Dietary and nutrient intakes of school girls in Kathmandu, Nepal

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Abstract

The present study was carried out on school girls aged 10-18 years of Kathmandu district with the objective to assess the dietary and nutrient intakes of these girls. Data of three days dietary and nutrient intakes were collected using 24 hr recall method. The major findings of the study have shown that the intake of fats and oils, sugars and roots and tubers exceeded 60% of the amounts recommended by the ICMR, whereas intake of protective foods such as pulses, green leafy vegetables and fruits were less than 50% of the suggested balanced diet. Mean intake of nutrients such as fat, niacin, ascorbic acid and phosphorus exceeded the recommended dietary intakes (RDIs), whereas intake of energy, protein, calcium, iron, vitamin A and folic acid were lower than RDIs. But intake of none of the nutrients was less than 50% of RDIs.

keywords: Diet; nutrient; adolescent girls.

Introduction

World Health Expert Committee defines adolescence as a wide range (10-20 yrs) of age chronologically and within this period most of the extensive anatomical, biological and mental development take place.1 Sexual maturation becomes evident and is accompanied by "growth spurt" in height (142 cm-164 cm) and in weight (34-55 kg).2

The onset of adolescence triggers a growth rate greater than in any other stage of human life except for the first year of life.3 The onset of puberty results from hormonal activities which in turn results in marked morphological changes in all organs and the system becomes mature in both sexes.4 Major changes such as gonadal growth and development, growth of secondary sexual organs and sexual characteristics, respiratory, circulatory and muscular systems leading to increased strength and efficacy and changes in body composition take place during adolescence.1

There is a rapid increase in the length and thickness of the muscles.5 Blood volume increases from 2.5 to 3.5 litres in girls during this period. An infant has only three bones in its wrist and remaining six bones develop during childhood and their complete hardening takes place in the adolescent period.6 Besides, in girls breadth increases and bony pelvis widens in preparation for reproduction.4 After onset of growth spurt, the body starts laying down more fat and girls develop more fat cells. The fat content of the body increases from 18% to 28%.6,5,7 Even intra-individual variations in energy intake during adolescence is a possible nutritional factor contributing to the onset and magnitude of adolescent growth spurt and leads to retarded physical and intellectual development.7,1

Thus, proper nutrition prior to and throughout the adolescent period is indispensable for optimum growth in height and weight and for better outcome of pregnancies later in life. The adolescent growth spurt characterized by peak velocities of growth in height and weight, provides a second opportunity for achievement of full genetic potential for growth.8 Unfortunately, these increased inputs are absent particularly in diets of adolescent girls in developing countries. As a result, the physiological opportunity provided by adolescence to correct growth deficits of early childhood, may not be fully availed of and the adolescent girls would end up as a stunted adult. Therefore, adolescence is and important time for nutritional interventions. However, basic data of daily food intake of Nepalese adolescent girls have not been reported so far. Thus, the present study was carried out with the objective to assess the dietary and nutrient intakes of the adolescent girls and their adequacy in comparison with recommended dietary allowances (RDAs).

Methodology

Eighty school girls, aged 10-18 years were selected randomly from four government-aided schools of Kathmandu. Of the several methods for dietary data collection, 24 hr recall of diet consumed by the subjects through interview, was selected because this method has been frequently used and is convenience practically

to obtain current dietary intake information. The main part of the questionnaire focused on daily items of breakfast, morning meal, snacks, evening tea and dinner. This part of information was collected for three alternate days including one holiday. All the food items consumed during the past 24hr under survey were recalled by the subject and recorded by the investigator. The recall interviews were conducted in the school premises. Since the subjects were not able to report the ingredients of the recipes, their homes were visited and their mothers were asked for the information regarding quantities of raw ingredients used to prepare the items and the method of preparation. The amount consumed as reported by the subjects was verified from the mothers. The subjects were also present during the interviews. The local common utensil were exhibited for better estimation of the quantities of food consumed by the subjects. The utensils used in the interview were standardized using standard measuring cups. All the recipes consumed by the subjects were prepared by the investigator, raw food equivalent of the portions consumed by the subjects and nutrient intakes were calculated, using a computer-based programme. The data in the Indian food composition tables' Nutritive Value of Indian Foods'[9] was used for developing the computer programmes. The intakes over three days for each subject was averaged for a 24-hr period and compared with the dietary guidelines for food groups formulated for Indians recently by the Indian Council of Medical Research (ICMR) in 1998.[10] The foods which could not be fitted into the broad categories of the balanced diet recommended by ICMR were considered as others. These included Jams, Jellies and honey. Mean nutrient intakes of the subjects were compared with the recommended daily intakes of nutrients reported by ICMR in 1992.[11]

Result

Dietary Intake

The mean dietary intakes in terms of different food groups in comparison with what is recommended by the ICMR as balanced diet for the respective age groups are presented in Table I. The major observation that emerge from this table is that except for the mean intake of cereal, which was 102% of the recommended balance diet for the 10-12y old girls, intake of all other food groups were lower than that of the suggested balanced diet. However, it was interesting to note that intake of fats and oils, sugars and roots and tubers exceeded 60% of the suggested optimal diet, while intake of protective foods, such as pulses, green leafy vegetables (GLVs) and fruits was less than 50% of the recommended balanced diet. When the mean intakes of food groups were compared between age groups 10-13 year and 13-18 year, a trend of higher intake was observed among older age group except for the intake of cereals, GLVs and sugars. However, only the intakes of roots and tubers, other vegetables, fruits, milk and milk products were significantly higher for the 13-18 y age group as compared to the 10-13 years. Although increasing trend in the intakes of food groups was observed among older age group as compared to younger, none of the groups could meet the suggested balanced diet, with the exception of cereal intake in the younger children and roots and tubers among older children.

Nutrient Intakes

Mean nutrient intakes of the subjects studied are present in Table II. Increasing trend in the mean intake of all the nutrients (except iron) with increase in age was observed. However, the mean intake of certain nutrients such as energy, protein, iron, folic acid, vitamin A and zinc were found to be the highest in the age group 13-16 years as compared to 10-13 year and 16-18 year. The differences in the intake of nutrients of groups, 10-13 year and 16-18 year, were not statistically significant with the exception of ascorbic acid, the intake of which was significantly lower for the 10-12 year age group, compared to the
older children. When mean nutrient intakes of the subjects were computed as percent of RDIs, mean intakes of fats, niacin, ascorbic acid and phosphorus were found to be higher than the RDIs, whereas intake of other key nutrients such as energy, protein, calcium, iron, vitamin A (except among age group 13-16 year) and folic acid was found to be lower than RDIs. But none of these nutrients was grossly deficient, i.e. mean intakes were not less than 50% of RDIs.

Table I: Mean intake (gm/day) of different food groups of adolescent girls and as percent of RDA (N=80).

	Age groups						
	10-13 year (N=18)			*13-18 year (N=62)*			*'t' values*
Food groups	*Intake (gm) Mean±SD*	*RDA (gm)*	*Intake as percent of RDA*	*Intake (gm) Mean±SD*	*RDA (gm)*	*Intake (gm) as percent of RDA*	*10-13 year versus 13-18 year*

Cereals	275.2±86.83	270	101.9	279.7±67.1	300	93.2	0.23NS
Pulses	24.6±18.34	60	41.0	28.8±20.51	60	47.9	0.78NS
GLVs	45.4±38.70	100	45.4	37.87±42.45	100	37.9	0.67NS
Roots and tubers	75.0±52.34	100	75.0	102.9±50.18	100	102.9	2.06*
Other vegetables	34.3±28.17	100	34.3	61.5±45.4	100	61.5	2.41**
Nuts and oilseeds	1.6±2.26	-	-	2.1±4.97	-	-	0.43NS
Fruits	15.8±14.68	100	15.8	41.6±51.05	100	41.6	2.10**
Meat, fish and poultry	26.0±46.70	100	26.0	45.0±60.52	100	45.6	1.23NS
Milk and milk products	69.0±64.91	500	13.8	112.7±119.92	500	22.5	1.48*
Sugars	21.9±22.77	30	73.1	15.8±10.84	30	52.9	1.58NS
Fats and oils	15.7±8.93	25	62.9	16.6±7.90	25	66.6	0.42NS
Others (jams, jellies, pickles)	1.1±1.55	-	-	0.8±1.91	-	-	0.60NS

* Significant at p<0.05 ** Significant at p<0.01

Table II: Mean nutrient intakes per day of adolescent girls and comparison with respective RDI (N=80)

	Age groups									
Nutrients	*10-13 y (N=18)*			*13-16 y (N=48)*			*16-18 y (N=14)*			*F/ratio*
	Intake Mean±SD	*RDI*	*Percent RDI*	*Intake Mean±SD*	*RDI*	*Percent RDI*	*Intake Mean±SD*	*RDI*	*Percent RDI*	
Energy (Kcal)	1522±463.85	1970	76.0	1631±322.79	2060	79.2	1562±213.85	2060	75.9	0.76NS
Protein (g)	41.4±13.63	57	69.2	49.0±16.57	65	76.0	47.0±13.95	63	74.6	1.57NS
Fats (g)	27.1±13.66	22	122.9	35.2±17.62	22	160.2	35.3±18.34	22	160.4	1.63NS
Carbohydrate (g)	279±87.78	-	-	286±57.81	-	-	274.0±43.89	-	-	23NS
Vitamin A	462.4±435.8	600	77.2	895.6±865.14	600	149.3	530.0±272.50	600	88.3	3.067NS
Ascorbic acid (mg)	44.3±28.11 (a,b)	40	110.7	67.9±30.66(a)	40	169.9	70.3±29.21(b)	40	175.9	4.60*

Thiamin (mg)	0.9±0.41	1.0	91.9	1.1±0.60	1.0	114.5	1.09±0.26	1.0	109.1	1.23NS
Riboflavin (mg)	0.6±0.21	1.2	49.9	1.0±1.37	1.2	82.5	0.9±0.53	1.2	73.6	0.83NS
Folic acid (µg)	54.8±43.3	70	67.4	79.1±41.20	100	79.1	74.1±24.83	100	74.1	2.48NS
Niacin (mg)	13.6±4.17	13	101.6	14.9±5.54	14	106.5	14.5±3.51	14	103.6	0.47NS
Iron (mg)	17.99±7.97	19	83.9	19.44±7.312	28	68.2	16.19±3.97	30	54.0	1.56NS
Calcium (mg)	409.0±208.62	600	68.2	455.6±214.52	600	80.2	469.5±234.43	500	93.9	0.39NS
Phosphorous (mg)	833.0±247.05	600	138.8	992.3±284.5	600	165.4	995.7±203.02	500	165.9	2.56NS
Zinc (mg)	5.4±3.89	-	-	6.29±9.40	-	-	5.2±1.63	-	-	0.16NS

(a,b) superscript indicates significant with (a) and (b).

* Significant at $p<0.05$

Matching superscript alphabet indicates significant difference between values.

Discussion

Dietary Intake

The data on dietary and nutrient intakes on Nepalese adolescent girls are reported here for the first time. Inadequate dietary intakes of iron, vitamin C, vitamin A and folic acid could be contributing factors to a high prevalence of anaemia.

In general, the results showed intake of protective foods such as GLVS, pulses and fruits less than 50% of the RDAs, while the intake for roots and tubers, fats and oils and sugar exceeded 60% of RDAs. The diets were both qualitatively and quantitatively not adequate with reference to several food groups, a finding reported from many developing countries for the poorer income groups.

The consumption of cereal and GLVs were found to be much more among Nepalese girls in the present study as compared to the reports in various studies on adolescent girls in India.[12,13,14] The intake of GLVs (37-45 gm/ day) among the subjects in the present study was two-fold higher than the amount (16-25 gm/day) reported for Indian girls.[12] Besides, the type of GLVs, consumed by the subjects of the present study were mustard leaves, rape leaves and garden cress leaves that contained much higher level of iron, carotene and vitamin C. Iron content per 100 gm of garden cress leaves, mustard leaves and rape leaves are 28.6 mg, 16.3 mg, and 12.5 mg respectively.[9] The studies carried out in different part of India have shown that the food intake is related to socio-economic status of the population, i.e. high income group had better intake of diets as compared to low income families.[13,15] As income rises, it has been reported that there is a decline in cereal consumption with a corresponding increase in protective foods.[16] In the present study subjects, a decrease in cereal intake was also seen in the intake of pulses and GLVs will need to be addressed in nutrition educational efforts especially in view of the lower intake seen in the present study in anaemic subjects compared to non-anaemics.

Nutrient Intakes

Nutrient intakes are expected to increase with age but the difference between the various age groups is not significant. The observation that nutrient intakes were highest for the 13-16 group, when taken together with the reported age at menarche of 13-15 year implies that pre-menarcheal period was associated with higher intakes. This is consistent with the observation that peak height velocity occurs in the pre-menarcheal period.[17,8] Deficient intakes of energy, protein, calcium, vitamin A, rioflavin and folic acid in the present study seemed to be

consistent with results reported in Indian studies.[12,13,18,19] It has been reported for Bangladeshi girls that more than 60% had nutrients less than RDIs.[20] Ethnicity was a factor that influence nutrient intakes. The higher niacin intakes of Newars, found an easy explanation in the higher meat intake. The significant correlation between intakes of vitamin A, riboflavin and fats was observed in the present study, with increasing per-capita income and is indication of the qualitative improvement in the diets, although this was not reflected for all nutrients. Higher intake of food items and nutrients have been reported for all age group population of better income as compared to low income Indian family.[13,15] Analysis of nutrient intakes of anaemic and non-anaemic girls brought out the interesting finding that folic acid intake was significantly higher in non-anaemic subjects and further a significant positive correlation was also observed between haemoglobin levels and folic acid intake. Thus, the dietary data indicated folic acid deficiency to be an important factor in anaemia seen in these children. Mean iron intakes were not different between anaemic and non-anaemic subjects. Although a positive correlation was noted between iron intake and haemoglobin levels, this was not significant. It is known that total intake of iron per se may not explain high prevalence of anaemia in a population but the bioavailable iron intake which in turn is determined by the composition of the diet, is important.[21] It has been reported in India that iron intake per adult consumption unit maybe 30mg/day[16] yet anaemia is highly prevalent in all age, sex groups and especially so in the vulnerable group of young children, menstruating girls and pregnant women.[22]

The Nepalese diets have not been analyzed for bioavailability of iron. However, from studies carried out elsewhere made it clear that meat, fish and poultry and ascorbic are enhancers of iron absorption.[23] The finding that non-vegetarian subjects in the present study had significantly higher haemoglobin levels coupled with the observation that their meat intake averaged 48.6±60.23 gm/day argues for a role of iron bioavailability in curing anaemia in the population.

Further, the dietary data also indicated that other dietary deficiencies such as vitamin A may have a role in the prevalence of anaemia in this population. Study conducted in Nepal have shown that vitamin A is also postulated to have a role in mobilization of iron stores from the liver.[24,25] Overall, it appeared that dietary inadequacies had a role in the etiology of anaemia seen in these girls.

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