

Research Paper :

Assessment of food consumption pattern and nutritional status of pre-school children

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ABSTRACT

The investigation was conducted to study the socio-economic profile and food consumption pattern of pre-school children of 3-5 years of age from rural areas of Yamunanagar district of Haryana State (India). Three hundred pre-school children were selected randomly. Information was collected on socio-economic profile, food frequency, mean daily food intake, nutrient intake and adequacy of food and nutrient intake of pre-school children. The data revealed that wheat, a staple food was consumed daily. Milk and milk products were found to be essential part of diet. The mean daily food and nutrient intake of preschool children were lower than RDA. Intake of cereals, green leafy vegetables, fruits, milk and milk products was found to be significantly higher ($P < 0.05$) in boys than girls. Intake of energy, iron, riboflavin and niacin was marginally inadequate in majority of preschool children. The adequacy of food and nutrient intake was also lower than the recommended values.

Key words : Food intake, Nutrient intake, Food adequacy, Nutrient adequacy.

Pre-school children form an important segment of population. This age is a dynamic period of physical growth and development along with mental, emotional and social changes. Since children play an important role in the development of nation, any investment for their development, therefore, is of national importance. Pre-school stage is the most critical period as it involves drastic changes among children and also because the foundation for life time health, strength and intellectual vitality is laid during this period. Pre-school age is one of the most vulnerable periods in the life of children due to easy susceptibility to malnutrition and infection (George *et al.*, 2000).

Preschoolers have very special nutritional needs because of their fast growth and development, which is dependent on the adequacy of diet consumed. Adequate food is the most important requisite for growth, while it is important throughout childhood, it is more crucial during first five years of life when rapid growth is occurring (Rana and Hussain, 2001). The stubborn persistence of child malnutrition in India is one of the tragedies of present time. One third of babies in India are born with low birth weight. This is heart breaking given the dramatic development in our agriculture, advances in literacy and great strides in economic growth (Das, 2002). The nutrition surveys conducted by the National Nutrition Monitoring Bureau (1994-96) and the National Institute of Nutrition (NIN) in 12 states of the country indicated that rural population was consuming inadequate diets, deficient in

most of the nutrients. It was further indicated that there was widespread energy deficiency in rural households. About 60 per cent of the preschool children were underweight and 62 per cent were stunted and about 15 per cent of children of 1-5 years of age suffered from short duration malnutrition (Vijayraghavan and Rao, 1998). The problem of malnutrition was more common in rural areas as compared to urban areas and undernutrition was more severe among female children than male children. Dietary intake of preschool children continues to be affected by economic and social factors. Even caste differential in nutritional status among preschoolers in rural Haryana has been reported. The present investigation was conducted to study the socio-economic profile and food consumption pattern of pre-school children of 3-5 years of age from rural areas of Yamunanagar district of Haryana State (India).

METHODOLOGY

For the present investigation, Yamunanagar district of Haryana State was selected purposively .

Selection of blocks and villages:

List of villages of Yamunanagar district was obtained from the Block Development Officers. Two blocks *viz.* Chachhroli and Bilaspur were taken randomly. Four villages namely, Bakarwala, Tibbi-Aryana, Sandhey and Kotda, were selected randomly from these blocks.

Selection of respondents :

For present study, 300 pre-school children (150 boys and 150 girls) in the age group of 3-5 years were drawn proportionately from the randomly selected four villages of Yamunanagar district.

A well structured detailed interview schedule was developed in accordance with the methodological procedure keeping in view the objectives of the investigation. The data were collected with the help of interview schedule by paying repeated visits to the study areas. Initially, friendly situation was built up so as to develop efficient rapport with the mothers of the respondents. The information was collected about socio-economic profile of respondents.

Dietary assessment :

Information regarding the intake of food for three consecutive days was collected from the respondents using 24 hour recall method as used by National Nutrition Monitoring Bureau (NNMB,1980). Katories, spoons and glasses of standard size were shown to the mothers of subjects to help them in estimating the exact amount of food consumed by the preschool children. Cooked food consumed was converted into their raw equivalents. The mean daily food intake was calculated by taking the mean intake of three days. Average intake of respondents was compared with Recommended Dietary Allowance (RDA) of Indian Council of Medical Research (ICMR, 1980). Nutrients, namely energy, protein, thiamine, riboflavin, niacin, vitamin B₁₂, folic acid, vitamin C, iron and calcium were calculated using food composition table of ICMR (1980). Nutrient intake of three consecutive days was added, mean was taken out and was compared with RDA (ICMR,1980).

Food Adequacy Ratio (FAR) and Nutrient Adequacy Ratio (NAR):

The average daily food intake and nutrient intake were compared with the RDI and RDA (ICMR, 1980), respectively.

Statistical analysis of data :

The data were analyzed with the help of percentage, mean and standard deviation and z-test (Panse and Sukhatme, 1961).

FINDINGS AND DISCUSSION

The results obtained from the present investigation are presented below:

Socio-personal and economic profile of respondents:

Socio-personal and economic profile of the preschool

children is presented in Table1. Out of total 300 subjects surveyed, 150 were male and 150 were female and majority of the subjects (46.60%) belonged to lower caste and remaining 41.70 per cent and 11.7 per cent belonged to middle and high caste, respectively. Majority (66.30%) of the families were living in pucca type of houses. Majority of the subjects (65.40%) were from joint families and remaining (34.60%) were from nuclear families. Majority of the subjects (63.30%) were from middle size families and remaining 28.30 per cent and 8.40 per cent were from large and small size families, respectively. The mothers of 50.60 per cent of the respondents were illiterate and remaining were educated upto Primary level (13.30%), Middle level (17.30%), High School level

Table 1: Socio-economic profile of school children

		N=300	Percentage
Sex	Male	150	50.00
	Female	150	50.00
Type of family	Nuclear	104	34.60
	Joint	196	65.40
Size of family	Small (upto 4 member)	25	8.40
	Medium (5-8 member)	190	63.30
	Large (9 and above)	85	28.30
Caste	Lower	140	46.60
	Middle	125	41.70
	High	35	11.70
Type of house	Kaccha	16	5.40
	Pucca	199	66.30
	Partial pucca	85	28.30
Mother's education	Illiterate	152	50.60
	Primary	40	13.30
	Middle	52	17.30
	High School	43	14.40
	Graduate and above	13	4.40
Father's education	Illiterate	52	17.30
	Primary	34	11.40
	Middle	70	23.40
	High School	106	35.30
	Graduate and above	38	12.60
Mother's working status	Non-wage earner	178	59.40
	Non-wage earner +	122	40.60
Father's occupation	Farming		
	Labour	79	26.40
	Caste occupation	29	9.60
	Business	41	13.60
	Farming	116	38.70
	Service	35	11.70
	Land holding	Landless	85
Up to 5 acres	153	51.00	
More than 5 acres	62	20.60	

(14.40%) and Graduate and above (4.40%).

Data on education of respondents' fathers showed that majority of them (35.30%) were educated upto High School level and remaining were illiterate (17.30%), educated upto Primary level (11.40%), upto Middle level (23.40%) and Graduate and above (12.60%). Most of the respondents' fathers (38.70%) were engaged in farming and remaining were labourers (26.40%), were doing caste related occupations (9.60%), were engaged in business (13.60%) and 11.70 per cent were serviceman. Mothers of 59.40 per cent of the subjects were house wives (non-wages earners) and 40.60 per cent were working mothers. Forty five per cent of the respondents were from low income group and 31.7 per cent and 22.7 per cent were from middle and high income group, respectively. Fifty one per cent of the families were having land upto 5 acres and rest 28.4 per cent and 20.6 per cent were landless and having land more than 5 acres, respectively.

Food intake:

Mean daily intake of pre-school children is presented in Table 2. Daily mean cereal intake of boys and girls was 145.70 g and 141.18 g and was significantly ($P < 0.05$) lower than the RDA. It was observed that daily mean intake of cereals of boys was significantly ($P < 0.05$) higher than that of girls. Among cereals, wheat was the staple food in their diets. Similarly, fewer intakes of cereals by preschool children had been reported by Dannhauser *et al.* (2000) and Lakshmi *et al.* (2001). Gibson (2000) reported adequate intake of cereals by pre-school children.

The mean daily intake of pulses by boys and girls was 35 and 33.2 per cent of RDA and was significantly ($P < 0.05$) lower than RDA. The average daily consumption of pulses was found to be higher in boys than the girls. The reason for the low intake of pulses was their high price and less frequency of their inclusion in diet *i.e.* on

alternately and weekly basis. The less intake of pulses by preschool children had been reported by Lakshmi *et al.* (2001) and Laxmaiah *et al.* (2002).

The average daily consumption of GLV was 19.27 and 17.95 g by boys and girls, respectively and was significantly ($P \leq 0.05$) lower than RDI in both the cases. However, the daily mean intake of GLV was significantly ($P \leq 0.05$) higher in boys than the girls. The reason for low consumption was unawareness about the importance of GLV in diet and improper purchasing practices. Various researchers (Agrawal *et al.*, 1999, Khosla *et al.*, 2000 and Lakshmi *et al.*, 2001) had also reported inadequate intake of green leafy vegetables, in previous studies.

The daily mean intake of roots and tubers and other vegetables was 87.22 and 85.87 g by boys and girls, it was 58.14 per cent and 57.24 per cent of RDA, respectively and also significantly ($P \leq 0.05$) lower than RDI. Boys were consuming significantly ($P \leq 0.05$) higher amount of roots and tubers and other vegetables than girls. The low intake of roots and tubers was also reported by Leamen and Evers (1997) and Khosla *et al.* (2000) and Golder *et al.* (2001).

The average daily consumption of fruits was 65.27 and 62.94 g by boys and girls which was significantly ($P \leq 0.05$) lower than the RDI. The average daily consumption of fruits was found to be significantly ($P \leq 0.05$) higher among boys than girls. The reasons for the lower consumption of fruits was high price. Faber *et al.* (1999) and Golder *et al.* (2001) had also reported low intake of fruits in the diets of pre-school children.

The average daily consumption of milk by boys and girls was 416.05 ml and 376.54 ml, respectively. The milk intake was significantly ($P \leq 0.05$) lower than the RDA. The mean daily intake of milk was found to be significantly ($P \leq 0.05$) higher in boys than girls. Lakshmi *et al.* (2001) also reported low intake of milk and milk products than RDA by pre-school children.

Table 2 : Mean daily food intake of pre-school children

Food group (gm)	RDA	Boys (n=150)	Girls (n=150)	Z ₁ (boys)	Z ₂ (girls)	Z-value
Cereals	210	145.70±44.43 (69.38)	141.18±15.78 (67.22)	16.50*	18.26*	0.86*
Pulses	45	15.75±12.58 (35.00)	14.94±08.69 (33.20)	18.30*	25.65*	0.25*
Green leafy vegetables	50	19.27 ±10.25 (38.54)	17.95±09.28 (35.90)	02.82*	3.25*	1.40*
Roots and tubers and other vegetables	150	87.22±21.28 (58.14)	85.87±21.38 (57.24)	9.31*	10.71*	0.30*
Fruits	100	65.27 ±15.36 (65.27)	62.94±26.11 (62.94)	6.54*	7.84*	1.15*
Milk and milk products	500	416.05±145.62 (83.21)	376.54±132.85 (75.30)	12.05*	12.41*	0.42*
Fats and oils	25	17.00±05.05 (68.00)	15.90±06.21 (63.60)	18.68*	19.36*	0.40*
Sugar and Jaggery	30	14.45±07.61 (48.16)	14.03±07.89 (46.76)	22.85*	32.60*	0.07*

Values are mean + S.D.

Figures in parentheses indicate per cent RDA

Z-values indicate comparison of intake and RDA

RDA- Recommended Dietary Allowance ICMR(1989)

Z₁ and Z₂-show comparison of intake and RDA

* indicates significance of value at P = 0.05

The mean daily intake of fats and oil by boys and girls was found to be 17.00 and 15.90 g which was significantly ($P \leq 0.05$) lower than RDI. It was observed that boys were consuming significantly ($P \leq 0.05$) higher amount than girls. The reasons for the lower consumption were high price hence their lower availability. Vijayaraghavan and Rao (1998) and Golder *et al.* (2001) also reported low intake of fats and oils by pre-school children. Denninson *et al.* (1998) reported higher intake of fats and oils by preschool children. The daily mean intake of sugar and jaggery was 48.16 per cent and 46.76 per cent of RDI which was significantly ($P < 0.05$) lower than RDI.

Nutrient intake:

Mean nutrient intake of pre-school children of Yamunanagar district is given in Table 3. The daily mean intake of energy by boys and girls was found to be 1218.14 Kcal and 1173.50 Kcal which was 72.07 per cent and 69.43 per cent of RDA, respectively and was significantly ($P \leq 0.05$) lower than RDA. It was found that mean energy intake of boys was significantly ($P \leq 0.05$) higher than the girls. Inadequate intake of energy by preschool children was also reported by previous workers (Vijayaraghavan and Rao 1998; Dannhauser, 2000 and Rana and Hussain 2001). The daily mean intake of protein of boys and girls was 27.47g and 26.65 g, respectively and was significantly ($P \leq 0.05$) lower than the RDA. It was observed that boys were consuming significantly ($P \leq 0.05$) higher amount of protein than girls. Inadequate intake of protein by preschool children was reported by Agrawal (1999), Vijayaraghavan and Rao (1998) and Rana and Hussain (2001). The daily mean intake of calcium was found to be 410.50 mg and 399.00 mg among boys

and girls, respectively. The boys were consuming significantly ($P \leq 0.05$) higher amount of calcium than girls, which might be because of consumption of more amount of milk and milk products than girls. The higher intake of calcium has also been reported by Vijayaraghavan and Rao (1998). On the contrary, lower intake of calcium was reported by Dannhauser (2000). The mean daily intake of iron was found to be 9.37 mg (boys) and 8.60 mg (girls) which was significantly lower than RDA. Less intake of iron may be due to less consumption of green leafy vegetables. Inadequate intake of iron among preschool children was reported by Golder *et al.* (2001) and Rana and Hussain (2001) too. The mean daily intake of \hat{a} carotene was 81.12 per cent and 79.50 per cent of RDA among boys and girls, respectively Dannhauser (2000) and Khosla *et al.* (2000) had also reported lower intake of \hat{a} carotene by children.

The mean daily thiamine intake of boys (98.80% of RDA) and girls (90.99% of RDA) was quite close to RDA values. It was found that boys were consuming slightly higher amount of thiamine than girls. The higher intake of thiamine might be due to consumption of whole cereals and pulses. The per cent mean daily intake of riboflavin and niacin was significantly ($P \leq 0.05$) lower than the RDA among both boys and girls. Khosla *et al.* (2000) and Dannhauser (2000), had also reported lower intakes of thiamine, riboflavin and niacin among preschoolers.

Boys and girls were consuming 0.48 μ g and 0.44 μ g of vit. B₁₂ daily, respectively which was significantly ($P \leq 0.05$) lower than RDA. Vitamin C intake was 65.37 and 59.62 per cent of RDA in the daily diets of boys and girls, respectively. Dannhauser *et al.* (2000) also reported low intake of vitamin C by pre-school children. The mean daily intake of folic acid by pre-school children was

Table 3 : Mean daily nutrient intake of pre-school children

Nutrient	RDA	Boys (n=150)	Girls (n=150)	Z ₁ (Boys)	Z ₂ (Girls)	Z- value
Energy (Kcal)	1690	1218.14±78.93 (72.07)	1173.50±63.72 (69.43)	25.82*	31.40*	2.75*
Protein (g)	30	27.47±8.55 (91.56)	26.65±7.51 (88.80)	09.42*	07.22*	2.40*
Calcium (mg)	400	410.50 ±74.30 (102.62)	399.00±17.20 (99.75)	01.50*	04.50*	2.06*
Iron (mg)	18	9.37±1.76 (52.05)	8.60±1.66 (47.70)	63.42*	71.50*	1.50*
-carotene (ug)	1600	1298.01±30.16 (81.12)	1272.09±29.29 (79.50)	09.86*	10.86*	2.01*
Thiamine (mg)	0.9	0.89±0.17 (98.80)	0.81±0.15 (90.99)	12.12*	10.32*	0.29*
Riboflavin (mg)	1.0	0.69±0.19 (69.00)	0.66±0.18 (66.00)	21.45*	20.82*	2.89*
Niacin (mg)	11	6.93±01.29 (63.00)	6.69±01.32 (60.08)	43.12*	41.24*	2.13*
Vitamin B ₁₂ (ug)	0.2-1	0.48±0.29 (48.00)	0.44±0.25 (44.00)	21.49*	21.82*	2.95*
Vitamin C (mg)	40	26.15±12.02 (65.37)	23.84±11.15 (59.62)	07.05*	09.12*	1.17*
Folic acid (ug)	40	52.19±12.80 (130.47)	51.96±13.82 (129.87)	03.47*	04.67*	2.08*

Values are mean+ S.D.

Figures in parentheses indicate per cent RDA

RDA- Recommended Dietary Allowance ICMR (1989)

* indicates significance of value at P = 0.05

significantly ($P \leq 0.05$) higher than the RDA and this was in agreement with the findings of Bamji and Thimayamma (2000).

Adequacy level of food intake of the preschoolers :

The data revealed that the cereal consumption by 12.6 per cent of boys and 8.7 per cent of girls was adequate while 25.4 per cent of boys and 16 per cent of girls were having marginally adequate consumption of cereals (Table 4). Forty eight per cent of boys and 52.6 per cent of girls were consuming marginally inadequate amount of cereals in their diets. Substantially inadequate intake of cereals was observed in diets of 13.4 per cent and 22.6 per cent of boys and girls, respectively. The adequate intake of cereals by children was reported by Yadav and Singh (1999) too. Majority *i.e.* 73.4 per cent of boys and 77.3 per cent of girls were consuming substantially inadequate amount of pulses. Low consumption of pulses has earlier been reported by Yadav and Singh (1999) and Lakshmi *et al.* (2001).

Majority of the respondents, 88 per cent of the boys and 94.6 per cent of girls were consuming substantially inadequate amount of GLV. Similarly, majority of the respondents (87.3% boys and 95.3% girls) were taking substantially inadequate amount of roots and tubers and other vegetables. Only eighteen per cent of boys and 5.3 per cent of girls were having marginally adequate consumption of fruits. Majority of the respondents, 64.6 per cent of boys and 79.3 per cent of girls were consuming substantially inadequate amount of fruits. Low intake of roots and tubers and other vegetables has earlier been reported by Golder *et al.* (2001). Adequate consumption of milk and milk products was found among 51.4 and 39.4 per cent of boys and girls, respectively. Higher intake of milk and milk products has also been reported by Vijayaraghavan and Rao (1998).

Twenty six per cent and 28.7 per cent of boys and girls were having marginally adequate consumption of fats and oils. Majority of the respondents, 66.6 per cent of boys and 70.6 per cent of girls were consuming substantially inadequate amount of sugar and jaggery. Less intake fats and oils and of sugar and jaggery was earlier reported by Yadav and Singh (1999) and Golder *et al.* (2001).

Adequacy level of nutrient intake by the pre-schoolers:

Fifty seven per cent of boys and 50 per cent of girls were consuming marginally inadequate amount of energy. Inadequate intake of energy by pre-school children has been reported earlier by various workers (Vijayaraghavan and Rao, 1998; Dannhauser *et al.* 2000 and Rana and

Table 4 : Adequacy level of food intake of the pre-schoolers

Respondents	Cereals				Pulses				Green leafy vegetables				Roots and tubers and other vegetables			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Boys n=150	19 (12.6)	38 (25.4)	73 (48.6)	20 (13.4)	5 (3.3)	11 (7.3)	24 (16.00)	110 (73.4)	2 (1.4)	6 (4.0)	10 (6.6)	132 (88.0)	1 (0.7)	3 (2.0)	15 (10.0)	131 (87.3)
Girls n=150	13 (8.7)	24 (16.0)	79 (52.6)	34 (22.7)	6 (4.0)	8 (5.4)	20 (13.3)	116 (77.3)	0 (0.0)	2 (1.4)	6 (4.00)	142 (94.6)	0 (0.0)	2 (1.4)	5 (3.3)	143 (95.3)
Respondents	Fruits				Milk and milk products				Fats and oils				Sugar and jaggery			
Boys n=150	8 (5.4)	27 (18.0)	18 (12.0)	97 (64.6)	77 (51.4)	61 (40.6)	9 (6.0)	3 (2.0)	13 (8.6)	35 (26.0)	89 (59.4)	9 (6.0)	0 (0.0)	2 (1.4)	48 (32.0)	100 (66.6)
Girls n=150	2 (1.4)	8 (5.3)	21 (14.0)	119 (79.3)	59 (39.4)	43 (28.6)	40 (26.6)	8 (5.4)	16 (10.7)	43 (28.7)	84 (56.0)	7 (4.6)	0 (0.0)	2 (1.4)	42 (28.0)	106 (70.6)

Values in parentheses indicate percentage

I. 100 % and above (adequate)

III. 50-74.9 % of RDA (marginally inadequate)

II. 75 to 99.9% of RDA (marginally adequate)

IV. Below 50 % of RDA (substantially inadequate)

Hussain, 2001). Protein intake of 39.3 per cent of boys and 31.3 per cent of girls was found to be adequate (Table 5).

It was observed that 46 per cent of boys and 36 per cent of girls had adequate intake of calcium. Higher calcium intake was reported by Vijayaraghavan and Rao (1998). The data revealed that 55 per cent of boys and 46 per cent of girls consumed marginally inadequate amount of iron while 38 per cent of boys and 48 per cent of girls were consuming substantially inadequate amount of iron. Similarly, lower intake of iron has earlier been reported by Khosla *et al.* (2000). Adequate intake of α -carotene was observed in 44.6 and 35.3 per cent of boys and girls, respectively. Adequate intake of β -carotene has been reported by Bamji and Thimmayamma (2000). Adequate intake of thiamine was found among 46 and 35.3 per cent of boys and girls, respectively. Majority of the respondents (52.60% boys and 60.60% girls) were consuming marginally inadequate amount of riboflavin.

Forty one per cent of boys and 43.00 per cent of girls consumed marginally inadequate amount of niacin. Similarly, lower intake of riboflavin and niacin has earlier been reported by Dannhauser *et al.* (2000). Thirty eight per cent of boys and 32.6 per cent of girls were consuming adequate amount of vitamin B₁₂. Vitamin C intake among 20.6 per cent of boys and 12 per cent of girls was observed marginally adequate. Intake of folic acid among 54.6 per cent of boys and 51.3 per cent of girls was found to be adequate and remaining respondents were having marginally adequate intake of this vitamin. These findings are in agreement with those of Bamji and Thimayamma (2000).

Conclusion :

It can be concluded that diets of the preschool children were deficient in almost all the nutrients except calcium and folic acid. The intake of food and nutrients was significantly (P<0.05) higher in boys than girls. There is an urgent need to impart nutrition education to mothers of preschool children so that they can provide balanced diet to their children and improve their nutritional status

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Table 5: Adequacy level of nutrient intake of the preschoolers

Respondents	Energy				Protein				Calcium				Iron			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Boys n=150	12 (8.0)	37 (24.7)	85 (57.00)	16 (10.00)	59 (39.3)	91 (60.6)	0 (0.00)	0 (0.00)	69 (45.0)	79 (52.60)	2 (1.4)	0 (0.00)	2 (1.4)	8 (5.4)	82 (54.6)	58 (38.6)
Girls n=150	9 (6.0)	28 (18.7)	75 (50.00)	38 (25.00)	47 (31.3)	95 (63.3)	8 (5.4)	0 (0.00)	54 (35.0)	91 (60.6)	5 (3.4)	0 (0.00)	1 (0.6)	8 (5.4)	69 (46.0)	72 (48.0)
Respondents	β Carotene				Thiamine				Riboflavin				Niacin			
Boys n=150	67 (44.6)	55 (36.6)	10 (6.7)	18 (12.0)	69 (46.0)	61 (40.6)	16 (11.0)	4 (2.7)	17 (11.3)	32 (21.3)	79 (53)	22 (15.00)	14 (9.3)	35 (23.3)	62 (41.3)	39 (26.00)
Girls n=150	53 (35.3)	58 (38.6)	32 (21.4)	7 (4.6)	53 (35.3)	57 (38.0)	30 (20.00)	10 (7.00)	8 (5.4)	24 (16.0)	90 (60.0)	28 (18.6)	12 (8.0)	26 (11.3)	65 (43.00)	47 (31.3)
Respondents	Vitamin B₁₂				Vitamin C				Folic acid							
Boys n=150	58 (38.6)	83 (55.3)	2 (1.3)	7 (4.6)	17 (11.3)	31 (20.6)	30 (20.00)	72 (48.0)	82 (54.6)	68 (45.3)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Girls n=150	4 (3.76)	83 (55.3)	9 (6.0)	9 (6.0)	7 (4.6)	18 (12.0)	43 (29.0)	82 (54.6)	77 (51.3)	73 (48.6)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

Values in parentheses indicate percentage

I. 100 % and above (adequate)

III. 50-74.9 % of RDA (marginally inadequate)

II. 75 to 99.9% of RDA (marginally adequate)

IV. Below 50 % of RDA (substantially inadequate)

REFERENCES

- Agrawal, K.**, Kushwah, A., Kushwah, H.S., Agrawal, R. and Rajput, L.P. (1999). Dietary analysis and assessment of nutritional status of pre-school children of urban and rural population. *Indian J. Nutr. Dietet.*, **38**: 231-235.
- Bamji, M.S.** and Thimayamma, B.V.S. (2000). Impact of women's work on maternal and child nutrition. *Ecol. Food Nutr.*, **39**(1): 13-31, 20.
- Dannhauser, A.**, Bester, C.J., Joubert, G., Badenhorst, P.N., Slabber, M., Badenhorst, A.M., Toit, E. Du, Barnard, H.C., Botha, P. and Nogabe, L. (2000). Nutritional status of pre-school children in informal settlement areas near Bloemfontein, South Africa. *Pub. Health Nutr.*, **3**: 303-312.
- Das, G.** (2002). A South Asian Puzzle. *Times of India*, New Delhi. p 6. 28 July, 2002.
- Dennison, B.A.**; Rockwell, H.L. and Baker, S.L. (1998). Fruit and vegetable intake in young children of USA. *J. American Clin. Nutr.* **17**(4): 371-378.
- Faber, M.**, Smuts, C.M. and Benade, A.J.S. (1999). Dietary intake of primary school children in relation to food production in a rural area in KwaZul-Natal, South Africa. *Internat. J. Food Sci. Nutr.*, **50**(1): 57-64.
- George, K.A.**, Kumar, N.S., Lal, J.J. and Sreedevi, R. (2000). Anemia and nutritional status of pre-school children in Kerala. *Indian J. Pediatr.*, **67**(8): 575-578.
- Gibson, S.A.** (2000). Iron status of pre-school children aged 1.5 to 4.5 years : Association with breakfast cereals, Vit. C and meat. *Proc. Nutr. Soc.*, **59**: 49A.
- Golder, A.M.**, Erhardt, J.G., Scherhaum, U., Mohammad, S., Biesalski, H.K. and Furst, P. (2001). Dietary intake and nutritional status of women and preschool children in the Republic of the Maldives. *Pub. Hlth. Nutr.*, **4**(3): 773-780.
- ICMR** (1980). Nutrient requirement and recommended dietary allowances for Indians. Indian Council of Medical Research, New Delhi.
- Khosla, S.**, Singh, I. and Sangha, J. (2000). A study of nutritional profile of preschool children living in urban slums of Ludhiana city. *J. Res. Punjab agric. Univ.*, **37**(1-2): 124-132.
- Lakshmi, J.A.**, Begum, K., Saraswathi, G. and Prakash, J. (2001). Prevalence of anaemia in Indian rural preschool children : Analysis of associative factors. *Indian J. Nut. Diet.* **38**: 182-190.
- Laxmaiah, A.**, Rao, K.M., Brahmam, G. N.V., Sharad Kumar, Ravindranath, M., Kashinath, K., Radhaiah, G., Rao, D.H., Vijayraghavan, K. and Kumar, S. (2002). Diet and nutritional status of rural preschool children in Punjab. *Indian Pediatr.*, **39**(4): 331-338.
- Leaman, M.** and Evers, S. (1997). Dietary intake by food groups of pre-school children in low income communities in Ontario. *J. Canadian Dietet. Assoc.*, **58**(4): 184-191.
- National Nutrition Monitoring Bureau (NNMB)** 1980. Dietary surveys and Methods. NIN, Hyderabad, India.
- Panse, V.G.** and Sukhatme, P.V. (1961). Statistical Methods of Agricultural Workers. 2nd Ed. Indian Council of Agricultural Research, New Delhi.
- Rana, K.** and Hussain, M. (2001). Body weight status of pre-school children belonging to high income group in relation to nutrient intake. *Indian J. Nutr. Pediatr.*, **38**: 236-241.
- Vijayaraghavan, K.** and Rao, D.H. (1998). Diet and nutrition situation in rural India. *Indian J. Med. Res.*, **108**: 243-253.
- Yadav, R.J.** and Singh, P. (1999). Nutritional status and dietary intake in tribal children of Bihar. *Indian Pediatr.*, **36**(1): 37-42

