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## Iron deficiency prevalence and dietary patterns of school going children (5-10y)

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### Abstract

The present study was carried out to assess the iron deficiency prevalence and dietary pattern of school going children (5-10y) in Hisar, Haryana. A sample of 100 rural respondents from Govt. Primary School of Mangali village and 100 urban respondents from Govt. Primary School of Hisar city of 5-10 year age were selected. The study showed that the diet of respondents were deficient in protein, iron, zinc, vit. A and vit. C and the intake of these nutrients were lower than 50 per cent of RDA among majority of respondents. Mean value of Hb content of school going children was 10.8 g/dl. A total of 64.5 per cent respondents suffered from anaemia. Mild form of anaemia (52.5%) was more prevalent and severity of anaemia was only among 10.5 per cent of the respondents. Girls were found to be more anaemic than the boys.

**Keywords:** Nutrient intake, Iron deficiency Aneamia, Hb

### Introduction

Micronutrient malnutrition has been reported to be a major public health problem among school going children in India. Iron deficiency continues to be the most prevalent micronutrient disorder. In scientific terms, anaemia is defined as a blood haemoglobin concentration below cut-off level (haemoglobin  $\leq 110$ g/L) It represents a systemic condition with numerous health consequences including anaemia, decreased intellectual performance and exercise capacity.

Furthermore in developing countries low standard of lifestyle, low socio-economic condition and a lack of knowledge on good dietary practices and personal hygiene, which is associated with intestinal parasitic infection, contribute even more to the high occurrence of iron deficiency and hence, anaemia (Hall *et al.*, 2001) [5]. Poor diet quality and low dietary iron bioavailability are the principal contributing factors for nutrition related iron deficiency. The bioavailability of haem iron is high with absorption rate of 20-30%, whereas the bioavailability of non haem iron is determined by the presence of enhancing or inhibiting factors. The main enhancers of non haem iron absorption are haem iron (red meat, fish and poultry) and vitamin C. Inhibitors include phytates (bran and oat products, whole wheat and brown flour), polyphenols (tea, coffee, cocoa and vegetables) and calcium (Reddy *et al.*, 2000) [12]. Prevalence of anemia in school age children as per studies conducted during 1981 to 1996 in different six metro cities of India ranged from 14 per cent in Chennai to 96 per cent in Kolkata. A high prevalence of anemia i.e. 51-66.4 per cent in school going children of 5-11 years was also recorded in different states of India (Sethi *et al.*, 2003) [13].

### Material and Methods

The sample for the present study was collected from Govt. Primary School of Hisar city and Govt. Primary School of Mangali village of Hisar, Haryana. A sample of 100 rural and 100 urban respondents of 5-10 year age were taken randomly, thus to make a total sample of 200 school going children.

### 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.

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Average daily nutrient intake was compared with the Recommended Dietary Allowances of ICMR (Gopalan *et al.*, 2004) [3]. Nutrient Adequacy Ratio (NAR) was calculated as follows:

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

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

Category	Range	Score
Adequate	100 percent of RDA.	1
Marginally adequate	75-99.9 percent	2
Marginally inadequate	50-74.9 percent	3
Substantially inadequate	Below 50 percent of RDA.	4

### Analysis of blood Sample

A sample of venous blood (1 ml) was collected from the

subject in fasting stage (Gibson, 2005) [2] 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

The average nutrient intake of school going girls and boys (5-10y) showed that the intake of calories was lower than RDA among both the sexes.

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

Nutrient intake	Recommended Daily Allowance (RDA)	Nutrient intake				't' <sup>b</sup> values (P<0.05)
		Boys (n=117)	't' <sup>a</sup> value	Girls (n=83s)	't' <sup>a</sup> value	
Energy (kcal)	1950	1619.9±225.52 (83.1)	1.46	1614.6±189.20 (82.8)	1.77	0.86
Protein (g)	41	30.5±7.02 (74.4)	1.50	29.7±5.64 (72.4)	2.01*	0.38
Fat (g)	25	24.1±10.43 (96.4)	0.08	24.2±8.94 (96.8)	0.09	0.98
Iron (mg)	26	9.5±2.70 (36.5)	6.13*	9.4±2.19 (36.1)	7.59*	0.81
Zinc (mg)	10	5.3±1.41 (53)	3.32*	5.2±1.10 (52)	4.39*	0.45
Calcium (mg)	400	429.5±201.88 (107.3)	0.14	392.8±179.37 (98.2)	0.03	1.18
Vitamin C (mg)	40	18.8±18.10 (47)	1.17	18.7±15.90 (46.7)	1.34	0.96
Vitamin A (µg)	600	214.2±204.47 (35.7)	1.88	203.5±156.93 (33.9)	2.53*	1.68

Values are mean ±SD

\* Significant at 5% level

Values in parentheses indicate percentage

't'<sup>a</sup> values showing comparison of daily mean nutrient intake and RDA

't'<sup>b</sup> value showing comparison between daily mean nutrient intake boys and girls

Protein intake of girls was found to be significantly lower than RDA, while consumption of protein was not significantly different among the boys and girls. The gender difference with regard to fat intake was found to be non-significant (Table 1).

Both boys and girls were taking fewer amounts of iron and zinc which were significantly lower as compared to RDA. A non significant difference, however, was observed between boys and girls respondents. Comparatively girls were consuming less calcium (98.2% of RDA) than the boys (107.3% of RDA). The daily average intake of vit. C and vitamin A of the school going children were inadequate and significantly lower than recommended dietary allowances.

Table 2 presents adequacy of food intake among school going children (5-10y). Majority of boys (60.7%) and girls (54.2%) consumed adequate amount of cereals followed by almost equal percentage (35% boys and 38.6% girls) of respondents who had marginally adequate intake of cereals. Above 50 per cent children of both sexes consumed pulses below 50 per cent of RDI. Only 1 per cent rural children consumed pulses adequately. Consumption of roots and tubers was below 50 per cent of RDI among majority of boys (48.7%) and girls (44.6%). Approximately 30 per cent of boys and girls consumed marginally inadequate amount of roots and tubers.

When comparing adequacy of green leafy vegetables of boys and girls, it was found that most of the boys (68.2%) were taking inadequate amount of green leafy vegetables as compared to 48.2 per cent girls.

Adequacy related to other vegetables represent that above 50 per cent boys and girls were consuming inadequate amount of other vegetables. Out of 200 respondents, only 26 respondents were taking fruits on daily basis. The intake of milk and milk products was inadequate among 71 per cent of boys and 65.1 per cent girls respondents. While only 7.7 per cent boys and 12 per cent girls were taking adequate amount of milk and milk products. The amount of fats and oils in the diet of majority of respondents was also inadequate. Conversely, adequate amount of sugar and jaggery was consumed by most of the boys (76.1%) and girls (79.5%).

Results in Table 3 describe that haemoglobin level of both boys and girls was lower than the reference value (11.5 g/dl). The mean value for hematocrit of school going boys and girls was 36.59 which fell in the range of reference values. The MCH, MCHC and MCV contents in the blood of respondents were within the range of respective reference values but at the lower end. A non-significant difference, however, was observed between boys and girls.

**Table 2:** Adequacy of food intake among school going children (5-10Y)

Category of adequacy	Adequacy of food intake																	
	Cereals		Pulses		Roots & tubers		Green leafy vegetables		Other vegetables		Fruits		Milk & milk products		Fats and oils		Sugar and jaggery	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
I	71 (60.7)	45 (54.2)	1 (0.9)	1 (1.2)	8 (6.8)	8 (9.6)	4 (3.4)	6 (7.2)	23 (19.7)	15 (18.1)	11 (64.7)	5 (55.5)	9 (7.7)	10 (12)	17 (14.5)	4 (4.8)	89 (76.1)	66 (79.5)
II	41 (35.0)	32 (38.6)	16 (13.7)	9 (13.7)	16 (13.7)	16 (19.3)	14 (12)	14 (16.9)	14 (12)	7 (8.4)	5 (29.4)	4 (44.4)	5 (4.3)	6 (7.2)	21 (17.9)	17 (20.5)	11 (9.4)	10 (12)
III	5 (4.3)	6 (7.2)	35 (29.9)	30 (36.1)	36 (30.8)	22 (26.5)	19 (16.2)	23 (27.7)	21 (17.9)	12 (14.5)	1 (5.9)	-	19 (16.2)	13 (15.7)	24 (20.5)	29 (34.9)	16 (13.7)	5 (6)
IV	-	-	65 (55.6)	43 (51.8)	57 (48.7)	37 (44.6)	80 (68.2)	40 (48.2)	59 (50.9)	49 (59)	-	-	84 (71.8)	54 (65.1)	55 (47)	33 (39.8)	1 (0.9)	2 (2.4)

Values in parentheses indicate percentage

I 100 per cent and above (Adequate)

II 75 to 99.9 per cent of RDI (Marginally adequate)

III 50 to 74.9 per cent of RDI (Marginally inadequate)

IV Below 50 per cent of RDI (Inadequate)

**Table 3:** Mean concentration of haematological indices of iron status of school going children (5-10Y)

Haematological parameter	Reference value	Sex		't' value (P<0.05)
		Boys (n=117)	Girls (n=83)	
Haemoglobin (g/dl)	11.5	10.9±1.67	10.6±1.34	1.53
Hematocrit (%)	34-42	36.8±4.03	36.3±3.21	0.91
Mean Cell Haemoglobin (MCH) (pg)	25-33	24.6±3.08	24.7±3.32	0.27
Mean Cell Haemoglobin Concentration (MCHC) (g/dl)	31-37	30.4±1.52	30.2±1.45	0.28
Mean Cell Volume (MCV) (fL)	77-95	81.1±9.10	80.7±8.48	0.89

Values are mean ±SD

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

Prevalence of iron deficiency anaemia	Sex		
	Boys (n=117)	Girls (n=83)	Total
Mild	60 (51.3)	45 (54.2)	105(52.5)
Moderate	3 (2.6)	0 (0)	3(1.5)
Severe	9 (7.7)	12 (14.5)	21(10.5)
Total	72 (61.5)	57 (68.7)	129(64.5)

Values in parentheses indicate percentage.

Table 4 summarizes the anaemia prevalence among school going boys and girls. Comparatively boys were slightly better than the girls. Majority of the girl respondents (68.7%) were anaemic against 61.5 per cent boys. Majority of boys and girls suffered from mild form of anaemia. Severe anaemia was noticed in 14.5 per cent girls and 7.7 per cent boys.

**Discussion**

In present study, the energy intake of children was lower than its RDA (82.9% of RDA). Hakeem *et al.* (2002) [4] and Mitra *et al.* (2007) [11] also observed that energy intake of school children was low when compared with RDA. Handa *et al.* (2008) [6] studied that the protein intake of school going children of Allahabad district (30.17g/day) and it was similar to protein intake (30.1g/day) noticed among the subjects of the present study subjects. Consumption of iron, zinc, vit. A and vit. C of school children was significantly lower than their respective recommended levels, may be because of lower consumption of green leafy vegetables and fruits by majority of children. Kumari and Singh (2001) [9] and Aranctal *et al.* (2003) [1] reported similar pattern of low consumption of green leafy vegetables which resulted in less iron and zinc intake of children. Lower content of vit. A and vit. C in diet of affluent Indian school children was observed by Srihari *et al.* (2007) [14].

Intakes of pulses, roots and tubers, green leafy vegetables, other vegetables and milk and milk products were inadequate (< 50% of RDI) among majority of school going children. Mishra and Tiwari (2007) [10] reported that majority of the subjects were at inadequate level for pulses, green leafy vegetables, roots and tuber and milk and milk products.

Mean value of Hb level of school going children was less than cut off value (< 11.5g/dl) and values of hematocrit, MCH, MCHC and MCV were within the range of respective reference values. Hanumante *et al.* (2008) [7] observed Hb content (10.5g/dl) in subject before treatment. Hioui *et al.* (2008) [8] observed similar value of hematocrit (36%), MCH (27.35 pg), MCHC (26.7 g/dl) and MCV (79.25 fl) in school children and found no significant difference between boys and girls.

Total 64.5 per cent of the respondents were anaemic. Mild form of anaemia (52.5%) was more prevalent and severity of anaemia was only among 10.5 per cent of the respondents. Girls were found to be more anaemic than the boys, might be because of their lower iron and protein intake. Verma *et al.* (2004) [15] observed 81.8 per cent prevalence of anaemia among school going girls from slum of Ahmedabad city. In national capital territory of Delhi, 64.4 per cent prevalence of anaemia was noticed amongst primary school age children (Sethi *et al.* 2003) [13].

## Conclusion

The study shows that diets of most of the school going children (5-10y) were deficient in terms of protein, iron, zinc, vit. A and vit. C. Mild form of iron deficiency anaemia is most prevalent and girls were more anaemic than boys.

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