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## Nutritional Status and Dietary Pattern of 7-9 Years School Going Children in India and Ethiopia

**Preeti Ghate**

Food and Bioprocess Technology Program, College of Engineering and Technology  
Wollega University, Nekemte, Ethiopia

**Deepali Kotwal**

Department of Food Science and Nutrition, Lady Amritbai Daga College and  
Smt. Ratnadevi Purohit College for women, Nagpur University, Nagpur, India

### **Abstract:**

The present cross sectional study was conducted to assess the dietary pattern and nutritional status of 7 to 9 year-old children of India[Nagpur] and Ethiopia[Nekemte]. Nutritional status of children was assessed in terms of demographic and socio-economic profile, dietary assessment, and anthropometric measurement. The children were selected randomly from the low socioeconomic group. 77% of the children in Nagpur followed four meal pattern [B+L+S+D] while in Nekemte three meal pattern [B+L+D] was followed their diets were monotonous and cereal-based. In Nagpur 55% of children liked to eat ready to eat food liked rock - roll, kurkura, and chips, 21% of children liked chicken meat, in Nekemte. 82 % and 61% of the children consumed fruits rarely in Nekemte and Nagpur. The results of the study revealed that food and nutrient intake was inadequate and consumption of all the nutrients by the children was comparatively less than the recommended dietary allowances. The intake of fruits and vegetables particularly, that of green leafy vegetables was also found to be grossly inadequate which could possibly have led to the deficient micronutrient intake. Data on anthropometry revealed that out of total children screened (N=200), mean height and weight in all the age group was significantly less than the National Center for Health Statistics standards. So there is an urgent need to educate mothers of school going children about the importance of balanced diet and promote the consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers, sugar and jaggery, fats and oil, milk and milk products, fruits etc. in the children's diet to improve their nutritional status so that children contribute in the well-being of the nation as children are the future of the nation's prosperity.

**Key words:** dietary pattern, nutritional status, height; body-weight

### **1. Introduction**

Nutritional status is a major determinant of the health and well-being among children and there is no doubt regarding the importance of the studies of nutritional status on children according to spatial and temporal dimension (NFHS-2, 2002). In developing country like India, and Ethiopia children are vulnerable to malnutrition because of low dietary intakes, infectious diseases, lack of appropriate care, and inequitable distribution of food within the household. Children from economically weaker communities have the poorest nutritional status on almost every measure, and the high prevalence of wasting in these noticed groups (28%) is of particular concern (Balgir, 2004). Low socio economic communities in general and primitive tribal groups in particular are highly disease prone. Also they do not have required access to basic health facilities. They are most exploited, neglected, and highly vulnerable to diseases with high degree of malnutrition, morbidity and mortality. Their misery is compounded by poverty, illiteracy, ignorance of causes of diseases, hostile environment, poor sanitation, lack of safe drinking water and blind beliefs, etc. (Balgir, 2004). The nutritional status of individuals is commonly evaluated through the use of anthropometry. Anthropometric measurements are used as outcome indicators that reflect the end result of all the factors that affect nutritional status (Reddy, 2006). A growth pattern is a complex network of various factors with a great variation at every sphere. Several investigators have provided sufficient evidence to prove that socio economic status is one of the important factors affecting the physical growth of children (Dixit et al, 1992; Bogin 1999; Arifeen et al, 2001). Mishra et al (2005) stated that higher socio-economic group is likely to be different from the lower socio-economic group. It attributed nutritional deficiencies, lack of opportunity and poor environment stimulation to be the likely causes of growth delay. Arifeen et al (2005) stated that people belonging to lower socio-economic status generally have large families with improper spacing, higher incidence of under-malnutrition and infections. Dixit et al (1992) studied various environmental factors, affecting growth performance and stated that better income was the only real protective factor for optimum growth. Children are likely to be the victim of under nutrition due to extreme poverty, lack of dwelling, and inadequate access to food and exposure to polluted environment. Moreover the paucity of information regarding the optimum feeding and hygienic practices may contribute to the frequent episodes. Child malnutrition can

also lead to poorer health and higher risk of mortality in later life. Many factors have been associated with child malnutrition in the literature. These include the extent of poverty as measured by the family's socio-economic status, availability of food and poor diet, breastfeeding practice, the incidence of infectious and parasitic diseases, health care access, immunization history, vitamin A supplementation, care during pregnancy, water supply and sanitation, health seeking behaviour, and demographic characteristics, including child's age and sex, birth intervals between previous and next child, and mother's age at childbirth. Better nutrition means stronger immune system, less illness, better health and productive community.

Anthropometric measurements such as height and weight are useful not only for growth and nutritional studies but are useful also for adaptation studies. Poor growth of children of low income groups in the technically under developed countries is to a large extent believed to be due to malnutrition. However, apart from malnutrition genetic, environmental factors may also be expected to play an important role, though their exact role in this respect is not very well understood (Singh, 2005). The differences in growth between Indian and Ethiopian children and those living in developed countries were ascribed till recently to possible environmental, genetic and socio-cultural factors.

However, empirical studies indicate that the growth pattern can be explained in terms of genetic as well as of socio-economic environmental variables and that the latter are responsible for one share of the variance among different populations (Eveleth and Tanner, 1990; WHO, 1995). Jelliffe (1966) observed that the environment and especially nutrition affects growth more than any other factors. Whereas Dugdale et al. (1970) showed that genetic factors act on growth but become effective only when the nutritional and other factors reach an optimal level. Physical growth of Indian children is based mostly on cross-sectional studies and most of the earlier studies pertaining to growth velocity are confined

In the present study, an attempt has been made to examine the trend of growth in height and weight among boys and girls of Nagpur [ India ] and Nekemte [Ethiopia] children and also to compare the dietary pattern.

## 2. Materials and Methods

The present study was conducted on school going children in the age group 7-9 years. Total 200 school going children i.e. 100 boys and 100 girls were selected proportionately for the study, from the Govt. School of Nagpur and Nekemte.

- **Survey Schedule:** Information regarding the general information, demographic and socio-economic profile, dietary intake, and anthropometric status was collected with the help of questionnaire-cum-interview schedule. The selection of sample was done by purposive stratified random sampling method.
- **Diet survey:** Food and nutrient intake of 200 children was recorded by using twenty four hours dietary recall method. It was used to assess the dietary intake for three consecutive days. Quantitative dietary assessment was done through actual weighing of food item. Cooked food consumed, was converted into their raw equivalents. The food intakes were compared with the balanced diets recommended by the ICMR (1981) and nutrient intakes were compared with the recommended dietary allowances for Indians (ICMR, 2010).
- **Anthropometric measurements:** Anthropometric measurements of weight and height of boys and girls were taken as per the IBP recommendation. The reading was taken to the nearest 0.1mm, and weighing machine was used to weigh of the boys and girls wearing minimum clothing and it was recorded to the nearest 0.5 kg.
- Nutritional status of all the selected children was assessed by measuring body height (cm), weight (kg) which was compared with the NCHS(National Center for Health Statistics) Standards. Height of children was measured by a vertical measuring rod calibrated in centimetres placed on plain floor. Weighing balance calibrated in kilogram and gram was used for taking weight of respondents.
- **Statistical Analysis:** Statistical Analysis was done by using Statistical Package for Social Sciences (SPSS) software. Frequency distribution, percentages, means and standard deviation and 'Z' value were calculated for the parameters expressed numerically. All the data were evaluated statistically by two tail 't'-test and was used to compare statistical significance between the different group. All the tests were considered significant at 5 % and 1 % level.

## 3. Result and Discussion

- Distribution of the children according to socioeconomic status in Nagpur and Nekemte
- Kuppaswamy's socioeconomic scale

Kuppaswamy socioeconomic scale was used to measure the socio-economic status of the respondent's families. It reveals the socio-economic status of the respondents' families.

It was categorized into three levels by taking into consideration of education, occupation and income. No respondent from both places i.e Nagpur and Nekemte was observed under level I, II and III. In Nagpur 23 % belonged to lower middle income group (IV), 77 %, belonged to lower group (V). In Nekemte 8 % belonged to upper lower group (IV), 92 % belonged to lower group (V).

S.No.	City	Age group	Category	
			(IV) group	(V) group
I	Nagpur	7-9 years	23	77
II	Nekemte	7-9 years	08	92

Table 1: Distribution of children according to socioeconomic status in Nagpur and Nekemte  
[ IV group = Lower upper lower group ] [ V group = Lower group ]

• Dietary pattern of the children

Dietary pattern was categorized into number of meals taken per day. 77 % and 4% of children were taking 4 meals pattern per day (B+L+S+D= Breakfast + Lunch+ Snacks + Dinner). 23 % and 83%, of children were taking 3 meals pattern per day i.e (B+L+S= Breakfast + Lunch+ Snacks) and ( B+L+D= Breakfast + Lunch+ Dinner ) in Nagpur and Nekemte. 8% and 5% of children were taking 2 meals pattern per day i.e (L+D= Lunch+ Dinner) and (B+D= Breakfast + Dinner) in Nekemte only.

City	Age group	Number of meals taken per day			
		B+L+S+D	B+L+S	L+D	B+D
Nagpur	7-9 years	77	23	00	00
		B+L+S+D	B+L+D	L+D	B+D
Nekemte	7-9 years	4	83	8	5

Table 2: Distribution of dietary pattern of children in Nagpur and Nekemte

Note :a) B+L+S+D= Breakfast + Lunch+ Snacks + Dinner

b) B+L+S= Breakfast + Lunch+ Snacks, c) B+L+D= Breakfast + Lunch+ Dinner

d) B+D= Breakfast + Dinner, e) L+D= Lunch+ Dinner

• Food liked by the children

Table 3 exhibits the foods liked by the children. The trend was towards readymade food in India. In Nagpur in the age group of 7-9 years i.e 55% of children liked to eat ready to eat food liked rock - roll, kurkura, and chips . 29% of children liked to eat chocolates, chewing gum, and ice-cream. 16% of children liked dosa, samosa, kachori and panipuri which are still evergreen favorite delicious of Indian people in Nagpur city. In Nekemte, in the age group of 7-9 years i.e 21% of children liked chicken meat, 3% of children liked goat meat, 3% of children liked beef meat 2% of children liked pasta, 2% of children liked egg, 15% of children did not respond, 54% of children liked everything whatever is cooked in their respective households.

City	Food items	Food liked
		<b>7-9 years</b>
Nagpur	[Rock & roll	55
	Kurkura	
	Chips ]	
	[Chewing gum	29
	Chocolates	
	Ice cream]	
	[Samosa	16
	Kachori	
	Dosa	
	Panipuri]	
Nekemte	Chicken meat	21
	Goat meat	03
	Beef meat	03
	Pasta	02
	Egg	02
	Not responded	15
	Liked everything	54

Table 3: Distribution of liked foods by children in Nagpur and Nekemte

• Foods disliked by the children

Table 4 exhibits the disliked foods by the children. Out of the total children screened (n=200) In age group of 7-9 years, i.e 22% of children disliked bitter gourd, 17% of children disliked palak, 14 % of children disliked bottle gourd, 12% of children disliked cluster beans, 15 % of children disliked cabbage,11% of children disliked brinjal, and 9 % of children disliked pumpkin. In age group of 7-9 years i.e 39% of children don't have dislike for any food because of limited availability of food in their households. 34% of children disliked shiro wat, 8%,of children disliked pumpkin, 9% of children disliked potatoes, 6% of children disliked cabbage, 4%,of children disliked beef meat.

S.No.	City	Food items	Food disliked
			<b>7-9 years</b>
I	Nagpur	Bitter gourd	22
		Brinjal	11
		Palak	17
		Bottle gourd	14
		Cluster beans	12

		Cabbage	15
		Pumpkin	09
<b>II</b>	<b>Nekemte</b>	Shiro wat	34
		Pumpkin	08
		Cabbage	06
		Potato	09
		Beef meat	04
		No dislike	39

Table 4: Distribution of disliked foods by the children in Nagpur and Nekemte

- Frequency of consumption of fruits

As vending machine availability increased, fruit consumption decreased. Out of the total screened respondents (n=200), 12% of the children consumed fruits once in 15days, 27% of the respondents consumed fruits once in a month, 61 % of the respondents consumed fruits rarely in Nagpur. In Nekemte 18% of the respondents consumed fruits once in a month, 82 % of the respondents consumed fruits rarely.

Research has demonstrated that food neophobia is an important predictor of fruit and vegetable intake. Children who are reluctant to try new foods generally have lower intakes of fruit and vegetables. Children learn about eating not only through their own experiences but also by watching others. In a study of preschool children, Birch found that when children saw other children choosing and eating vegetables, the observing children did not like, preferences for and intake of disliked vegetables increased. Social environments play an important role in the development of children's eating patterns and diet quality.

City	Age group	Frequency of consumption of fruits		
		15days	Monthly	Rarely
<b>Nagpur</b>	7-9 years	12	27	61
<b>Nekemte</b>	7-9 years	00	18	82
	Total	(6)	(22.5)	(71.5)

Table 5: Frequency of consumption of fruits in Nagpur and Nekemte

Note : Figures in parenthesis indicate percentages

- Frequency of consumption of non vegetarians food

Result revealed that frequency of the consumption of non vegetarian foods in the household. In age group of 7-9 years children consumed non vegetarian foods i.e 11.76 % after 8 days , 33.33% consumed non vegetarian foods after the period of 15 days, 54.90 % consumed only after a month respectively in Nagpur.

In age group of 7 - 9 years children in their household consumed non vegetarian foods as follows, 22 % once a month, 78% after two months in Nekemte. All the families in Nekemte city consumed non – vegetarians foods, due to lack of money, and increase in price for non vegetarians food items they were usually consuming vegetarians foods. Non-vegetarians foods are more costly than vegetables.

City	Age group	Frequency of consumption of Non vegetarians			
		8 days	15days	Monthly	Total
<b>Nagpur</b>	7-9 years	6 (11.76)	17(33.33)	28(54.90)	51
<b>Nekemte</b>		<b>Once a month</b>	<b>After Two Months</b>		<b>Total</b>
	7-9 years	22 (22)	78 (78)		100

Table 6: Frequency of consumption of non vegetarians foods in Nagpur and Nekemte

Note : Figures in parenthesis indicate percentages

- Food and Nutrient Intake

The study exhibits the daily mean intake of all the food groups viz cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, fruits, milk and milk products, meat/ fish / egg, fats and oils and sugar jaggery were lower than RDI in the age group of 7-9 years. Their daily diet consumption was 187.6 and 185.2 g/day which was 69.48 and 68.59 per cent of RDI in Nagpur and Nekemte respectively. In Nagpur and Nekemte pulses average intake was 27 and 25.2 g/day, which was lower than RDI. Intake of green leafy vegetable was significantly low as compared to RDI i.e 15.8 and 18.2 per cent of RDI. The deficit intake of other vegetable in Nagpur and Nekemte children was -40 percent and -45.30 percent. The consumption of roots and tubers was 58.5 and 54 g/day which was 58.5 and 54 percent of RDI in Nagpur and Nekemte respectively. Daily mean intake of fruits was 31.8 and 22.6 g/day which was 31.8 and 22.6 per cent of RDI, in Nagpur and Nekemte. The maximum deficit intake of milk and milk products in Nagpur and Nekemte was -56 percent and -99.16 percent. The deficit intake of Meat/ fish / Egg in Nagpur and Nekemte children was -75.60 percent and -78.20 percent. The deficit intake of fats and oil in Nagpur and Nekemte children was -28.80 percent and -30.80 percent. The deficit intake of sugar and jaggery in Nagpur and Nekemte children was -35.00 percent and -25.00 percent. But in Ethiopia they consumed more sugar in tea.

Food groups	RDI (g)	Daily mean intake for 7-9 years		% RDI	Z value
		Nagpur	Excess or deficit %		
Cereals <sup>NS</sup>	270	187.6±31.36	-30.52	69.48	3.98
Pulses <sup>NS</sup>	60	27±6.06	-55.00	45	1.04
G L V <sup>NS</sup>	100	15.8±20.48	-84.20	15.8	3.05
Other Veg <sup>NS</sup>	100	60±19.16	-40.00	60	2.93
Root & Tubers <sup>NS</sup>	100	58.5±18.90	-41.50	58.5	1.34
Fruits <sup>**</sup>	100	31.8±12.02	-68.20	31.8	1.92
Milk Products <sup>**</sup>	500	220±40.40	-56.00	44	2.51
Meat/ fish /Egg <sup>NS</sup>	50	12.2±11.48	-75.60	24.4	1.16
Fats & oils <sup>NS</sup>	25	17.8±2.42	-28.80	71.2	0.61
Sugar & Jaggery <sup>**</sup>	30	19.5±2.71	-35.00	65	0.30

Table 7: Average daily intake of food groups of 7-9 years children in Nagpur  
 Note(\*\* Significant at both levels) (NS =Insignificant) ( \* Significant at 5% level and In Significant at 1% level.)  
 Values are mean ±SD

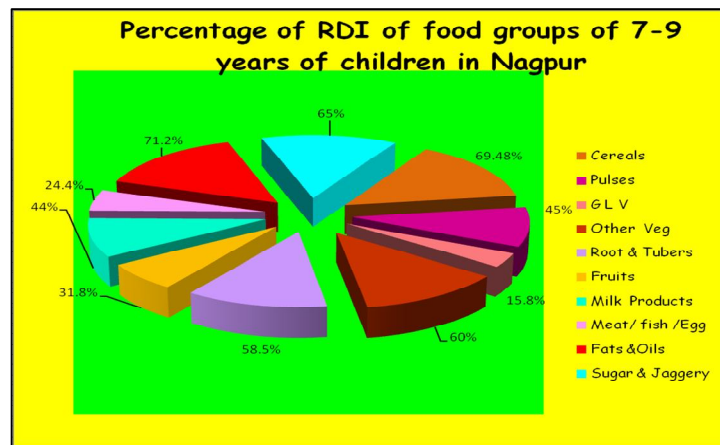


Figure 1: Percentage of RDI of food groups of 7-9 years children in Nagpur

Food groups	RDI(g)	Daily mean intake (g) for 7-9 years		% RDI	Z value
		Nekemte	Excess or deficit %		
Cereals <sup>NS</sup>	270	185.2±28.15	-31.41	68.59	3.98
Pulses <sup>NS</sup>	60	25.2±7.06	-58.00	42	1.04
G L V <sup>NS</sup>	100	18.02±21.65	-81.98	18.02	3.05
Other Veg <sup>NS</sup>	100	54.7±20.45	-45.30	54.7	2.93
Root & Tubers <sup>NS</sup>	100	54±9.25	-46.00	54	1.34
Fruits <sup>**</sup>	100	22.6±12.78	-77.40	22.6	1.92
Milk Products <sup>**</sup>	500	4.2 ± 12.38	-99.16	0.84	2.51
Meat/ fish /Egg <sup>NS</sup>	50	10.9±11.50	-78.20	21.8	1.16
Fats & oils <sup>NS</sup>	25	17.3±3.69	-30.80	69.2	0.61
Sugar & Jaggery <sup>**</sup>	30	22.5 ±3.23	-25.00	75	0.30

Table 8: Average daily intake of food groups of 7-9 years children in Nekemte  
 Note(\*\* Significant at both levels) (NS = Insignificant) ( \* Significant at 5% level and Insignificant at 1% level.)  
 Values are mean ±SD

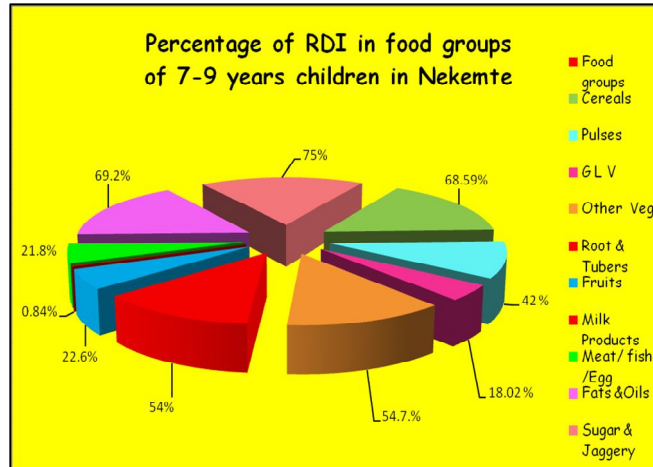


Figure 2: Percentage of RDI in food groups of 7-9 years children in Nekemte

The study exhibits the average intakes of all nutrients i.e energy, protein, calcium, iron, zinc, vitamin C, β – carotene, thiamine, riboflavin, niacin and folic acid were lower than RDA in the age group of 7-9 years children in Nagpur and Nekemte. The study exhibits the daily mean energy intake for children between the age group of 7-9 years was 1295.78 and 1291.66 Kcal / day which was 76.62 and 76.42 per cent of RDA in Nagpur and Nekemte respectively. The mean daily intake of protein for children was 25.03 and 24.02 which is lower than the daily ICMR Recommended Allowances of 29.5 g/ day (ICMR 2010). Hence, these children were consuming less protein i.e 84.84 and 81.42 per cent of RDA. The deficit intake of calcium in Nagpur and Nekemte children was -14 percent and - 49.62 percent. The daily mean intake of iron for children between the age group of 7-9 years was 11.09 and 13.14 mg. i.e 69.31 and 82.12 per cent of RDI. The mean daily intake of zinc for children between the age group of 7-9 years was found to be 4.00 and 5.49 mg/day which was 50 and 68.62 in Nagpur and Nekemte respectively. The deficit intake of vitamin C in Nagpur and Nekemte children was -7.70 percent and -8.75 percent. The deficit intake of β - carotene in Nagpur and Nekemte children was -93.67 percent and -89.42 percent. The average daily intake of thiamine was 0.6 and 0.4 mg, which was 75 and 50 per cent of RDA respectively in Nagpur and Nekemte. Hence Nagpur children were consuming higher amount of thiamine when compared to Nekemte. The deficit intake of thiamine in Nekemte and Nagpur children was -25percent and -50 percent. The mean daily intake of riboflavin was 0.64 and 0.43 which was lower than RDA i.e (64 and 43) per cent of RDA in Nagpur and Nekemte. Mean intake of niacin for children between the age group of 7-9 years was found to be 8.19 and 7.01 mg/day which was 63 and 53.92 per cent of RDA in Nagpur and Nekemte respectively. The deficit intake of niacin in Nagpur and Nekemte children was -37.00 percent and - 46.08 percent. The deficit intake of folic acid in Nagpur and Nekemte children was -37.33 percent and 43.61 percent.

Nutrients	Daily mean intake of nutrients of 7-9 years children				
	RDA	Nagpur	Excess or deficit %	% RDA	Z value
Energy <sup>NS</sup>	1690	1295.78±98.07	-23.33	76.62	14.14
Range		1287.5- 1177.7=109.8			
Protein <sup>**</sup>	29.5	25.03±4.06	-15.15	84.84	0.43
Range		25.78-17.89=7.89			
Calcium <sup>**</sup>	600	512± 128.85	-14	85.33	7.14
Range		567.6-525.2=42.4			
Iron <sup>**</sup>	16	11.09±1.48	-30.69	69.31	0.12
Range		12.67-9=3.67			
Zinc <sup>**</sup>	8	4.00±0.69	-50.00	50	0.42
Range		5.93-3.97=1.96			
	RDA	Nagpur	Excess or deficit %	% RDA	Z value
Vitamin C <sup>**</sup>	40	36.92±26.22	-7.70	92.3	1.32
Range		36.1-26.3=9.8			
β carotene <sup>**</sup>	4800	303.73±26.73	-93.67	6.32	4.29
Range		368.8-248.8=120			
Thiamine <sup>**</sup>	0.8	0.6±0.13	-25	75	0.67
Range		0.5-0.4=0.1			
Riboflavin <sup>**</sup>	1.0	0.64±0.06	-36.00	64	0.65
Range		0.79-0.68=0.11			
Niacin <sup>**</sup>	13	8.19±1.44	-37.00	63	0.21

Range		10.30-7.61=2.69			
Folic acid**	120	75.21±12.00	-37.33	62.67	1.66
Range		98.29-82.92=15.37			

Table 9: Average daily intake of nutrients of 7-9 years of children in Nagpur  
 Note(\*\* Significant at both levels ) ( NS =Insignificant ) (\* Signifiacnt at 5% level and In Significant at 1% level.)

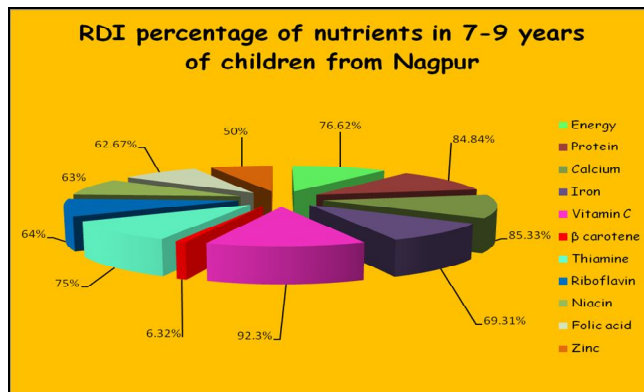


Figure 3: Percentage of RDA in nutrients of 7-9 years of children in Nagpur

Nutrients	Daily mean intake of nutrients for 7-9 years children				
	RDA	Nekemte	Excess or deficit %	% RDA	Z value
Energy <sup>NS</sup>	1690	1291.66±99.97	-23.57	76.42	14.14
Range		1282.8-1127.9=154.9			
Protein**	29.5	24.02±3.05	-18.58	81.42	0.43
Range		25.53-21.23=4.3			
Calcium**	600	302.28±47.16	-49.62	50.33	7.14
Range		342.08- 225.42=116.66			
Iron**	16	13.14±1.30	-17.88	82.12	0.12
Range		13.23-12.23=1.00			
Zinc**	8	5.49±0.55	-31.38	68.62	0.42
Range		8.73-6.76=1.97			
Vitamin C**	40	32.50±9.09	-18.75	81.25	1.32
Range		32.3-25.4=6.9			
β carotene**	4800	507.72±37.95	-89.42	10.57	4.29
Range		583.12-469.7=113.42			
Thiamine**	0.8	0.4±0.04	-50	50	0.67
Range		0.5-0.3=0.2			
Riboflavin**	1.0	0.43±0.15	-57.00	43	0.65
Range		0.72-0.34=0.38			
Niacin**	13	7.01±1.39	-46.08	53.92	0.21
Range		9-5.61=3.39			
Folic acid**	120	67.67±11.82	-43.61	56.39	1.66
Range		91.12-69.92=21.2			

Table 10: Average daily intake of nutrients of 7-9 years of children in Nekemte  
 Note(\*\* Significant at both levels ) ( NS =Insignificant ) (\* Signifiacnt at 5% level and In Significant at 1% level.)

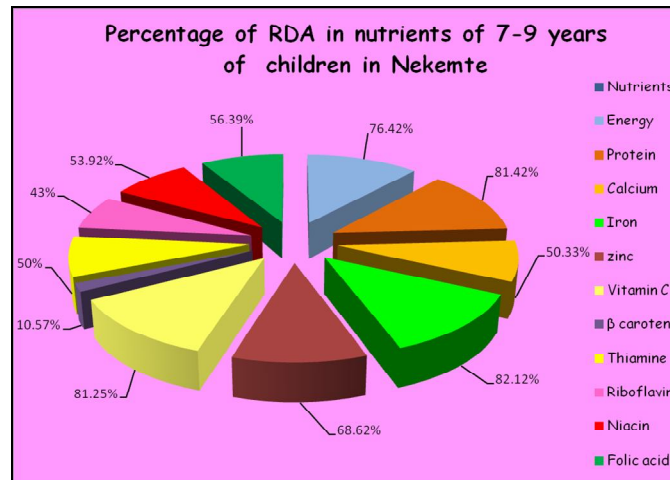


Figure 4: Percentage of RDA in nutrients of 7-9 years of children in Nekemte

- Anthropometric Measurements Of Children
- Weight measurements of children with NCHS standards

Table 9 exhibits the mean weight of the children. Mean weight of 7 years of male was 16.16 kg and 16.26 kg, which was 67.33 and 67.75 per cent of the reference value in Nagpur and Nekemte .In females of same age group, mean weight was 15.12 and 15.55 kg , which was also lower than the reference value i.e 67.78 and 65.19 per cent of the reference value in Nagpur and Nekemete . Mean weight of 8 years of male was 17.52 kg and 17.55 kg, which was 65.62 and 65.73 per cent of the reference value in Nagpur and Nekemte .In females of same age group, mean weight was 16.96 and 16.72 kg , which was also lower than the reference value i.e 63.76 and 62.86 per cent of the reference value in Nagpur and Nekemte .

Underweight, or low weight for age, is a composite of height for age and weight for height. It is generally considered a general indicator of malnutrition, since a child that is underweight could be stunted or wasted, or both stunted and wasted.(World bank document report) The observed values for weight in all age groups were lower than the respective reference values. This may be due to lower intake of food or may be due to frequent illness or infestation. The present findings are consistent with those of kaur (1992) who found that the values were much below the reference values recommended by NCHS (1990) .Awasti and Pande (1997) also observed that 57.6 per cent of pre schoolers (1.5 to 3.5 years ) were underweight with mean weight of 10.1 ± 0.07 kg. Zulkifli et al (1990) reported that 33.7 to 65.3 per cent of pre-school children was found underweight .According to Golder et al.(2001), 51 per cent of the children were found underweight. Lakshmi and Padma priya (2004) reported values which were below reference values of weight, recommended by ICMR.

Place	Age	Mean Weight measurements of children				
		Sex	Number	Weight (Kg)	NCHS	Percentage
Nagpur	7+	M	28	16.16 ± 0.89	24	67.33
		F	25	15.12 ± 1.39	23.3	64.89
	8+	M	22	17.52 ± 1.50	26.7	65.62
		F	25	16.96 ± 1.88	26.6	63.76
Nekemte	7+	M	30	16.26 ± 0.90	24	67.75
		F	29	15.55 ± 1.52	23.3	66.74
	8+	M	20	17.55 ± 2.30	26.7	65.73
		F	21	16.72 ± 1.27	26.6	62.86

Table 11: Weight measurements of children with NCHS standards

- Height measurements of children with NCHS standards

Growth assessment best defines the health and nutritional status of children, because disturbances in health and nutrition, regardless of their etiology, invariably affect child growth and hence provide an indirect measurement of the quality of life of an entire population (De Onis et al., 1993).

Table 10 exhibits the mean height of the children. Mean height of 7 years of male was 110.10 cm and 110.56 cm, which was 88.50 and 88.87 per cent of the reference value in Nagpur and Nekemete .In females of same age group, mean height was 107.64 and 107.53 cm , which was also lower than the reference value i.e 87.16 and 87.07 per cent of the reference value in Nagpur and Nekemte. Mean height of 8 years of male was 119.22 cm and 120 cm, which was 91.99 and 92.59 per cent of the reference value in Nagpur and Nekemete .In females of same age group, mean height was 117.4 and 117.59 cm , which was also lower than the reference value i.e 90.80 and 90.94 per cent of the reference value in Nagpur and Nekemte .



The height of the children was noticed and compared with the NCHS standard values. The height of children was found below the reference value in present study. This might be due to lower intake of food, or low per capita income or lowest food availability or height of children may be affected by genetic factors.

These findings are consistent with those of Goyal (1990) who reported that mean height of preschool children of 6 years was shorter than the Harvard standards. Awasthi and Pande (1997) also observed that 82.8 per cent of the pre schoolers were stunted with mean height of  $81.9 \pm 0.3$  cm. Lakshmi and Padma priya (2004) reported below standard values for height in six anganwadi is located in and around Coimbatore city.

Place	Age in years	Mean Height measurements of children				
		Sex	N	Height (cm)	NCHS Stds	Percentage
Nagpur	7+	M	28	$110.10 \pm 5.20$	124.4	88.50
		F	25	$107.64 \pm 4.32$	123.5	87.16
	8+	M	22	$119.22 \pm 6.29$	129.6	91.99
		F	25	$117.4 \pm 3.90$	129.3	90.80
Nekemte	7+	M	30	$110.56 \pm 5.32$	124.4	88.87
		F	29	$107.53 \pm 6.99$	123.5	87.07
	8+	M	20	$120 \pm 6.08$	129.6	92.59
		F	21	$117.59 \pm 3.29$	129.3	90.94

Table 12: Height Measurements Of Children With NCHS Standards

#### 4. Conclusion

Hence it may be concluded that the consumption of foods was inadequate and nutrients were found to be limiting nutrients in the diets of school children. So there is an urgent need to educate mothers of school going children about the importance of balanced diet and promote the consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers, sugar and jaggery, fats and oil, milk and milk products, fruits etc. in the children's diet to improve their nutritional status so that children contribute in the well-being of the nation as children are the future of the nation's prosperity. Awareness programs regarding affordable but nutritious foods should be introduced by the government through community participation, involvement of NGOs and other sectors.

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