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# Nutrient intake and nutritional anaemia among school going children

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## ABSTRACT

The main objective of this study was to estimate the prevalence of the iron deficiency anaemia and nutrient intake of the school going children (5-10Y) from Hisar, Haryana. A total 200 children screened for the study; 100 from govt. Primary school of Hisar city and 100 from Govt. Primary school of Mangali village, Hisar. Analysis of blood and dietary intake (24-h recall method) were used to assess the nutritional status of school going children. The finding indicated that the diet of school going children was significantly lower than RDA in term of protein, iron, zinc, vit-A and vit-C. Mean haemoglobin level in the blood of respondents was lower than reference value. Total of 129 respondents affected from anaemia. Out of them 52.5, 1.5 and 10.5 per cent were mild, moderate and severely anaemic, respectively.

**Key Words :** Iron deficiency anaemia, Nutrient intake, Haematological assessment, School going children

## INTRODUCTION

With one sixth of the global population residing in India, one third of about two billion people suffering from vitamin and micronutrient deficit are in our country. Iron deficiency is a highly prevalent micronutrient deficiency. The problem is more severe in children of school going age. India has the highest prevalence of 42 per cent underweight and 31 per cent stunted children under five and 74 per cent of Indian children are anaemic (IFPRI / UNICEF report). A high prevalence of anaemia *i.e.* 51-66.4 per cent in school going children of 5-11 years was recorded in different states of India by Sethi *et al*. (2003).

Iron deficiency anaemia refers to a condition in which the haemoglobin content of the blood is lower than normal as a result of a deficiency of one or more essential nutrients. Iron deficiency in school age children is associated with retardation of growth, decreased immunity, poor cognitive development resulting in lower Intelligence Quotient (IQ) and behavioural abnormalities. The contributing factors for anaemia are size at birth, birth interval, lack of adequate information on nutritional needs, poor diet quality and low dietary iron bioavailability and poor environmental conditions such as bad housing, overcrowding, indoor air pollution, poor sanitation and lack of safe drinking water.

The assessment of nutritional status of this segment of population is essential for making progress towards improving overall health of the school age children. The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence The objective of the present study was to record the prevalence of iron deficiency anaemia and their nutrient intake among 5-10 year old school going children.

## METHODOLOGY

Present study was conducted in Hisar city of Haryana state. Purposive random sampling technique was used for selection of city and rural area and for selection of school from both areas. Random sampling

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procedure was used to obtain a sample of 200 school going children; 100 from each school.

**Dietary intake (24-h recall method):**

The 24-h recall method was used to assess the diet intake of the respondents. The mean daily diet intake was calculated taking mean of two days intake. Average daily nutrient intake was compared with the Recommended Dietary Allowances of ICMR (Gopalan *et al*., 2004). Nutrient Adequacy Ratio (NAR) was calculated as follows:

$$NAR = \frac{\text{Nutrient Intake}}{\text{RDA}} \times 100$$

The adequacy of nutrient intake of the school going children was done by following categories.

| Category | Range | Score |
|---|---|---|
| Adequate | 100 per cent of R.D.A. | 1 |
| Marginally adequate | 75-99.9 per cent | 2 |
| Marginally inadequate | 50-74.9 per cent | 3 |
| Substantially inadequate | Below 50 per cent of R.D.A. | 4 |

**Analysis of blood sample:**

A sample of venous blood (1 ml) was collected with the subject in fasting stage (Gibson, 2005) by medically qualified technicians. About 1ml of blood was collected in the tube containing anticoagulant (EDTA heparin). A complete haemogram was obtained by using the automated coulter cell counter. The Coulter counter was calibrated using standard procedures.

Haemoglobin, Hematocrit, Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration, (MCHC) and Mean Cell Volume (MCV) were calculated using standard procedures.

Data coding, entry and validation was done using appropriate software mainly SPSS/PC. 't'-test was used for analyzing the data. Frequency and percentages were also calculated.

## RESULTS AND DISCUSSION

The data on nutrient intake in Table 1 illustrated the daily mean nutrient intake of school going children (5-10Y). It was found that the intake of energy and protein among all the children was below their recommended daily allowances. Daily mean intake of energy was 1617.7 Kcal/day which was 82.9 per cent of RDA and protein represents only 73.4% of RDA among school going children of 5-10 years. The consumption of iron and zinc was significantly ($P<0.05$) lower than their respective RDA. Iron intake was 36.6 per cent of RDA while zinc was 52 per cent of RDA in the daily diet of all the school going children. The daily mean intake of vit. C of the school going children was inadequate. They were taking only 18.7 mg/day which was 46.7 per cent of recommended dietary allowances. Similarly, the average intake of vit. A of school going children was significantly ($P<0.05$) less than RDA and was only 34.9 per cent of the recommended dietary allowance.

Table 2 reveals about the adequacy of nutrient intake by school going children. It was found that the intake of energy and protein was marginally inadequate (< 50% of RDI) followed by inadequate consumption of iron, zinc, vit-C and Vit-A among majority of school going children. On the other hand, most of the children were taking fat and calcium adequately.

**Table 1 : Daily mean nutrient intake of school going children (5-10Y)**

| Nutrient intake | Recommended Daily Allowance (RDA) | Daily mean nutrient intake | 't' value | % (RDA) |
|---|---|---|---|---|
| Energy (kcal) | 1950 | 1617.7±210.73 | 1.58 | 82.9 |
| Protein (g) | 41 | 30.1±6.48 | 1.68 | 73.4 |
| Fat (g) | 25 | 24.1±9.81 | 0.09 | 96.4 |
| Iron (mg) | 26 | 9.4±2.49 | 6.66* | 36.1 |
| Zinc (mg) | 10 | 5.2±1.29 | 3.68* | 52 |
| Calcium (mg) | 400 | 414.3±193.24 | -0.07 | 103.6 |
| Vitamin C (mg) | 40 | 18.7±17.18 | 1.24 | 46.7 |
| Vitamin A (µg) | 600 | 209.8±185.87 | 2.09* | 34.9 |

Values are mean ±SD
* Significant at 5% level
Values in parentheses indicate percentage
't' values showing comparison of daily mean nutrient intake and RDA

**Table 2 : Mean adequacy of nutrient intake of school going children (5-10 Y)**

| Category of adequacy | Energy | Protein | Fat | Iron | Zinc | Calcium | Vit C | Vit A |
|---|---|---|---|---|---|---|---|---|
| I | - | 13 | 79 | - | 1 | 85 | 19 | 10 |
| | | (6.5) | (39.3) | | (0.5) | (42.3) | (9.5) | (5.0) |
| II | 15 | 66 | 59 | 1 | 8 | 44 | 11 | 11 |
| | (7.5) | (32.8) | (29.4) | (0.5) | (4.0) | (21.9) | (5.5) | (5.5) |
| III | 127 | 112 | 46 | 14 | 99 | 57 | 36 | 22 |
| | (63.5) | (56.0) | (23.0) | (7.0) | (49.5) | (28.5) | (18.0) | (11.0) |
| IV | 58 | 9 | 16 | 185 | 92 | 14 | 134 | 157 |
| | (28.9) | (4.5) | (8.0) | (92.0) | (45.8) | (7.0) | (66.7) | (78.1) |

Values in parentheses indicate percentage

I 100% and above (Adequate)
II 75 to 99.9% of RDA (Marginally adequate)
III 50 to 74.9% of RDA (Marginally inadequate)
IV Below 50% of RDA (Inadequate)

**Table 3: Hematological estimations of school going children (5-10Y)**

| Haematological parameter | Reference value | Observed value (n=200) |
|---|---|---|
| Haemoglobin (g/dl) | 11.5 | 10.84±1.55 |
| Hematocrit (%) | 34-42 | 36.59±1.46 |
| Mean Cell Haemoglobin (MCH) (pg) | 25-33 | 25.60±2.65 |
| Mean Cell Haemoglobin Concentration (MCHC) (g/dl) | 31-37 | 30.27±4.55 |
| Mean Cell Volume (MCV) (fL) | 77-95 | 80.85±1.62 |

Values are mean ±SD

The data regarding haematological estimation have been presented in Table 3. Mean haemoglobin content of children was 10.84g/dl which was lower than the reference value. The values for hematocrit, Mean cell haemoglobin, Mean cell haemoglobin concentration, Mean cell volume were within the range of their respective reference values but at the lower side.

Table 4 shows the prevalence of iron deficiency anaemia in school going children (5-10Y). A total of 64.5 per cent respondents were anaemic. The mild form of iron deficiency anaemia was more prevalent among the school going children which was 52.5 per cent of total amaemia prevalence while severity of anaemia was exist only 10.5 per cent.

It appears from the present study that the diet of majority of school going children was deficient in almost all the nutrient especially iron, zinc, vit-c and vit-A. The consumption of these nutrients was lower than 50 per cent of RDA. Contributing factor was the food habit of the study respondents which was based on the staple food items without sufficient inclusion of good nutritional sources such as animal foods, dairy products and lesser intake of fruits and vegetables. Energy and protein intake was also lower than recommended dietary allowances. Meme *et al.* 2007 reported the energy consumption of school children with feeding program was higher (86 % of RDA) than without feeding program children (76% of RDA). Several workers ( Sankhala *et al.,* 2004; Agrahar-Murugkar, 2005; Mitra *et al*., 2007) reported that the protein intake was relatively lower among school children. According to Aranctal *et al*. (2003) low consumption of green leafy vegetables which resulted in less iron and zinc intake of children as similar to the present study. Sankhala *et al*. (2004) noted that iron, vit. A and vit. C intake of 1-12 Y old children was below 50 per cent of RDA. The zinc intake was significantly lower than recommendation in school children of Allahabad city as observed by Handa *et al*. (2008).

**Table 4: Prevalence of iron deficiency anaemia among school going children (5-10 Y)**

| Prevalence of iron deficiency anaemia | Total (n=200) |
|---|---|
| Mild | 105 (52.5) |
| Moderate | 3 (1.5) |
| Severe | 21 (10.5) |
| Total | 129 (64.5) |

Values in parentheses indicate percentage

The intake of energy and protein was marginally inadequate (50-74.9% of RDA). The most limiting nutrients in diet of majority of respondents were iron, zinc, vitamin C and vitamin A.

The results revealed that total 64.5 per cent of the respondents were anaemic. Mild form of anaemia was more prevalent and severity of anaemia was only among 10.5 per cent of the respondents. The prime cause of nutritional anaemia is inadequate iron intake and low bioavailability. Source of iron in the diet of school children was vegetables and pulses; their intake was also lower than the RDI and their diet contained inhibitor of iron absorption such as phytates and polyphenols. High concentration of polyphenols in tea reduces nonhaem iron bioavailability via formation of insoluble complex (Reddy *et al.,* 2000). According to Bhoite and Iyer (2011) prevalence of anaemia was 73% in the rural area of Vadodara district, Gujarat. Iron deficiency anaemia was the commonest type of anaemia noted in 68.42 per cent children of urban slum in Delhi (Gomber *et al*., 2003).

**Conclusion:**

To conclude, childhood anaemia continues to be a significant public health problem in school children. The diet of school going children was found deficient in iron, zinc and vitamin A. Iron deficiency, poor bioavailability of dietary iron coupled with low intake of heam iron derived from animal foods, low intake of fruits and vegetables is a major etiological factor for anaemia.

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