A study to determine calorie and protein intake in adolescent school girls of Indore city, M.P., India

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Introduction: Adolescence is a significant period of human growth and maturation. This period of rapid growth requires a well-balanced diet. An inadequate diet and unfavourable environment adversely influence the growth resulting in short stature and low lean body mass. Not much attention has been paid to adolescents by nutrition-related programmes. Hence, this study was planned to assess the dietary intake of adolescent girls. **Method:** This was a cross-sectional study conducted in five schools in urban areas of Indore city. The study group included 400 school girls of age 11 to 18 years. After taking written informed consent from the parents, data was collected on personal information, dietary intake and socioeconomic status. Anthropometric measurements were done, and data were analyzed. **Results:** The calorie intake in this study ranged from 69% to 86% of R.D.A. Mean protein intake ranged from 71.5% to 73.7% of R.D.A., and mean iron intake ranged from 50% to 71.4% R.D.A. All the girls were consuming an inadequate amount of calories, proteins and iron. **Conclusion:** All the adolescent girls in this study had low intakes of calories, iron and protein, which is comparable to that found in other Indian studies.

Keywords: Adolescent girls, Calorie intake, Protein intake, Iron intake, Indore

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Mahendra Solanki, Associate Professor, Department of Orthopaedics, M.G.M. Medical College and Associated Hospitals, Indore, Madhya Pradesh, India. Email: drmahendra2707@gmail.com	Sunita Solanki, Mahendra Solanki, A study to determine calorie and protein intake in adolescent school girls of Indore city, M.P., India. Int J Med Res Rev. 2021;9(6):406-411. Available From https://ijmrr.medresearch.in/index.php/ijmrr/article/view/1386	

Introduction

Adolescence is a significant period of human growth and maturation. An exceptionally rapid rate of growth characterizes this period, and nutritional needs are also more during this period of the life cycle.[1].

Young girls are a very important part of our society because the nation's health depends largely on the would-be mothers. This period of rapid growth requires a well-balanced diet. Also, it is a must for normal growth and maintenance of physical and mental fitness. However, inadequate diet and unfavourable environment in developing countries adversely influence the growth and nutrition of adolescence, resulting in short stature and low lean body mass. The high rate of malnutrition in girls not only contributes to increased morbidity and mortality associated with pregnancy and delivery but also to increased risk of delivering low birth-weight babies. This contributes to the intergenerational cycle of malnutrition.[2].

Poor nutrition starts before birth, generally continues into adolescence and adult life and can span generations. Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood and, when pregnant, are more likely to deliver low birth-weight babies. Epidemiological evidence from both developing and industrialized countries now suggests a link between foetal under-nutrition and increased risk of various adult chronic diseases (ACC/SCN, 2000). Nutrition challenges continue throughout the life cycle, particularly for girls and women (Fig. 1).

It is thus imperative to prevent malnutrition at every stage of the life cycle. Investing in nutrition throughout the life cycle will have both short-term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity, and increased adult productivity (ACC/SCN, 2000).[5].

Hence, there is a need for regular assessment of the physical growth and nutritional status of adolescent girls. The present study, therefore, is an attempt in this regard to evaluate the physical growth and calorie and protein intake of school-going girls aged between 11 to 18 years in Indore city.

Source: ACC/SCN, 2000
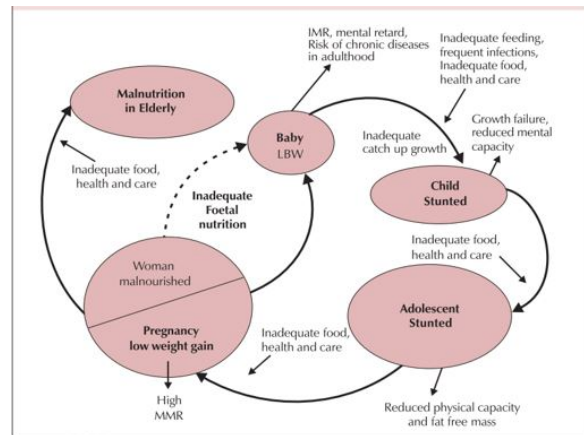
Figure 1: Nutrition throughout the life cycle.

Material and Methods

Study design: It is a cross-sectional study conducted in 5 schools in urban areas of Indore city

Sampling technique: The schools were selected by purposive sampling. Girls of age 11-18 years were selected from these schools.

Sample size: 400 schoolgirls of age 11 to 18 years.

Inclusion Criteria: All the girls between the age group 11- 18 years whose parents gave consent for this study were included.

Tools and techniques of data collection: After taking permission from the school's Principal, consent forms were distributed to the girls to take consent from the parents.

Then, a self-formulated questionnaire was administered to those students whose parents gave consent for this study. Data was collected on-

01. **Socioeconomic status –** Assessment of the socioeconomic status is an inherent part of various community based and many hospital-based studies, which seek to study the effect of socioeconomic status on different physiological states. They were classified according to Kuppuswamy socioeconomic status scale. This scale takes account of education, occupation and income of the family to classify study groups into high, middle and low socioeconomic status.

02. **Dietary Intake-** It was calculated using 24 hrs dietary recall method. The quantity of cooked food consumed by each subject during the

01. last 24 hours was inquired using standard cups. The raw amount of food consumed by each subject was calculated. Caloric and nutrient intake was calculated using data in 'Nutritive Value Of Indian Foods', Indian Council of Medical Research, Hyderabad.[3]

02. **Anthropometric measurements -** Nutritional Anthropometry is concerned with the measurements of the variations of physical dimensions and body composition at stages of the life cycle and different planes of nutrition-

- **Height:** A vertical measuring scale fixed on a wall was used. Height was measured to an accuracy of 0.1cm. The subject was asked to remove the footwear and stand upright on a flat floor, looking straight, with feet parallel and with heels, buttocks, shoulder and back of the head touching the wall.

- **Weight:** is a sensitive index of nutritional status. It was measured by using a portable weighing machine. Subjects were weighed to the nearest 0.5 kg. Subjects were asked to stand straight and without shoes.

- **Body mass index:** is defined as the weight in kilograms divided by the square of the height in metres (kg/m2). The B.M.I. index has the least correlation with body height and the highest correlation with independent measures of body fat. "B.M.I.- for- Age: Girls, Age 2-20 years", developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000), was used as the reference standard. B.M.I. was plotted against the age in the chart to determine the weight status by percentile group. <3rd percentile height of NCHS standard was considered 'stunted' and <5th percentile 'B.M.I. for Age' of NCHS reference was considered Thin'.

The statistical analysis was carried out using Microsoft Excel. The mean values of food and nutrient intakes of adolescents were calculated for different age groups. Nutritive value tables for Indian foods were used for calculating nutrient intakes. [4]

The food intake was compared with the balanced diets recommended for Indians. The intake of nutrients compared with the recommended dietary allowances (R.D.A.) for Indians.

Result

Information from 400 adolescent girls was collected on socioeconomic and nutritional status. Data thus obtained was analyzed.

Most of the girls (85%) belonged to the lower-middle and upper-lower socioeconomic class. 90% of girls were of the Hindu religion. 261 (65.25%) girls in this study were vegetarians, while 139 (34.75%) were nonvegetarians.

At all ages, the mean height and weight were less than the NCHS standards. 'B.M.I. for Age 'was significantly associated statistically with socioeconomic status P=.005 and Calorie intake P=0.03.

It shows that mean calorie intake ranged from 69% to 86% of R.D.A. All the girls were consuming an inadequate amount of calories. A maximum of 86% of R.D.A. was seen in the 11- 12 years age group, and the least intake, 69%, was seen in the 13-15 years age group.

Table No: 1 Distribution of adolescent girls according to daily Calorie Intake.

Age (in years)	Number of Girls	Mean Calorie Intake (cal/day)	R.D.A.	% R.D.A.
11- 12	60	1700	1970	86
13-15	211	1415.11	2060	69
16-18	129	1535.83	2060	74
Total	400			

It shows that mean protein intake ranged from 71.5% to 73.7% of R.D.A. All the girls were consuming an inadequate amount of proteins.

Table No. 2 Distribution of adolescent girls according to daily Protein Intake.

Age (in years)	Number of Girls	Mean Protein Intake (gms/day)	R.D.A. (gms)	%RDA
11- 12	60	42	57	73.7
13-15	211	47	65	72.3
16-18	129	45	63	71.5
Total	400			

It shows that mean iron intake ranged from 50% to 71.4% of R.D.A. All the girls were consuming an inadequate amount of iron.

Maximum 71.4% of R.D.A. was seen in 14 years age group, and the least intake of 50 % was seen in 18 years age group.

Table No. 3 Distribution of adolescent girls according to daily Iron Intake.

Age (in years)	Number of Girls	Mean Iron Intake(mg/day)	R.D.A. (mgms)	%RDA
11+	13	9	19	42.6
12+	47	13	19	68.4
13+	60	17	28	60.7
14+	67	20	28	71.4
15+	84	17	28	60.7
16+	64	21	30	70.0
17+	53	19	30	63.3
18+	12	15	30	50.0

Discussion

WHO defines adolescence as the segment of life between the ages of 10-19 years? Adolescents are an in-between group, with some nutrition problems common with children and some with adults. Poor nutrition starts before birth, generally continues into adolescence and adult life and can span generations. [1]. chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood and, when pregnant, are more likely to deliver low birth-weight babies. [5].

 In the present study, the findings indicate that dietary intake of calories (54-86% of R.D.A.) and protein (47-76% of R.D.A.) was inadequate in all the girls. These findings are comparable to studies conducted in other parts of India. In a study conducted among poor adolescent girls in rural Rajasthan by Chaturvedi et al. [6], the energy and protein intake was 64-74% and 65-77% of the recommended allowances, respectively. In a study by Venkaiah et al., 75% of the girls consumed more than 70% of R.D.A. for energy, and protein intake ranged from 40-to 100%. [7]. In another study by Malhotra et al., calorie and protein intakes were 68-75% and 67 – 87%, respectively. [8]. In a study done in rural areas of the Bhopal district, it was found that 70 % of the adolescents had a low intake of calories. [9]. Yadav and Singh observed a calorie deficiency of 29 % among the adolescents in tribal areas of Bihar. [10].

A study done in rural areas of Bhopal found that 70% of adolescents had a low intake of calories. [11]. Another study was done among rural adolescents in the Karnal district; Haryana (2015) reported that more than half of the girls, i.e., 54.3%, had inadequate energy

Intake.[12]. In another study, participants had 78.40 % and 73.03% calorie intake between 10- 15 and 16- 19 years, respectively. [13]. In a study by Seema Choudhary et al., 29.64% of the study subjects suffered from chronic energy deficiency grade III.[14].

A study conducted by Khandelwal et al. in the Shimla district concluded that the adolescent girls aged 13-15 years had a percentage deficit in calorie, iron, zinc and calcium intake of 47.7, 61.5, 53.6, and 43.6 percent, respectively, as compared to R.D.A.[13]. In another study by A.Dutta et al., the mean energy intake was 1306.35kcal, that is, 56.07 percent of daily intake as per R.D.A. Average protein consumption is 40.12 grams per day, which is 77.30 percent of R.D.A. prescribed for adolescents, which is approximately 22.75 less than R.D.A.[16]. In a study conducted by Sharma et al. in 2005, it was reported that the protein intake on an average was thirty percent less than that recommended by the Indian Council of Medical Research (ICMR), which is comparable to the present study. The mean calorie intake for 301 adolescent girls was 1155.9+ 522.7 Kcal, which is only fifty-six percent of recommended daily calorie intake, similar to the present study.[17].

In a study, the majority of the adolescent girls (82.5%) had a calorie intake of less than 1400 kcal. 7.5% of girls had a calorie intake of less than 1000 kcal. The average energy intake was 1239.6±176.4 kcal/day. The calorie intake of adolescent girls was less than the recommended dietary allowances for their age. The average calorie intake was deficient by 39%. The average protein intake was 39.5±7 gm/day, which was deficient by 36%. [18].

The intake of pulses, milk and milk products in the present study was low. This could be the possible reason for the energy and protein deficits in the diets. Moreover, the diets were cereal-based and vegetarian, so the protein quality can be expected to be rather low. The intake of fruits and green leafy vegetables was also found to be grossly inadequate.

In the present study, the iron intake was found to be very low, 40 -70 %, which is comparable to the iron intake by the adolescent girls in rural areas reported by Venkaiah et al.[7]. and in 6 blocks of Delhi reported by Malhotra et al. [8], which were 35 -80% and 54 to 71 %, respectively. Only a minor increment was seen with age. It

Is a well-known fact that during adolescence, the iron requirements increase due to the changes in body mass, expanded blood volume and increased respiratory enzymes; the onset of menstruation one year after the peak growth further increases these requirements.[19]. But in the absence of adequate dietary intake of iron, the girls become highly prone to anemia.

Conclusion

All the adolescent girls in this study had low intakes of calories, iron and protein. So far, most of the interventions have either focused on children aged 0-5 years or on pregnant women and, to some extent, on lactating women. Investing in nutrition throughout the life cycle will have both short term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity and increased adult productivity.

However, not much attention has been paid to adolescents by nutrition-related programmes in developing countries.

What new this study adds to the existing knowledge?

Very few studies have been done in India on adolescent girls. I could not find any study being done in Indore City. All the girls in this study had poor calorie, protein and iron intake. The health programmes directed at adolescent girls need more emphasis on their diet.

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