

Assessment of Nutritional Status of 7-10 Years School Going Children of Allahabad District: A Review

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Abstract: The objective of the study was to investigate nutritional status of 7-10 years school going children. A total of 150 school going children were selected from four different schools of Allahabad district, India. Data on dietary intake was collected by using 3 days dietary recall method. Heights, weights and Mid Upper Arm Circumference were measured. Haemoglobin levels of children were estimated by cyanmethaemoglobin method. Clinical status assessing anemia was also recorded. Consumption of all the nutrients by majority of the students was comparatively less than the recommended dietary allowances. Data on anthropometry revealed that out of total children screened (N=150), mean height and weight in all the age group was significantly ($p<0.05\%$) less than the National Center for Health Statistics standards. The mean MUAC in all the age groups was significantly ($p<0.01\%$) less than the National Health and Nutrition Examination Survey standards. Hemoglobin test revealed that 65.33% had hemoglobin level below the normal (12 g dl^{-1}) values, indicating anemia, out of which approximately half (53.33%) were mild anemic and 12% were moderate anemic. Feeling breathlessness and easily tired were experienced by 30.5 and 23.73% of the subjects respectively. It is concluded that poor anthropometric indices, undernutrition and iron deficiency anemia may be due to lower intake of food and nutrients than recommended.

Key words: Nutrition • Anthropometrics • Haemoglobin • Anemia

INTRODUCTION

Historically, the science of nutrition developed in part from the study of disease entities brought about by inadequate diet. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body. In developing countries like India various forms of malnutrition affect a large segment of population and both macro and micronutrient deficiencies are of major concerns. The most recent estimates (1996-2005), in developing world, approximately 146 million children are underweight, out of these 57 million children live in India [1] and Over 90% Indian women, adolescent girls and children are anemic [2]. Thatcher [3] and Amirhaveni and Barikor [4] suggested that the health of children is dependent upon food intake that provides sufficient energy and nutrients to promote optimal physical, social, cognitive growth and development. Inadequate energy and nutrients have a

variety of poor outcomes including growth retardation, iron deficiency anemia, poor academic performance and development of psychosocial difficulties. Waterlow [5] reported that, etiology of linear growth retardation is multi-factorial but has been explained by three major factors: poor nutrition, high levels of infection and problematic mother-infant interaction, which is closely related to the socio-economic status of the family.

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 [6]. In children, protein/calorie deficient diet results in underweight, wasting and lowered resistance to infection, stunted growth and impaired cognitive development and learning. Whereas, iron deficiency in school age children, is associated with retardation of growth, decreased immunity, poor cognitive development resulting in lower Intelligence Quotient (IQ) and behavioral abnormalities [7]. Therefore, it becomes very important to know the

nutritional status of school going children, the building blocks of state and country and hence the present study was carried out in Allahabad with following objectives:

- To assess the nutritional status of 7-10 year old school going children of Allahabad district.
- To study the adequacy of food and nutrient intake in their diets.
- To investigate the prevalence of undernutrition and iron deficiency anemia in the selected children.

MATERIALS AND METHODS

Schools were selected from the Allahabad district, Uttar Pradesh. A total of 150 school going children (7-10 years) were selected randomly with 50 each belonging to 7-8, 8-9 and 9-10 years age group. A combination of survey and laboratory test was used in order to obtain the information required.

Survey Schedule: The schedule was used to collect the information on general profile, anthropometric status, dietary intake, clinical status, haemoglobin status.

Diet survey: A dietary survey was conducted as described by Swaminathan, [8]. The food consumption frequency was recorded in terms of cereals, pulses, milk and milk products, green leafy vegetable, roots and tubers, fruits, meat and poultry, fats and oils and sugar. The daily dietary recall for three consecutive days was taken and was averaged out for one day. The average daily nutrient intake was calculated with the help of the food composition tables of Gopalan *et al.*, [9]. The calculated daily nutrient intake in terms of energy, protein, fat, ascorbic acid, iron, retinol, folic acid, calcium and zinc were then compared against recommended dietary allowances for Indians [10].

Anthropometrics survey: Nutritional status of all the selected children was assessed by measuring body heights (cm) and weights (kg). The mid upper arm circumference (MUAC) was also measured. Height and weight was compared with National Center for Health Statistics (NCHS) standards and MUAC with NHANES standards.

Height and Weight measurement: Height of each subject was measured in a standing position to the nearest 0.1 cm using non-stretchable steel tape. A personal weighing

machine was used to measure the body weight to the nearest 0.5 kg. The individuals were kept under basal condition with minimum clothing and without shoes [11].

Anthropometric assessment for Undernutrition:

Anthropometric assessment was conducted to identify children with moderate to severe undernutrition. Two indices were taken as a measure of chronic undernutrition i.e. height for age (stunted) and weight for height (wasted), with reference to NCHS standards of growth and development. 50th percentile was taken as median percentile function. Children found = -2SD from the median on height for age and weight for height were considered as moderate to severe malnourished. Children = -2SD from the median on height for age were considered as stunted and those = -2SD from the median on weight for height were considered as wasted. Stunting is considered as a measure of chronic undernutrition indicating that protein deficiency can cause retardation in one's physical growth [1]. Children =50th percentile function on height for age and weight for height were considered as normal.

Haemoglobin estimation: Haemoglobin level of subjects was estimated by using cyanmethaemoglobin method prescribed by INACG [12]. The WHO cut off values published by ICMR Task Force [13] for assessment of anemia in the children was used for the study.

Clinical survey: All the selected children were examined for the presence or absence of any clinical signs and symptoms of anemia, including paleness of nails and conjunctiva. The procedure of Gibson [14] was followed for the clinical survey.

RESULTS AND DISCUSSION

Data obtained was analyzed with respect to the objectives of the present study which were to find the prevalence of undernutrition and iron deficiency anemia among children. 7-10 year old 150 children were surveyed out of which 54% belonged to Hindu, followed by Muslims (35.33%) and Christians (10.66%).

Diet and Nutrient Intakes: Non-vegetarians predominated with 52.66 %, followed by vegetarians (38%) and ovo-vegetarians (9.33%). 43.3% children skips breakfast on daily basis out which 12.66% children skips breakfast 3-4 times/week Table 1. Similar were the findings of National Institute of Nutrition (NIN)

Table 1: Breakfast consumption pattern of children (7-10 years)

Age (years)	Skip Breakfast								Don't Skip Breakfast	
	1-2 t/wk		2-3 t/wk		3-4 t/wk		Pooled			
	f	%	f	%	f	%	f	%	F	%
7-8(n=50)	7	14	5	10	12	24	24	48	26	52
8-9(n=50)	14	28	5	10	3	6	22	44	28	56
9-10 (n=50)	9	18	6	12	4	8	19	38	31	62
Pooled (N=150)	30	20	16	10.66	19	12.66	65	43.33	85	56.66

Table 2: Food consumption frequency of children (7-10years)

Food Groups	N=150											
	Daily		4-6t/w		2-4t/w		1-2t/w		Occasionally		Never	
	f	%	f	%	f	%	f	%	f	%	f	%
Cereals	150	100	-	-	-	-	-	-	-	-	-	-
Pulses	107	71.33	34	22.66	9	6	-	-	-	-	-	-
Milk and milk products	124	82.66	19	12.66	7	4.66	-	-	-	-	-	-
Green leafy vegetables	29	19.33	48	32	32	21.33	28	18.66	13	8.66	-	-
Root and tubers	130	86.66	8	5.33	12	8	-	-	-	-	-	-
Other vegetables	39	26	58	38.66	31	20.66	22	14.66	-	-	-	-
Fruits	9	6	16	10.66	23	15.33	41	27.33	61	40.66	-	-
Meat and poultry	11	7.33	20	13.33	15	10	13	8.66	34	22.66	57	38
Fats and oils	150	100	-	-	-	-	-	-	-	-	-	-
Sugar and jaggery	150	100	-	-	-	-	-	-	-	-	-	-

Note: 4-6 t/w = 4-6 times per week 2-4 t/w = 2-4 times per week, 1-2 t/w = 1-2 times per week

(2003-2004), where in 11-13 year children, 33.8% children skipped breakfast 2-3 times/week and 3.9% were absolute breakfast skippers. The foods consumed daily by all the subjects included cereals, fats and oils and sugar and jaggery. Regarding the consumption of pulses it was found that a good proportion (71.33%) of the subjects consumed the item daily and 22.66% consumed 4-6 times per week as depicted in Table 2. Consumption of milk and milk products by the subjects was also found to be frequent, 86.66% consumed milk on daily basis whereas, 12.66% consumed milk 4-6 times per week. Percentage of the children (32%) consuming green leafy vegetables 4-6 times per week was higher than those (19.33%) who were consuming daily.

The survey showed that the consumption of roots and tubers was quite frequent in comparison to most of the other foods except cereals, fats and oils and sugar and jaggery. Majority of the non-vegetarians and ovo-vegetarians consumed meat and poultry occasionally, whereas only 7.33% consumed it on daily basis.

Intakes of all the nutrients in all the three age groups except folic acid in girls of 8-9 years age group and children of 9-10 years age group were comparatively less than the recommended dietary allowances (RDA) of the respective age groups, published by the ICMR [10]. Protein was inadequate in spite of adequacy of pulses and inclusion of meat and poultry. The reason may be lower dietary intakes of foods. The mean nutrient intakes per day as well as how much this varies from the RDA can be seen in the Table 3, 4 and 5.

The anthropometric measurements, clinical status and haemoglobin status etc. Tables 6-8 that are unsatisfactory are reflections of the low nutrient intakes of the children.

According to UNICEF [1] extensive survey carried out in different parts of India, both rural and urban areas, indicate that the diets are predominantly cereal based and so these diets are deficient in several nutrients, deficiencies of these nutrients therefore occur frequently and to a greater degree among children. Inadequate intake of nutrients compounded by poverty is the main cause of

Table 3: Average daily nutrient intake of children (7-8 years)

Nutrients	R.D.A (ICMR)	Girls (7-8 years)		Boys (7-8years)	
		Observed Mean (n=27)	Result	Observed Mean (n=23)	Result
Energy (Kcal)	1950	1055.67±321.59	S**	1253.13±434.09	S**
Protein (g)	41	30.17±11.43	S**	32.86±12.77	S**
Fat (g)	25	20.30±9.37	S*	23.92±10.85	NS
Calcium (mg)	400	365.25±215.31	NS	395.05±210.90	NS
Iron (mg)	26	13.68±4.70	S**	10.93±3.31	S**
Retinol (µg)	600	154.43±103.60	S**	150.12±104.09	S**
Vitamin C (mg)	40	20.86±16.24	S**	16.39±9.73	S**
Folic Acid (µg)	60	41.59±18.90	S**	57.74±23.22	NS
Zinc (mg)	10	4.84±1.46	S**	5.19±1.32	S**

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS

Table 4: Average daily nutrient intake of children (8-9 years)

Nutrients	R.D.A (ICMR)	Girls (8-9 years)		Boys (8-9 years)	
		Observed Mean (n=26)	Result	Observed Mean (n=24)	Result
Energy (Kcal)	1950	1113.96±244.77	S**	1243.33±344.16	S**
Protein (g)	41	24.93±7.73	S**	32.59±9.63	S**
Fat (g)	25	23.35±7.57	NS	21.02±9.02	S*
Calcium (mg)	400	315.01±198.45	S*	365.35±219.19	S*
Iron (mg)	26	14.52±6.35	S**	13.55±5.43	S**
Retinol (µg)	600	134.42±114.05	S**	157.71±125.67	S**
Vitamin C(mg)	40	24.07±17.13	S**	20.79±11.43	S**
Folic acid(µg)	60	51.43±15.95	S*	78.85±30.63	S**
Zinc (mg)	10	4.86±1.27	S**	5.75±1.22	S**

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS

Table 5: Average daily nutrient intake of children (9-10 years)

Nutrients	R.D.A (ICMR)	Girls (9-10 years)		R.D.A. (ICMR)	Boys (9-10 years)	
		Observed Mean (n=26)	Result		Observed Mean (n=24)	Result
Energy (Kcal)	1970	1223.81±388.69	S**	2190	1191.13±381.25	S**
Protein (g)	57	37.75±13.12	S**	54	40.76±11.54	S**
Fat (g)	22	24.63±7.93	NS	22	26.09±12.69	NS
Calcium (mg)	600	454.37±282.39	S*	600	416.22±309.69	S**
Iron (mg)	19	12.71±4.29	S**	34	21.47±5.77	S**
Retinol (µg)	600	145.65±96.91	S**	600	140.75±112.16	S**
Vitamin C(mg)	40	18.24±9.05	S**	40	15.21±11.73	S**
Folic Acid (µg)	70	72.50±23.78	NS	70	74.99±21.14	NS
Zinc (mg)	10	5.59±1.79	S**	10	5.88±1.76	S**

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS

nutritional deficiency disorders. Similar were findings of Singh [15] and NIN [16] carried out survey in Uttar Pradesh and reported that diet and nutrient intakes, especially micronutrients were grossly inadequate compared to RDA.

Anthropometric Measurements of Children (7-10years):

Mean height in all the age group was significantly (p< 0.05) lesser than the NCHS standards except in 7-8 year boys and 8-9 year girls where a non significant difference was observed. The mean height in the age

group 7-8 years for boys and girls was 121.33 cm and 118.09 cm respectively. Mean height of girls was higher (126.57 cm and 131.39 cm) than boys (124.81 cm and 128.54 cm) in the age groups 8-9 and 9-10 year respectively.

The mean weight in all the age groups was significantly (p< 0.05) lesser than the NCHS standards except in 7-9 years girls where the difference was insignificant. The difference in weight was more in the age group 9-10 year for both boys (3.90 cm) and girls (3.22 cm) as compared to 7-9 years group. The mean MUAC in all

Table 6: Mean height of Children (7-10 years)

Age (years)	Boys				Girls			
	n=73	Observed Mean (cm)	50 th percentile NCHS std.	Result	n=79	Observed Mean (cm)	50 th percentile NCHS std.	Result
7-8	23	121.34±6.32	124	NS	27	118.09±11.0	123.5	S*
8-9	24	124.81±8.34	129.6	S*	26	126.57±7.80	129.3	NS
9-10	24	128.54±10.9	134.8	S**	26	131.39±7.58	135.2	S*

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS

Table 7: Mean weight of Children (7-10 years)

Age (years)	Boys				Girls			
	n=73	Observed Mean (kg)	50 th percentile NCHS std.	Result	n=79	Observed Mean (kg)	50 th percentile NCHS std.	Result
7-8	23	21.06±2.80	22.9	S**	27	20.71±3.23	21.8	NS
8-9	24	23.60±3.19	25.3	S*	26	24.68±5.19	24.8	NS
9-10	24	24.20±3.92	28.1	S**	26	25.28±3.53	28.5	S**

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS

Table 8: Mean MUAC of Children (7-10 years)

Age (years)	Boys				Girls			
	n=73	Observed Mean (mm)	50 th percentile NCHS std.	Result	n=79	Observed Mean (mm)	50 th percentile NCHS std.	Result
7-8	23	148.96±10.74	187	S**	27	150.81±1.72	183	S**
8-9	24	165.99±19.59	190	S**	26	157.46±2.39	195	S**
9-10	26	168.20±20.68	200	S**	26	168.20±4.05	211	S**

Significant = S* (at 5%), Significant = S** (at 1%), Non significant = NS.

the age groups was significantly ($p < 0.01$) lesser than the NHANES standards. The difference was more in 7-8 year age group (38.04 cm) among boys and 9-10 years age group (42.80 cm) among girls. Age and sex wise distribution based on the anthropometric parameters are shown in Table 6, 7 and 8.

Prevalence of Undernutrition among Children (7-10 YEARS): Table 9 (a and b) shows that out of the total children screened (N=150), 17.3% children were found stunted and 3% were wasted, whereas underweight was observed in 25% children. Stunted children (22%) were found more in the age group 7-8 years whereas, underweight children (30%) were more in the age group 9-10 years. NIN [16] observed stunting in about 72% of preschool children, while wasting was noticed in about 13%, indicating chronic undernutrition was more common. Underweight (<median 2SD) was observed in 53.2% children of Uttar Pradesh and 68% children (1-5 year) of Allahabad district. Joshi [17] reported that malnutrition is directly or indirectly responsible for more than half of the deaths of children below five years of age worldwide.

Prevalence of Anemia among Children (7-10 years): Out of the total children screened (N=150), 65.33% had Hb level below the normal (12 g dl^{-1}) values, indicating anemia, out of which half (53.33%) were mild anemic and 12% were moderate anemic, none of them were severe anemic. In 7-8 years age group, 36% were found to be normal, 54% were mild anemic and the remaining 10% were found to be moderately anemic. In 8-9 years age group the categories in the same order formed 30, 60 and 10%. In 9-10 years age group the categories in the same order formed 38, 46 and 16% (Table 10). Luxmi *et al.*, [18] stated that the prevalence of anemia according to haemoglobin level was found 99% among rural preschool children (1-5 years) of Mysore city. Such high prevalence of this nutritional disorder disease among children has been reported by several other nutritionist and organizations [13,19].

Clinical signs of anemia among children (7-10 years): As shown in Table 11 various clinical symptoms of anemia were present among children (7-10 years). Feeling breathlessness and easily tiredness were experienced by 30.5 and 23.73 % of the subjects respectively. Pale nails were observed in 10.16% and

Table 9a: Prevalence of undernutrition among children (7-10 years)

Nutritional Status	Age Group (Years)							
	7-8 (n=50)		8-9 (n=50)		9-10 (n=50)		Pooled (N=150)	
	f	%	f	%	f	%	f	%
Stunting (ht-for-age=-2SD)	11	22	8	16	7	14	26	17.33
Wasting (wt-for-ht=-2SD)	2	4	2	4	1	2	5	3
Stunting and Wasting both.	1	2	1	2	1	2	3	2
Undernourished (pooled)	14	28	11	22	9	18	34	22.66
Adequately Nourished(AN)	36	72	39	78	41	82	116	77

Table 9b: Prevalence of underweight among children (7-10 years)

Nutritional Status	Age Group (Years)							
	7-8 (n=50)		8-9 (n=50)		9-10 (n=50)		Pooled (N=150)	
	f	%	f	%	f	%	f	%
Underweight (wt-for-age=-2SD)	9	18	13	26	15	30	37	25
Adequate Weight (wt-for-age=-2SD)	41	82	37	74	35	70	113	75

Table 10: Prevalence of anemia among children (7-10 years)

Degree of anemia	Hb. Concentration (g dl ⁻¹)	7-8 years (n=50)		8-9 years (n=50)		9-10 years (n=50)		Pooled (N=150)	
		f	%	f	%	f	%	f	%
Normal	≥12	18	36	15	30	19	38	52	34.66
Mild	10-11.9	27	54	30	60	23	46	80	53.33
Moderate	10-7	5	10	5	10	8	16	18	12
Severe	<7	-	-	-	-	-	-	-	-

Table 11: Clinical Status of children (7-10 years), (Reference: Gibson 1990)

Clinical Signs.	Children (7-10 years)	
	N=118	Percent
Pale conjunctiva	6	5.08
Spoon Shaped Nails	3	2.54
Pale Nails	12	10.16
Tiredness	28	23.73
Breath less ness	36	30.50
Giddiness	-	-

spoon shaped nails in 2.54% of the subjects. Conjunctiva paleness was noticed only in a small proportion (5.08 %) of the subjects. The high prevalence of anemia among the children surveyed could be related to the inadequate diet, poor socio economic status, unhygienic environment and lack of parent's education.

CONCLUSION

To sum up all these observations among 7-10 year old-school going children of Allahabad district on anthropometry status of the children revealed that out of total children screened (N=150), mean height in

all the age group was significantly ($p<0.05\%$) less than the NCHS standards except in 7-8 year old boys and 8-9 year old girls where the difference (2.66 cm and 2.73 cm respectively) was non significant. The mean weight in all the age groups was significantly ($p<0.05\%$) less than the NCHS standards except in 7-9 years girls where the difference was insignificant. The mean MUAC in all the age groups was significantly ($p<0.01\%$) less than the NHANES standards. The difference was more in 7-8 year age group (38.04 cm) among boys and 9-10 year age group (42.80 cm) among girls, whereas, 17.33% children were found stunted and 3% were wasted, whereas 24.66% children were underweight. Hemoglobin test revealed that 65.33% had hemoglobin level below the normal (12 g dl⁻¹) values, indicating anemia, out of which half (53.33%) were mild anemic and 12% were moderate anemic. Feeling breathlessness and easily tired were experienced by 30.5 and 23.73% of the subjects respectively. Poor anthropometric indices, undernutrition and iron deficiency anemia may be due to lower intake of food and nutrients than recommended.

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