A Comparative Study of the Nutrient Intake by Anaemic and Non Anaemic Adolescent Girls (16-18 years)

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Abstract:
Malnutrition is an ever growing health problem recognised in the present adolescents today. The present study was undertaken to assess the nutrient intake of Adolescent girls (16-18 years) in Ajmer city and to make a comparative study of the Anaemic and Non Anaemic subjects. Anthropometric measures, biochemical investigation to assess the Haemoglobin levels in the subjects and dietary survey through 24 hour recall method for three consecutive days were measured from 250 subjects by using standard techniques. On an average the subjects of anaemic groups consumed significantly less (P <0.01) Energy, Protein, Iron, Vitamin A, Folic acid, Niacin, Ascorbic acid and Fibre. The non anaemic group had their nutrient intakes which were less than the Recommended Dietary Allowances (RDA), but the intakes of almost all the nutrients were even lesser in the anaemic group than the ones in the Non Anaemic group. The prevalence of anaemia in the girls of adolescent age group might be related to dietary deficiencies and perhaps poor dietary patterns. The present study undertaken indicated that those subjects who had deficient nutrient intake in their diet would have a higher risk of anaemia as compared to normal or overweight subjects.

Keywords: Nutrient Intake; Adolescent; Girls; Anaemic; Non-Anaemic

INTRODUCTION

Adolescence is an exciting time of development yet it is a complex one, a transition phase of life where one enters as a child and emerges as an adult. Rapid physical growth and development is accompanied by sexual maturation. The individual develops a capacity for abstract and critical thought, also a sense of self awareness when social expectations require emotional maturity. Adolescence is a highly formative period for behavioural patterns and activities relevant to health. Adolescents, are in a very crucial period, as they search for identity, strive for independence, acceptance and are concerned about their appearance. All these drastic changes may greatly affect eating patterns. These changes that occur in Adolescence have a direct brunt on the nutrient needs and dietary behaviour of Adolescents.[1]

Adolescence is a very rapid phase of growth, with specific need for nutrients. These needs need to be met in a balanced manner in order to prevent both undernutrition and obesity. Nutrition plays a crucial role in the transition from adolescence to healthy adulthood. Poverty, food insecurity, poor

sexual and reproductive health, violence, infectious and non-infectious diseases and quality of the available foods are few of the causes of Undernutrition in adolescents[2, 3, 4].

Excessive Energy intake should be avoided to prevent obesity. On the other hand the Protein intake of the adolescent should not be inadequate; or it will result in delayed or stunted growth and development. Malnutrition among children and adolescents is a major cause of delayed growth, lower intellectual quotient, impaired cognitive maturation, increased risk of contracting communicable diseases and behavioural problems[5]. Micronutrient needs are elevated during Adolescence in order to support the rapid growth spurt. Calcium needs are greater during Adolescence due to accelerated muscular, skeletal, and endocrine development. The Iron requirements during Adolescence are increased due to the deposition of lean body mass, increase in red blood cell volume and to support iron lost during menses in females. Folic acid is very important as a preventive measure against neural tube defects for females[1]. Due to the increased calorie intake, the need for Thiamine, Riboflavin, and Niacin increases. Vitamin D is required for the skeletal growth[6].

Teenagers have the reputation of having erratic eating habits. The physical and the emotional changes that take place in adolescence affect the dietary intake, the eating habits and thus the nutritional status. The diet of adolescents may be inadequate due to the ignorance about good and proper nutritional practices, skipping of meals in order to maintain a good physique, having an excessive inclination towards fast foods and overconsumption of soft drinks, sugary foods, and lack of consumption of fruits and vegetables.

The diet in Adolescence is of great significance because it affects the nutritional status of the future years. The choice of foods and preferences of adolescents are a cause of malnutrition in some places, in spite of adequate food availability[7, 8]. Adequate and well balanced foods should be eaten in order to prevent both under nutrition and obesity. It is essential that girls should ensure an optimum intake of Calcium, Iron and Folic Acid. Calorie and protein rich foods should also be consumed to support the growth spurt. Adolescents globally consume less than the prescribed amounts of fruits and vegetables and very high levels of sodium and sugar [7, 8].

The urgent need is, to conduct a nutrition screening for the adolescents, to evaluate their nutritional status, the adequacy as well as the excessive intake of nutrients. Nutrition education and counselling sessions must be organised for adolescents to address their behavioural needs and to ensure the development of proper food habits and thus a good nutritional status[1].

METHODOLOGY

The present study was undertaken to assess the nutrient intake of urban adolescent girls (16-18 years). To fulfil the objectives of the study the following steps were undertaken:
A) Selection of area
B) Selection of Subjects
C) Development of Tools and Collection of Data
    (i) General Information
    (ii) Biochemical Investigation to assess the Haemoglobin levels in the subjects
    (iii) Dietary survey through 24 hour recall method for three consecutive days.

A. Selection of area:
The study was conducted in the urban area of Ajmer City.

B. Selection of subjects:

A particular private school of Ajmer City was selected by convenience sampling. This school catered to the middle income strata of Ajmer City.

A Sample of 250 adolescent girls was selected by random sampling. The subjects selected were willing to provide the data required for the study.

These 250 Adolescent girls were tested for the presence of Anaemia. From which 205 were found to be Anaemic and 45 were Non- Anaemic. From among these 150 subjects were randomly chosen to form two groups Anaemic and Non -Anaemic. Out of the 150 subjects 145 completed the trial.

C. Development of Tools and Collection of Data:

(i) General information:
General Information pertaining to age, religion, caste, food habits, health status and information regarding the family: such as type, composition, educational status, occupation were collected from the subjects.

(ii) Biochemical Investigation
Haemoglobin estimation was done by Cyanomethemoglobin method of Dacie and Lewis (1975) as given in National Institute of Nutrition, Manual of Laboratory Techniques [9].

(iii) Dietary Survey:
Dietary survey was done to get information regarding the food consumption, nutrient intake levels, and sources of nutrient as well as food habits. Detailed information on food intake was obtained using 24-hour recall for three consecutive days. The cooked amount of foodstuffs consumed was recorded in terms of household measures (a set of standardized cups and spoons was used to aid the respondent to recall the quantities consumed.) The cooked amount of each food item consumed by the subject was then converted into raw equivalents.

The different food items were categorized into respective food groups the average intake of Energy, Protein, important Vitamins and Minerals were calculated from the values per 100 g of edible portion given in the Food Composition Tables by Gopalan *et al.* (2003)[10] and compared to the Recommended Dietary Allowances for girls (16-18 years) as given by ICMR (1998)[11].

STATISTICAL ANALYSIS OF DATA AND RESULTS

Data on various aspects were classified and tabulated and were presented in the form of frequency distribution. The data obtained was statistically analysed through appropriate statistical measures.

Results and Discussion

Anaemic subjects were recognized on the basis of their haemoglobin level being below 12 g/dl (WHO, 1968). 82% subjects were found to be Anaemic. The World Health Organization (WHO) criteria were taken as the basis for the identification of the degree of Anaemia. 42% subjects were found to be moderately anaemic (Haemoglobin level between 7 g/dl and 10 g/dl), 36% subjects were mildly Anaemic, (Haemoglobin level between 10 g/dl and 12 g/dl), 4% were severely Anaemic (Haemoglobin level less than 7 g/dl) and the remaining 18% subjects had normal haemoglobin level.

Table 1: Distribution of Adolescent Girls (16 – 18 years) according to Haemoglobin Values

N=250

Classification of Anaemia*	Haemoglobin levels	Number	Percentage
Severe	<7g/dl	9	4
Moderate	>7-<10g//dl	105	42
Mild	$\geq$ 10-<12 g/dl	91	36
Non-Anaemic	$\geq$ 12g/dl	45	18

WHO (1968) in De Meyer et al. (1989)

The mean nutrient intake was calculated from the results of the dietary survey and compared to the values as given by ICMR (1998)[11].

1) Energy: The mean Energy intake by anaemic and non – anaemic subjects was 1485+380 Kilo Calorie (Kcal) and 1893+360 Kilo Calorie (Kcal) respectively. The anaemic subjects fulfilled 72% of the Recommended Dietary Allowances (RDA) (i.e. 2060 Kcal) suggested by ICMR (1998)[11] in comparison to the non-Anaemic group which fulfilled 92% of the RDA. A significant difference was observed in the intake of energy of both the groups (P <0.01). Both the groups consumed significantly less (P <0.01) energy as compared to suggested RDA by ICMR (1998)[11] the reason being reduction in the consumption of cereals and roots and tubers.

2) Protein: The average daily Protein intake was 46.3+12.4 grams (g) and 58.5+14.6 grams (g) by anaemic and non-anaemic subjects respectively. The non-anaemic group fulfilled 93% of the RDA suggested by ICMR (1998)[11] which was significantly more (P<0.01) than the anaemic group which fulfilled 73% of the RDA. Significant difference (P <0.01) was observed between the Protein intake anaemic subjects with the RDA suggested by ICMR (1998)[11].

3) Fats: The mean intake of fats was 39.4+6.0 grams and 40.2+6.97 grams by the anaemic and non anaemic subjects respectively. The mean intake of fats by the subjects was much higher than the ICMR (1998)[11] suggested RDA of 22 grams. No significant difference (P >0.05) was observed between the two groups.

4) Iron: The daily dietary iron intake was 12.8+5.2 milligrams and 21.9+2.6 milligrams by anaemic and non-anaemic adolescent girls respectively. Compared to the ICMR (1998)[11] recommendations (30 mg) the intake of both the anaemic and non-anaemic groups was significantly less (P<0.01). The low intake was because of the inadequate consumption of green leafy vegetables and other rich sources of iron like flesh foods etc. A significant difference was also observed between the iron intakes of the two groups.
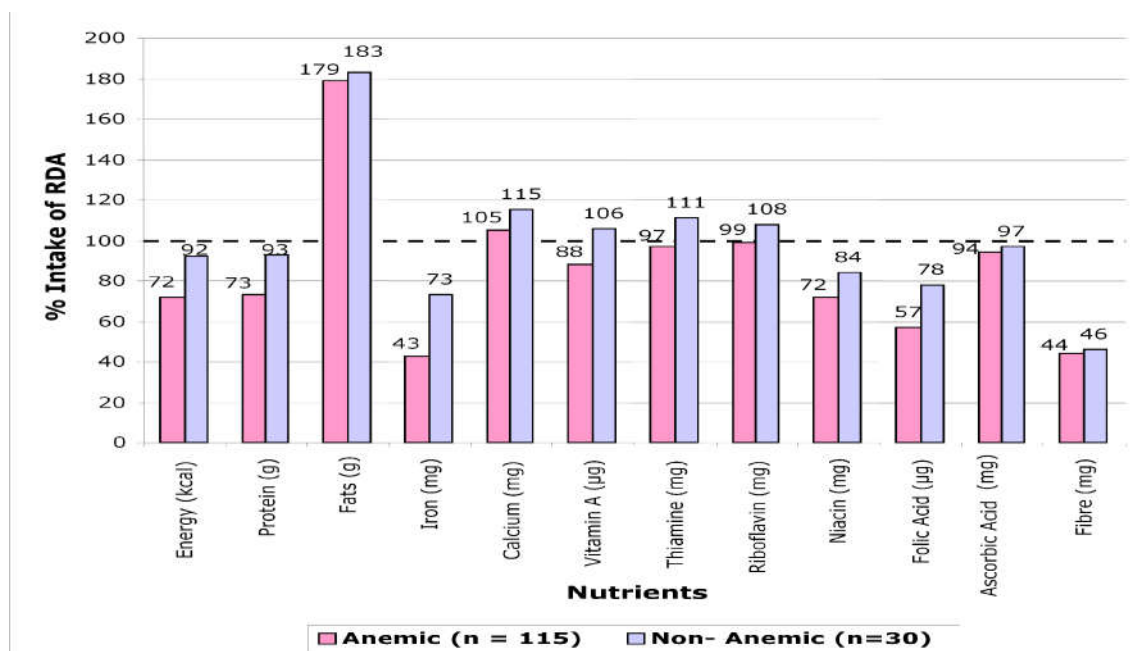

Figure 1: Comparison of the Dietary Intake of Nutrients by Anaemic and Non Anaemic Subjects (16-18 years) with ICMR Recommendations

5) Calcium: Average daily Calcium intake of anaemic and non-anaemic subjects was 523±142.8 milligrams and 577±69.5 milligrams respectively. The non-anaemic group fulfilled 115% of the RDA compared to the anaemic group which fulfilled 105% of the RDA. A significant difference was observed in the calcium intake of both groups (P <0.01). Compared to the ICMR (1998)[11] recommendation (500 mg) the intake of both anaemic and non-anaemic groups was significantly more P (<0.01) than adequate. The high intake of calcium was due to the consumption of large quantities of milk. Bansal (1985)[12] and Mundra (2004)[13] also reported higher intakes of calcium than RDA in adolescent girls.
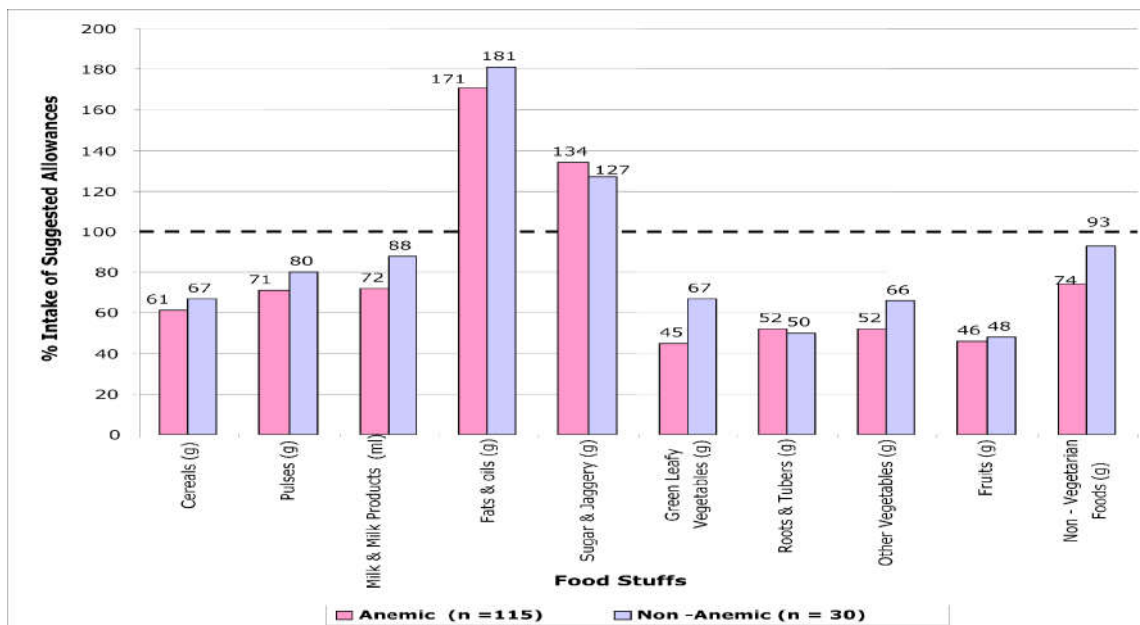

Figure 2: Comparison of the percent intake of Foods by Anaemic and Non Anaemic Subjects (16 -18 years) with Suggested Allowances (ICMR)

6) Vitamin A: The intake of vitamin A was found mainly in the form of its precursor of that is β-carotene in the diets of the adolescent girls. Milk was the only source of retinol in the diet of most of the subjects except a few non-vegetarians who consumed egg and meat occasionally.

The mean daily intake of β-carotene was 1947±692 micrograms and 2552±937 micrograms by anaemic and non-anaemic subjects respectively. The non-anaemic group fulfilled 106% of the RDA suggested by ICMR (1998)[11] (2400 µg) which was significantly more than the Anaemic group (P<0.01) which fulfilled only 88% of the RDA.

The intake of β-carotene of the Anaemic group was significantly lesser then the RDA (P<0.01) but no significant difference was observed between the RDA and the intake of β-carotene by the non-Anaemic group.

Among the good sources of carotene green leafy vegetables, yellow fruits and vegetables were consumed in inadequate amounts by the Anaemic Experimental subjects.

7) Vitamin B Complex: Mean daily intake of **Thiamine (B1)** in the anaemic and non-anaemic subjects was 0.97±0.2 milligrams and 1.1±0.1 milligrams respectively which formed 97% and 111% of the RDA. The thiamine intake of the non-anaemic group was significantly more (P<0.01) than the anaemic group.

The dietary intake of **Riboflavin (B2)** was 1.2±0.5 milligrams and 1.3±0.4 milligrams per day by anaemic and non-anaemic subjects respectively which fulfilled 99% and 108% of the RDA.

The mean daily intake of **Niacin (B3)** by anaemic and non-anaemic subjects was 10.2+2.0 milligrams and 11.8+3.3 milligrams respectively. The intake by both anaemic and non-anaemic groups was less than the ICMR recommendations (14 mg) fulfilling only 72% and 84% of the RDA respectively. No significant difference was observed between the two groups.

The average daily **Folic Acid** intake of 77.7+52.4 micrograms (µg) in the diets of non-anaemic subjects was significantly more (P <0.05) than 57.3+17.4 micrograms (µg) by anaemic girls. Compared to the ICMR recommendations for adolescent girls (100 µg) the diets of anaemic and non-Anaemic subjects fulfilled only 57% and 78% respectively of the RDA suggested by ICMR.

8) Ascorbic Acid (Vitamin C): The dietary intake of ascorbic acid was 37.5+9.2 milligrams and 38.8+6.0 milligrams for anaemic and non-anaemic subjects respectively fulfilling 94% and 97% of the RDA suggested by ICMR. No significant difference was found between the ascorbic acid intakes of both the groups.

9) Fibre: The daily dietary intake of fibre for the anaemic and non-anaemic group was 17.4+4.4 grams and 18.3+4.0 grams respectively with fulfilled 44% and 46% of the recommendation suggested by ICMR (40 g). Both the groups consumed significantly less (P <0.01) quantities of fibre as compared to the suggested RDA by ICMR (1998)[11]. The reason is less consumption of green leafy vegetables, other vegetables and fruits in the diet.

Table 2: Comparison of Dietary intake of nutrients of Anaemic with Non- Anaemic Subjects

N = 145

Nutrients	Recommended Allowance	Anaemic n=115	Non-Anaemic n=30	Difference	t-value
Energy (kcal)	2060	1485+ 380	1893+ 360	408+ 20	5.5**
Protein (g)	63	46.3+ 12.4	58.5+ 14.6	12.2+ 2.2	4.2**
Fats (g)	22	39.4+ 6.0	40.2+ 7.0	0.8+ 1.0	0.5
Iron (mg)	30	12.8+5.2	21.9+ 2.6	9.1+ 2.6	13.4**
Calcium (mg)	500	523+142.8	577+ 69.5	54+ 73.3	2.9**
Vitamin A (ug)	2400	1947+692	2552+ 937	605+ 245	3.3**
Thiamine (mg)	1	0.97+0.2	1.1+ 0.1	0.13+ 0.1	4.1**
Riboflavin (mg)	1.2	1.2+0.5	1.3+ 0.4	0.1+ 1.5	1.2
Niacin (mg)	14	10.1+2.0	11.8+ 3.3	1.7+ 1.3	1.6
Folic Acid (ug)	100	57.3+17.4	77.7+ 52.4	20.4+ 35	2.1*
Ascorbic Acid (mg)	40	37.5+9.2	38.8+ 6.0	1.3+ 3.2	1.0
Fibre (mg)	40	17.4+4.4	18.3+ 4.0	0.9+ 0.4	1.0

Values are Mean + SD

* Significant at P <0.05

** Significant at P <0.01

SUMMARY AND CONCLUSION

It is evident from the present study that the mean intake of cereals, pulses, milk and milk products, green leafy vegetables, roots and tubers, other vegetables and fruits were found to be deficient when compared to suggested allowances by National Institute of Nutrition (1998)[14]. The consumption of fats and oils, sugar and jaggery of all the adolescent subjects was adequate and higher than the recommended dietary allowances. The findings of a systematic review which assessed the dietary intake and practices among adolescent girls in low and middle-income countries showed that Adolescents around the globe consume less than the prescribed amounts of fruits and vegetables and high levels of sodium and sugar [7, 8]

In the Anaemic groups the mean nutrient intake of energy, protein, iron vitamin A, ascorbic acid, thiamine, riboflavin, niacin, folic acid, and fibre were found to be deficient whereas in the non-Anaemic group energy, protein, iron, ascorbic acid, niacin, folic acid and fibre were slightly in deficit. The mean intake of fats and calcium were higher than recommended dietary allowance for both the groups. The mean intake of iron was low due to insufficient consumption of green leafy vegetables, and other iron rich foods of animal origin, also due to inadequate consumption of vitamin C rich citrus fruits which enhances iron absorption in the body.

Hence from the present study it is quite evident that due to insufficient intake of nutrients especially Iron and Folic Acid, the Adolescent girls were Anaemic as compared to the Non Anaemic Group who consumed sufficiently better amounts of Nutrients.

The intervening years of adolescence and young womanhood before the onset of pregnancy, are very crucial in the life of an Adolescent Girl and it should be utilized for equipping the adolescent girls for a better and productive citizenship and safer motherhood by addressing the gigantic dilemma of anaemia.

RECOMMENDATIONS

1. Anemia contributes to poor mental performance and limits the adolescent's performance at school. This in turn affects the output of the future of the nation and is a waste of a natural resource - the intellectual power of its people. Hence national programmes should be developed to tackle the problem of anemia in adolescent girls by supplementation and nutritional counseling and thus improve the nutritional status of adolescent girls.
2. There is an urgent need for nutrition education for adolescent in schools and colleges which should include topics like:
- Consumption of a balanced diet, good eating habits, better ways of cooking food.
- Need for including iron rich foods in their daily dietary regimes.
- Ways of enhancing the availability of ingested iron by increasing the ingestion of enhancers of iron absorption (vitamin C) and by reducing the inhibitors of iron absorption (tannins and phytates).

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