among adolescent girls in Jaipur district observed that in all the three age groups there was a protein deficit of 23-29% than RDA.

Mathur, et al.,[10] in their study in Delhi, observed that Protein deficit was highest in 14 years old girls (36.92%). Goyle, et al.,[12] in their study in Jaipur, observed that mean protein intake among school children in 10-12 years, 13-15 years and 16-18 years age groups was 60.7%, 56.5% and 60.8% of the RDA, which is almost similar to the findings of our study. Protein is important for growth and maintenance of muscle. Adolescent nutrition is important for supporting the physical growth of the body and for preventing future health problems.

In the present study it was observed, that daily average intake of iron and calcium were less than the RDA in all age groups both in urban and rural school girls. A maximum of 62.8% iron deficit from RDA was observed in 17-19 years age group in urban school girls and in rural school girls a maximum of 57.5% iron deficit than RDA was in 14-16 years age group. In urban schools girls 24.7% calcium deficit from RDA was in 14-16 years age group while in rural school girls, about 67.4% calcium deficit than RDA was also in this age group.

Ahmad, et al.[6] also observed that mean iron deficit in both urban and rural adolescent girls of all age groups was 41-67%, and the percent deficit from RDA for calcium ranged from 51.7-66.9% in rural school girls while in urban school girls it was less than rural school girls i.e. 12.9%-29.7% which are in accordance with our findings while Kaur, et al.,[13] in rural Himachal Pradesh, reported that mean intake of iron was 39.9% of the RDA. For adolescent girls Iron is very important nutrient. Adolescent girls need extra iron for menstruation in addition to growth and development. Anemia in adolescent girls in future attributes to high maternal mortality rate; high incidence of low birth weight babies and high perinatal mortality.[14]

In the present study, it was observed that overall thinness (defined as BMI <5th percentile of NCHS- CDC reference) among urban girls was 17.0%(101/593), was higher than the overall thinness in rural girls (11.4%) (29/254). Adolescent girls of urban area are apprehensive about slim figure due to more media exposure. So nutrient intake was less among these girls.. It is posing a detrimental threat to their health and nutritional status.[10] Almost similar findings were also observed by Das, *et al.*[15] (14.7%) in their study. Sood, *et al.*[16] and Bose, *et al.*[17] reported a prevalence of thinness 5.1% and 23.1%, respectively, while Shahabuddin *et al.*,[18] in a rural community in Bangladesh, observed that 59.0% adolescent girls were thin. This higher figure of thinness in their study may be attributed to poor socioeconomic conditions of rural Bangladesh.

It was observed, that overall prevalence of overweight (defined as BMI >85th percentile NCHS-CDC reference) among urban school was 5.4% (32/593), which was more than rural girls (3.9%)(10/254).

Subramanyam, *et al.*,[19] in their study among adolescent girls in Chennai, observed that prevalence of overweight (BMI >85th percentile) was 9.6% in adolescent girls which is almost similar to our findings. While Mehta, *et al.*[20] and Sood, *et al.*[16] in their study, reported a prevalence of overweight 15.2% and 13.1%, respectively, which was more than our study and could be incriminated to the affluent society. Overweight in adolescent girls can result in a variety of adverse health outcomes. Adverse health outcomes include cardiovascular diseases, diabetes, osteoarthritis, gallbladder disease, and some sex hormone sensitive cancers.

CONCLUSION:

The findings indicate that diet of these girls were inadequate for energy, protein, iron and calcium which adversely affect the nutritional status. Therefore, need of

the hour is to plan and implement innovative developmental programmes to address the nutritional and health needs of adolescent girls in a comprehensive manner.

INTERPRETATION AND FUTURE IMPLICATIONS:

Future quantitative descriptive studies are required to validate the results of this study. Further research can be encouraged to improve nutrient intake of adolescent girls. Health education

Programmes on nutrient intake have to be carried out regularly in schools in consultation with concern health authorities.

LIMITATIONS:

Unable to find the difference regarding nutrient intake among the school and non school going adolescent girls because this is school based study. only a two day food recall for evaluating nutrient intake was used.

KEY FINDINGS:

Nutrient intake was less than the RDA as per ICMR guidelines in all age groups in both urban and rural school girls.

In urban girls the prevalence of thinness was more, 17.0% than in rural girls, 11.4%.

The study provides an indication to implement intensive health educational activities related to nutrition among the adolescent girls, their parents and teachers for effective management of these problems among all adolescent girls.

ACKNOWLEDGEMENT:

I am sincerely thankful to the principals of schools wherein the study was undertaken, for their valuable help extended during the study.

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