

Assessment of nutritional status of school going children in the age group 7-9 Years

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■ **ABSTRACT** : The present study was conducted in Pantnagar, U.S.Nagar district of Uttarakhand state to assess the nutritional status of the school going children. One hundred children of 7-9 years age (50 boys and 50 girls) were selected randomly. Nutritional status of children was assessed in terms of dietary assessment was done by 24 hour dietary recall method for three consecutive days of. The results of the study revealed that consumption of foods like cereals, pulses, fruits, GLV's, milk and milk products, fats and oils, sugar and jaggery were inadequate in the diets of both boys and girls. Nutrients like energy, fat, β - carotene, B-complex vitamins, vitamin C, iron and calcium were found limiting in the diets of school children. It was found that family size, father's occupation and parent's education had significant ($P<0.05$) effect on food intake of selected children. So there is an urgent need to educate mothers of school going children about the importance of balanced diet and preparation of nutrient-rich recipes based on locally available food stuffs in the children's diet to improve their nutritional status. The results of the study can be of use for planning need-based supplementary nutrition programmes by the policy-makers for the school children. Hence it can be concluded that feeding of nutrient rich supplements based on locally available food stuffs can go a long way in improving nutritional status of children which will contribute in the well- being of the children who are the future of the nation's prosperity.

■ **KEY WORDS**: School children, Nutritional assessment, Dietary assessment, Micronutrients

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The future of our nation and the prosperity of our people depend on the health and happiness of our children and the care they receive from family and society to grow up as good human beings and citizens. School going children form an important vulnerable segment of the nation's population. They constitute 20 to 25 per cent of the total population in

India. School age is a dynamic period of physical growth and development, when the child undergoes rapid mental, emotional and social changes. Children who fail to grow optimum during this crucial period may not make-up the loss in growth even on excellent diet in later life. Studies have shown that the performance of children, who had earlier suffered from malnutrition,

was clearly inferior to that of children who had not gone through malnutrition. Good nutrition is important throughout childhood because under nutrition during the first few years of life decreases adult body size and physical output when the growth rate is high. The high level of nutritional deprivation combined with heavy burden of disease at young age has negative consequences which will be expressed during adult life. Hence the school age period is nutritionally significant and children are considered to be the special risk group. Malnutrition during this period results in inferior school performance, working ability and physical growth (Kumari, 2005).

The school children are, therefore, in need of health promotion, health appraisal and health restoration. Their nutritional status can be ensured only by improving the economic conditions of their parents to a level at which they can afford adequate diets. Unfortunately today the economic conditions of a large proportion of the people are such that they simply cannot afford even the least expensive diets. Thus, the assessment of nutritional status plays an important role. To assess the nutritional status of an individual or population, anthropometry is widely recognized as one of the useful techniques because it is highly sensitive to detect under nutrition, while much of the global childhood stunting and wasting are the result of deficiencies in energy and protein known as Protein Energy Malnutrition which is mainly assessed by dietary intake at individual or household level. Therefore the problem of malnutrition and under nutrition pose a serious threat to growth and development along with poor academic performance, adverse effect on gross motor activities, skilled motor activities, perception, cognition, memory, attention span, language development and inter social relationship, in turn the personality of the children. Micronutrient deficiencies also cause reduced productivity in later life (Micronutrient Initiative, 2004).

■ RESEARCH METHODS

The research was carried out in Pantnagar at U.S.Nagar district of Uttarakhand state for being easily accessible and acquainted to researcher, was selected purposively and selection of respondents was done randomly from two blocks of Pantnagar. The present study was conducted on school going children in the age group 7-9 years. Total 100 school going children

i.e. 50 boys and 50 girls were selected proportionately for the study, from the two blocks from the Government Primary School of Pantnagar.

Nutritional status assessment:

Nutritional status was assessed by dietary survey method. Questionnaire-cum-interview method was used to study the food consumption pattern. Food intake of children 100 school going children was assessed by food frequency method. Children were asked whether they were using different foods daily, alternate days, weekly, rarely or not consumed. Dietary intake of those 100 children was recorded using 24 hours recall method for three consecutive days. The per cent of Recommended Dietary Allowances for each food stuff was calculated using the formula:

$$RDI\% = \frac{\text{Intake of food stuff}}{RDI} \times 100$$

Nutrient intake was calculated from 24 hour dietary recall data for three consecutive days using Food Composition Tables of ICMR (Gopalan *et al.*, 2004). Protein, fat, energy, iron, calcium, thiamine, riboflavin, niacin, Vitamin B₁₂, folic acid, Vitamin C and β-carotene intake was calculated. The mean nutrient intake was compared with the Recommended Dietary Allowances (RDA) given by ICMR (Gopalan *et al.*, 2004). z value was used to find out the difference between actual intake and RDA.

■ RESEARCH FINDINGS AND DISCUSSION

Dietary assessment of children showed that all the families (100%) consumed wheat daily while 56 per cent families on daily basis consumed rice. Pulses are the major source of protein in Indian diets. Six per cent of the respondent's families consumed red gram dal on daily basis followed by 28 per cent, 22 per cent, eight per cent and 36 per cent alternately, weekly, fortnightly and rarely, respectively. *Amaranthus*, *bathua leaves*, *coriander leaves*, *fenugreek leaves*, *bengal gram leaves*, *mustard leaves*, *mint* and *spinach* were the main green leafy vegetables that were consumed by the respondents' families (25, 21, 12, 35, 9, 14, 21 and 35 %, respectively) on weekly basis. *Amaranthus*, *coriander leaves*, *fenugreek leaves*, *mustard* and *spinach* were consumed alternately by 12, 9, 15, 13 and 5 per cent of the respondents' families, respectively. Since the data was collected during winter season, so the higher

Table 1 : Frequency of consumption of food stuffs by children (7-9 years)						(n=100)
Food stuffs	Daily	Alternately	Weekly	Fortnightly	Rarely	Not consumed
Cereals						
Wheat	100(100.0)	–	–	–	–	–
Rice	–	–	32 (32.0)	27 (27.0)	21 (21.0)	1 (1.0)
Maize	–	–	–	–	12 (12.0)	88 (88.0)
Pulses						
Bengal gram	1 (1.0)	14 (14.0)	3(3.0)	30 (30.0)	17 (17.0)	3 (3.0)
Black gram	4(4.0)	22 (22.0)	34 (34.0)	21(21.0)	15 (15.0)	4 (4.0)
Green gram	6 (6.0)	28 (28.0)	22 (22.0)	8 (8.0)	36(36.0)	–
Red gram	7 (7.0)	15 (15.0)	24 (24.0)	19 (19.0)	22 (22.0)	13 (13.0)
Mothbean	–	–	–	–	59 (59.0)	41 (41.0)
Lentil	–	–	–	22 (22.0)	45 (45.0)	33 (33.0)
Soybean	–	–	2 (2.0)	9 (9.0)	38 (38.0)	51 (51.0)
Green leafy vegetables						
Amaranthus	–	12 (12.0)	25 (25.0)	29 (29.0)	4 (4.0)	30 (30.0)
Bathua leaves	–	–	21 (21.0)	33(33.0)	22 (22.0)	24 (24.0)
Coriander leaves	–	9 (9.0)	12 (12.0)	27 (27.0)	30 (30.0)	22 (22.0)
Fenugreek leaves	–	15(15.0)	35 (35.0)	23 (23.0)	27 (27.0)	–
Bengal gram leaves	–	–	9 (9.0)	14 (14.0)	44 (44.0)	33 (33.0)
Mustard	–	13 (13.0)	14 (14.0)	17 (17.0)	35 (35.0)	–
Mint	–	–	21 (21.0)	23 (23.0)	31(31.0)	19 (19.0)
Spinach	–	5 (5.0)	35 (35.0)	33 (33.0)	27 (27.0)	–
Roots and tubers						
Radish	3 (3.0)	17 (17.0)	37 (37.0)	34 (34.0)	9 (9.0)	–
Carrot	–	8 (8.0)	43 (43.0)	32 (32.0)	17 (17.0)	–
Potato	84 (84.0)	16 (16.0)	–	–	–	–
Onion	93 (93.0)	2 (2.0)	5 (5.0)	–	–	–
Colocassia	–	–	–	5 (5.0)	44 (44.0)	51 (51.0)
Ginger	5 (5.0)	13 (13.0)	35 (35.0)	27 (27.0)	13 (13.0)	7 (7.0)
Garlic	41 (41.0)	23 (23.0)	24 (24.0)	12 (12.0)	–	–
Turnip	–	–	19 (19.0)	39(39.0)	33 (33.0)	9 (9.0)
Other vegetables						
Brinjal	–	13 (13.0)	37 (37.0)	36 (36.0)	11 (11.0)	3 (3.0)
Tomato	36 (36.0)	24 (24.0)	28 (28.0)	12 (12.0)	–	–
Cauliflower	1 (1.0)	14 (14.0)	37 (37.0)	36 (36.0)	12 (12.0)	–
Cabbage	–	15 (15.0)	40 (40.0)	34 (34.0)	11(11.0)	–
Green Chilly	82(82.0)	14 (14.0)	–	–	–	–
Lady finger	–	4 (4.0)	37 (37.0)	36 (36.0)	23 (23.0)	–
Peas	–	5 (5.0)	40 (40.0)	42 (42.0)	13 (13.0)	–
Other vegetables	–	12 (12.0)	41 (41.0)	30 (30.0)	17 (17.0)	–
Fruits						
Guava	–	–	28 (28.0)	47 (47.0)	25 (25.0)	–
Apple	–	–	2 (2.0)	30 (30.0)	63 (63.0)	5 (5.0)
Banana	–	–	24 (24.0)	53 (53.0)	23 (23.0)	–
Ber	7 (7.0)	37(37.0)	37 (37.0)	18 (18.0)	1 (1.0)	–
Lemon	–	4 (4.0)	39 (39.0)	40 (40.0)	17 (17.0)	–

Table 1 contd....

Contd.... Table 1

Orange	–	3 (3.0)	29 (29.0)	41 (41.0)	26 (26.0)	1 (1.0)
Any other	–	–	9 (9.0)	–	91 (91.0)	–
Milk and milk products						
Cow's milk	8 (8.0)	5 (5.0)	2 (2.0)	12 (12.0)	70 (70.0)	3 (3.0)
Buffalo's milk	80 (80.0)	1 (1.0)	–	6 (6.0)	13 (13.0)	–
Curd	12 (12.0)	46 (46.0)	33 (33.0)	7 (7.0)	2 (2.0)	–
Butter milk	26 (26.0)	31 (31.0)	25 (25.0)	18 (18.0)	–	–
Butter	10 (10.0)	13 (13.0)	27 (27.0)	22 (22.0)	28 (28.0)	–
Sweets	–	–	6 (6.0)	57 (57.0)	37 (37.0)	–
Fats and oils						
Desi ghee	44 (44.0)	13 (13.0)	10 (10.0)	6 (6.0)	27 (27.0)	–
Hydrogenated fat	21 (21.0)	26 (26.0)	10 (10.0)	–	28 (28.0)	15 (15.0)
Refined oil	–	–	–	–	8 (8.0)	92 (92.5)
Mustard oil	8 (8.0)	–	6 (6.0)	27 (27.0)	35 (35.0)	24 (24.0)
Meat products						
Eggs	–	–	–	–	5 (5.0)	95 (95.0)
Meat	–	–	–	2 (2.0)	2 (2.0)	96 (96.0)
Any other	–	–	–	2 (2.0)	1 (1.0)	97 (97.0)

consumption of the green leafy vegetables by the respondents' families might be due to the fact that these vegetables are found in abundance in the fields in winter season. The consumption of fruits was found to be less as compared to other foods. Majority of the respondents' families consumed buffalo's milk (80%) while 70 per cent of the respondents' families consumed cow's milk rarely.

Food consumption pattern:

The mean daily cereal intake of the school children was 119.14 g (44.12%) which was significantly ($P \leq 0.01$) lower than Recommended dietary Intake. Comparing the mean daily food intake of boys and girls which was 117.3 g and 120.56 g, respectively, it was found that the intake of boys was slightly lower than that of girls; however the difference was non-significant.

The mean daily intake of pulses of the school children was 42.69 g (60.98%), significantly lower ($P \leq 0.01$) than the Recommended Dietary Intake. It was also found that intake of pulses was non-significantly less in girls than that of boys. Daily mean intake of fats and oils by the school children was 8.35 g which was 33.40 per cent of RDI. The intake was, significantly ($P \leq 0.01$) lower than RDI. On comparing the intake of fats and oils of the girls and boys, it was found that the intake was non-significantly lower in girls. The school children were found to consume 123.92 g of milk and

milk products which was only 24.78 per cent of the RDI *i.e.* significantly ($P \leq 0.01$) lower. It was found that the consumption of milk and milk products was slightly higher in boys than in girls, however the difference was non-significant. Mean intake of green leafy vegetables was low (35.14 g) which was significantly ($P \leq 0.01$) lower than the RDI *i.e.* 35.14 per cent. It was also found that consumption of green leafy vegetables was lower in boys than in girls, however the difference was non-significant. Mean daily intake of fruits was 28.70g. Overall intake was 28.70 per cent of RDI which was significantly ($P \leq 0.01$) lower than RDI. It was found that the intake was slightly higher in girls than boys, however the difference was non-significant.

Mean daily nutrient intake of children :

Mean daily intake of energy among the school children was found to be 957.12 Kcal (56.66% of RDA) which was significantly ($P \leq 0.01$) lower than RDA. On comparing intake of boys and girls it was found that the intake of energy of boys was higher than girls, however the difference was non-significant. Mean daily nutrient intake of protein was found to be adequate in school children *i.e.* 38.52 g which was 93.95 per cent of RDA. Intake of protein in boys was 39.08 gm (95.31%) and in girls was 37.96 g (92.58%), respectively. The intake was higher in boys as compared to girls, however the difference was not significant.

The mean daily intake of fats and oils was found to be 13.12 g which was 52.48 per cent of the RDA *i.e.* significantly ($P \leq 0.01$) lower than the RDA. On comparing the mean daily intake of boys and girls with the RDA, it was found that the intake of fats and oils by the girls was slightly lower than the boys. The mean daily intake of β -carotene was 1678.4 μg in the school children *i.e.* only 34.9 per cent of the RDA, which was significantly ($P \leq 0.01$) lower than the RDA. It was found that girls had slightly higher intake than boys, however the difference was non-significant. The mean daily intake of thiamine was found to be 0.49 mg, which was significantly ($P \leq 0.01$) lower than the RDA. On comparing the intake of thiamine in boys and girls, it was found that the thiamine intake was non-significantly lower in girls as compared to boys. The comparison between the intake of boys and girls showed that

riboflavin intake of boys was slightly higher, though non-significant, in girls. Intake of niacin in school children was significantly ($P \leq 0.01$) lower than the RDA, *i.e.* 3.75 mg (28.84%). The intake was non-significantly higher boys than girls.

The mean daily intake of B_{12} vitamin in school children was 0.07 μg , which was only seven per cent of the RDA [significantly ($P \leq 0.01$) lower than RDA]. The intake of vitamin B_{12} was non-significantly higher in boys as compared to that of girls. Mean daily intake of Iron was found to be 7.15 mg which was 28.6 per cent RDA. The intake was significantly ($P \leq 0.01$) lower than RDA in school children. It was found that the intake of iron was non-significantly lower in girls as compared to boys and there was a non-significant difference between the calcium intake of boys and girls.

Food stuffs (g)	RDI (g)	Mean daily food intake	z value	Overall intake %age of RDI
Cereals	270	119.14 \pm 24.77	-61.07**	44.12
Pulses	70	42.69 \pm 20.58	-13.27**	60.98
Fats and oils	25	8.35 \pm 2.77	-60.10**	33.40
Sugars and Jaggery	30	6.83 \pm 2.78	-83.34**	22.76
Green leafy vegetables	100	35.14 \pm 36.44	-17.81**	35.14
Roots and tubers	100	49.83 \pm 33.12	-15.14**	49.83
Other vegetables	100	39.01 \pm 23.54	-25.90**	39.01
Fruits	100	28.70 \pm 18.15	-39.28**	28.70
Milk and milk products	500	123.92 \pm 52.16	-72.10**	24.78

Values are mean \pm SD

n= Number of school children

RDI- Recommended Dietary Intake (ICMR, 2008).

Z value shows comparison of nutrients intake with RDI.

* and ** indicate significance of values at $P=0.05$ and 0.01 , respectively

Food stuffs	RDI (g)	Mean daily food intake of children		z value		Boys vs. girls z value
		Boys (n=50)	Girls (n=50)	Boys	Girls	
Cereals	270	117.73 \pm 25.00 (43.60)	120.56 \pm 24.63 (44.65)	-43.13**	-42.94**	-0.19 ^{NS}
Pulses	70	38.19 \pm 12.05 (54.55)	35.74 \pm 11.30 (51.05)	-18.71**	-21.54**	2.83 ^{NS}
Fats and oils	25	8.43 \pm 2.72 (33.72)	8.28 \pm 2.85 (33.12)	-43.60**	-41.80**	-1.8 ^{NS}
Sugar and jaggery	30	6.84 \pm 2.80 (22.80)	6.82 \pm 2.80 (22.73)	-59.38**	-59.43**	0.05 ^{NS}
Milk and milk products	500	125.34 \pm 50.23 (25.06)	122.53 \pm 54.48 (24.50)	-52.76**	-49.02**	-3.74 ^{NS}
GLV's	100	26.74 \pm 16.65 (26.74)	42.15 \pm 46.28 (42.15)	-31.17**	-8.84**	-22.33 ^{NS}
Roots and tubers	100	55.64 \pm 34.01 (55.64)	43.34 \pm 31.32 (43.34)	-9.22**	-12.81**	3.59 ^{NS}
Other vegetables	100	39.92 \pm 25.14 (39.92)	37.97 \pm 21.99 (37.97)	-16.92**	-19.94**	3.02 ^{NS}
Fruits	100	27.68 \pm 16.29 (27.68)	29.64 \pm 20.30 (29.64)	-31.44**	-24.51**	-6.93 ^{NS}

Values are Mean \pm SD

Figures in parentheses indicate percentage

RDI = Recommended Dietary intake (ICMR, 2008)

Z value shows comparison of food intake and RDI

NS=Non-significant

n= Number of school children

* and ** indicate significance of values at $P=0.05$ and 0.01 , respectively

Frequency of food consumption :

The data on food frequency intake of children indicated that the intake of wheat was main cereal consumed daily by the children *i.e.* wheat was the staple food in the study area. Majority of children were consuming pulses *i.e.* green gram dal, black gram, bengal gram and red gram on alternate days. Children were consuming *bathua*, mustard leaves and spinach on weekly basis. The diet were cereals based and frequency of consumption of protective foods including green leafy vegetables was very low. Onion and potato were observed to be consumed daily while carrot, radish, garlic were consumed alternately and weekly. Consumption of fruits was less frequent. Among milk and milk products, buffalo's milk was consumed by majority of the respondents' families. Majority of the families consumed desi ghee daily followed by hydrogenated fat and mustard oil whereas refined oil was rarely consumed.

The mean daily cereal intake of the school children was 119.14 gm which was 44.12 per cent the Recommended Dietary Intake. The intake of boys was slightly lower than the girls.

Similarly the consumption of pulses was lower than RDI in school going children. Lower consumption of pulses may be due to lower agricultural production, higher price and low purchasing power of poor households. Results of present study indicated less consumption of green leafy vegetables (35.14g) by children (7-9 years) which was significantly ($P \leq 0.01$)

lower than RDI. Less consumption of green leafy vegetables might be due to the reason that children did not like the taste of green leafy vegetables and moreover, their mothers were also not aware of the importance of green leafy vegetable in their diet

The consumption of roots and tubers by children was 49.83 per cent which was significantly ($P \leq 0.01$) lower than RDI. Root and tubers are the richest sources of energy among vegetables. Besides energy, they also provide β -carotene, vitamins, calcium etc. Consumption of fruits was 28.70 per cent which was significantly ($P \leq 0.01$) lower than RDI. Lower intake of fruits might be due to the fact that they could not afford these due to high cost and unavailability, less awareness and lower trend of kitchen gardening. Fruits are very good sources of vitamin C and β -carotene along with it they are also good sources of fibre. Fruits were not a part of daily diet but they were eaten mostly when available locally and at the time of glut when cost was very low. Data indicated that milk was consumed as such or in other forms like butter, milk and curd. Overall milk intake was 24.78 per cent of RDI. The lower consumption may be due to lower family income and higher cost of milk and milk products and may be due the reason that milk is sold in the nearby dairies and a small amount is kept for their own consumption. Daily mean intake of fats and oils in children (7-9 years) was 33.40 per cent of RDI. Fats and oils are the concentrated source of energy and they reduce bulk in diet. No significant difference was observed in daily intake of fats and oil by the male

Table 4 : Mean daily nutrient intake of school children (7-9 years)				(n=100)
Nutrients	RDA	Mean daily nutrient intake	z value	Overall intake (% of RDA)
Energy (KCal)	1690	957.12±219.53	-33.38**	56.66
Protein (g)	41	38.52±10.07	-2.46**	93.95
Fat (g)	25	13.12±3.68	-32.28**	52.48
- carotene (ug)	4800	1678.4±1486.96	-20.99**	34.9
Vit. B ₁ (mg)	0.8	0.49±0.15	-20.66**	61.25
Vit. B ₂ (mg)	1.0	0.36±0.15	-42.66**	36.0
Vit. B ₃ (mg)	13.0	3.75±1.57	-61.66**	28.84
Vit. B ₁₂ (ug)	1.0	0.07±0.05	-186**	7.0
Folic acid (ug)	120	83.88±63.21	-5.71*	69.9
Vit. C (mg)	40	26.43±22.33	-6.08*	66.07
Iron (mg)	25	7.15±5.47	-33.05**	28.6
Calcium (mg)	400	289.12±134.26	-8.26**	72.28

Values are mean ± SD

RDA- Recommended Dietary Allowances (ICMR, 2008).

z-value shows comparison of nutrients intake with RDA.

n= Number of school children

* and ** indicate significance of value at P=0.05 and 0.01, respectively

and female respondents and their intake was significantly lower than RDI.

Nutrient intake :

Findings of the present study revealed that energy intake of school children significantly ($P \leq 0.01$) lower than its RDA (56.66 % of RDA). This energy gap was mainly due to lower energy density of their diet with inadequate intake of fats and oils, milk and milk products and roots and tubers. The data revealed that protein intake of the school children was adequate but significantly low than the RDA *i.e.* 38.52g (93.95%). The food habit was based on the staple food items without sufficient inclusion of protein sources or good nutritional sources such as animal food and dairy product. Iron intake of school children was significantly ($P \leq 0.01$) lower than its respective recommended level; because of lower consumption of green leafy vegetables and fruits by majority of children. The average intake of β - carotene, B- complex vitamins, folic acid and Vitamin C in study population was less as per recommendations. Lesser intake of fruits seemed to be the contributing factor. Mean intake of iron (28.6%), β -carotene (34.9%) was significantly lower than RDA. Low intake of these nutrients was due to inadequate intake of food stuff namely green leafy vegetable, other vegetable and fruits in their diet. Results revealed that socio-economic profile of children indicated majority of the respondents belonged to nuclear families. Higher

percentage of subjects was from small- sized families. Regarding monthly income, majority of the families belonged to lower income group. Data of food frequency showed that wheat was the staple food in the study area. Among pulses, consumption of green gram dal was common and frequent followed by black gram, bengal gram and red gram. Regarding green leafy vegetables, consumption of amaranthus, bathua, spinach, coriander, fenugreek leaves was found to be weekly. Onion and potato were observed to be consumed daily while carrot, radish, garlic were consumed alternately and weekly. Tomato and green chillies were found to be consumed frequently by the school going children. Consumption of fruits was found less frequent.

Hence it may be concluded that the consumption of foods like cereals, fruits, GLV's, milk and milk products, fats and oils, sugar and jaggery were inadequate in the diet of school children. Nutrients like energy, fat, β - carotene, B-complex vitamins, Vitamin C, Iron and Calcium 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. The findings of

Nutrients	Mean daily nutrient intake			z- value		Boys vs. girls z value
	RDA	Boys (n= 50)	Girls (n= 50)	Boys	Girls	
Energy (KCal)	1690	978.62 ± 202.45 (57.90)	935.61 ± 235.47 (55.36)	-24.84**	-22.65**	2.19
Protein (g)	41	39.08 ± 10.32 (95.31)	37.96 ± 9.75 (92.58)	-1.3**	-2.2**	0.9
Fat (g)	25	13.18 ± 3.87 (52.72)	13.06 ± 3.53 (52.24)	-21.88**	-24.36**	2.48
- carotene (ug)	4800	1628 ± 1255.44 (33.91)	1713.6 ± 1635.76 (35.7)	-25.26**	-18.86**	-6.4
Vit. B ₁ (mg)	0.8	0.51 ± 0.15 (63.75)	0.48 ± 0.16 (60)	-13.67**	-13.70**	0.03
Vit. B ₂ (mg)	1.0	0.39 ± 0.15 (39)	0.33 ± 0.13 (33)	-26.51**	-33.33**	6.82
Vit. B ₃ (mg)	13.0	3.78 ± 1.79 (29.07)	3.71 ± 1.33 (28.53)	-36.42**	-49.33**	12.91
Vit. B ₁₂ (ug)	1.0	0.08 ± 0.06 (8)	0.07 ± 0.03 (7)	-108.42**	-164.40**	55.98
Folic acid (ug)	120	93.16 ± 67.45 (77.63)	74.61 ± 57.86 (62.17)	-2.81**	-5.54**	2.73
Vit. C (mg)	40	30.98 ± 23.22 (77.45)	21.88 ± 20.63 (54.70)	-2.74**	-6.20**	3.46
Iron (mg)	25	7.90 ± 7.46 (31.60)	6.40 ± 1.95 (25.60)	-16.20**	-67.41**	51.21
Calcium (mg)	400	310.39 ± 142.86 (77.59)	267.85 ± 122.84 (66.96)	-4.43**	-7.60**	3.17

Values are Mean ± SD

RDA- Recommended Dietary Allowances (ICMR, 2008)

z value shows comparison of nutrients intake with RDA.

n= Number of school children

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Figures in parentheses indicate percentage.

the study will be useful for the policy makers for improving the functioning of Mid-day Meal Program running in the different districts of Uttarakhand and this will go a long way in overcoming nutrient deficiencies among school children.

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