

## A Study on Nutrient Adequacy in Pre-school Children of Women Migrant Laborers in Ludhiana City

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**ABSTRACT** One hundred and twenty children in the age group of 3-6 years of women migrant laborers that are domestic and construction laborers were selected from Ludhiana city by random sampling. The information regarding the quantities of foods consumed was collected from the mothers of the subjects by a 24-hour recall method. The daily mean intake of cereals and pulses was ninety-five and ninety-one percent of the suggested dietary intake, respectively. The daily mean intake of milk and milk products was thirteen percent and that of fruits and vegetables varies from eighteen to twenty-nine percent of the suggested amount indicating poor intake. The nutrient intake in all selected preschool children was found to be inadequate except protein intake and vitamin B<sub>12</sub> intake. The study concluded that the food and nutrient intake of children of both domestic and construction women laborers was inadequate. The study recommends that the mothers should be educated about appropriate feeding practices and selection of right foods for their children in order to achieve optimum health for them in their limited resources.

### INTRODUCTION

Children are the future of a country and precious resources for sustainable development of the human society. One out of every three children less than five years of age in developing countries is malnourished. It is a major drain on developing countries' prospects for development because malnourished children require more intense care from their parents and are less physically and intellectually productive as adults (Nandy and Miranda 2008). According to reports from the World Health Organization, thirty-five percent of global under-five child mortality can be attributable to malnutrition. The mortality risks of children with acute and serious malnutrition are nine times higher than the mortality risks of children without malnutrition (Chen 2009).

Malnutrition is the greatest threat to global public health. It has estimated that 178 million children are malnourished around the world, whereas forty percent children are found under nourished and among them 6.4 percent are estimated severely malnourished in India (Ghatge 2012). Childhood under-nutrition is a major global health problem, especially in developing countries like India. It leads to increased mor-

bidity and mortality among children. Apart from malnutrition, children in India usually suffer from other deficiency diseases and sometimes face death due to some specific diseases. The importance of nutrition during preschool years has recently been realized all over the world (Ahmed 2012).

Children are particularly vulnerable to micronutrient deficiencies owing to their high nutrient requirements for growth and susceptibility to infectious diseases such as diarrhea and respiratory infections, which can inhibit nutrient absorption and decrease appetite. The nutrient density of the diet given to young children is often insufficient to meet their nutrient requirements and increasing the diversity of foods provided to young children particularly meat, poultry, fish, eggs, fruits and vegetables is recommended to improve micronutrient intakes (Steyn et al. 2006).

Migration is the movement of human beings usually from rural to urban areas and to rich states in pursuit of better employment, better wages and better quality of life. In majority of cases, the members of the family including children accompany the migrants. The meager earnings of adult men labor were insufficient even for the survival of the family, forcing the female members and children to work (Goyal 2011). Migration is a universal phenomenon and can be de-

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defined as a permanent or semi-permanent shift of residence across administrative boundaries from an area, which have low job opportunities to the areas, which have better job opportunities (Chand 2002). Children of migrants often lose basic entitlements, miss school and are subject to health and security risks. Limited access of migrants to *anganwadis*, public distribution services and public health services has a negative impact on the health of their children.

Provision of good health and health services for workers in unorganized sectors is a big challenge for the healthcare providers and policymakers. Children of workers in the construction industry have special needs for growth and development, which are not met because of poor access to the basic health facilities and life amenities due to the temporary nature of stay of their parents at the construction sites (Yu et al. 2009; Nuzhat and Patil 2010). The approach of evaluating total diet quality is receiving increasing attention. Therefore, the study was carried out to determine the nutritional adequacy among children of migrant laborers with the following objectives:

1. To assess the food and nutrient intake of preschool children.
2. To determine the food and nutrient adequacy using suggested dietary intake and recommended dietary allowances.

### MATERIAL AND METHODS

One hundred and twenty children of women migrant laborers (domestic and construction laborers) in the age group of 3-6 years were selected from Ludhiana city by random sampling. The children were divided into three age groups of 3 to 4, 4 to 5 and 5 to 6 years. Information regarding the food consumption was collected from the mothers of the subjects by using a 24-hour recall method for three consecutive days. The average daily nutrient intake was calculated using Diet Cal, a computer software (Kaur 2014). The food and nutrient intake was compared with suggested dietary intakes for Indians and recommended dietary allowances (ICMR 2010), respectively. In order to determine the nutrient adequacy of diet, the nutrient adequacy ratios (NAR) were calculated for energy and protein along with micronutrients ( $\beta$ -carotene, vitamin C, folate, iron and calcium). The NAR was calculated using the following formula:

$$\text{NAR (\%)} = (\text{Intake of nutrient} / \text{Recommended intake of nutrient}) \times 100$$

Nutrient adequacy ratios (NAR%) were categorized as per Jood et al. (1999) as,

- ♦ Adequate: 100% and above
- ♦ Marginally adequate: 75% to 99.9%
- ♦ Marginally inadequate: 50% to 74.9%
- ♦ Inadequate: below 50%

Mean and standard deviation for various parameters were computed.

## RESULTS AND DISCUSSION

### General Information

According to the data collected from the survey, all the selected families of the preschool children were nuclear in case of both domestic and construction laborers. Further information regarding the composition of family revealed that majority (60%) of the families were medium sized (5 to 8 members) and forty percent were small sized (up to 4 members). Maximum families (55%) were in the income category of INR 10,000 to 15,000 followed by thirty-four percent falling under the income category of INR 5,000 to 10,000 per month.

The distribution of children according to their age revealed that among the preschool children from selected families, thirty-eight percent fall in the age group of 5 to 6 years, thirty-three percent in the 3 to 4 years and remaining twenty-nine percent in the age group of 4 to 5 years. Among them sixty-five percent were male and fifty-five percent were female. The collected data showed that thirty-three percent were having second birth order, twenty-eight percent were first in place, and twenty-six percent were at third place while thirteen percent were having birth order of above 3. Study further revealed that seventy-six percent of the preschool children were non-vegetarian, eighteen percent were vegetarian and only six percent were ovatarian. No supplements were provided to children. Majority of the mothers of the selected children were illiterate, that is seventy-five percent whereas seventeen percent and eight percent of the mothers completed their primary and middle school, respectively.

### Food Intake

The average daily food intake and its percent adequacy have been presented in Table 1

**Table 1: Average food intake by children of 3-6 years**

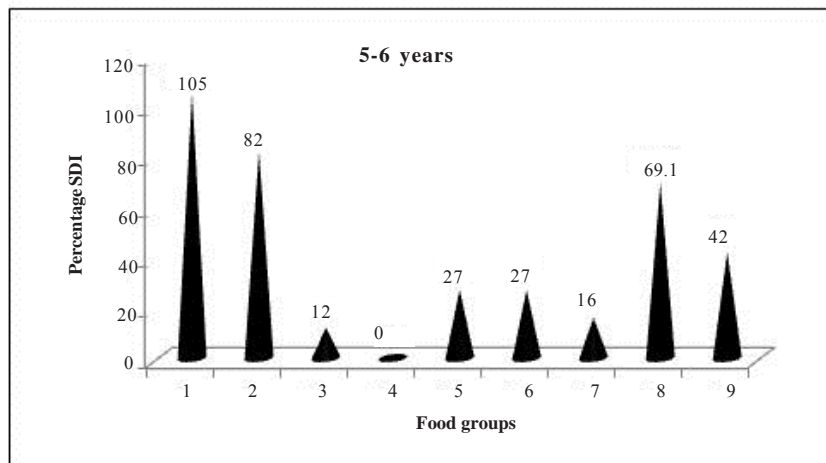
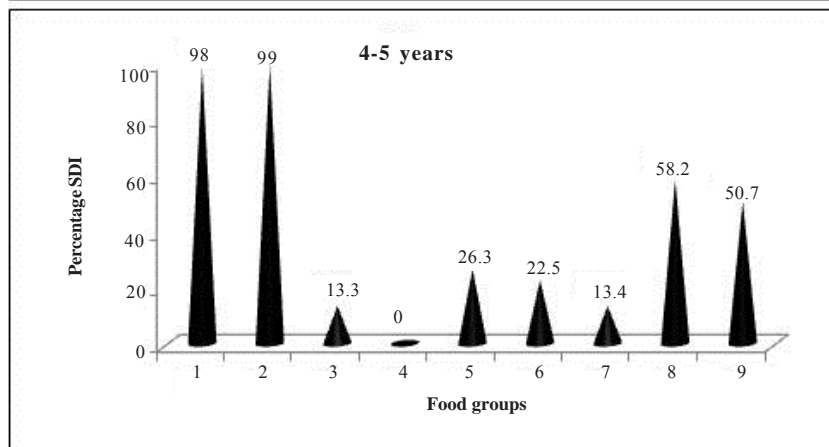
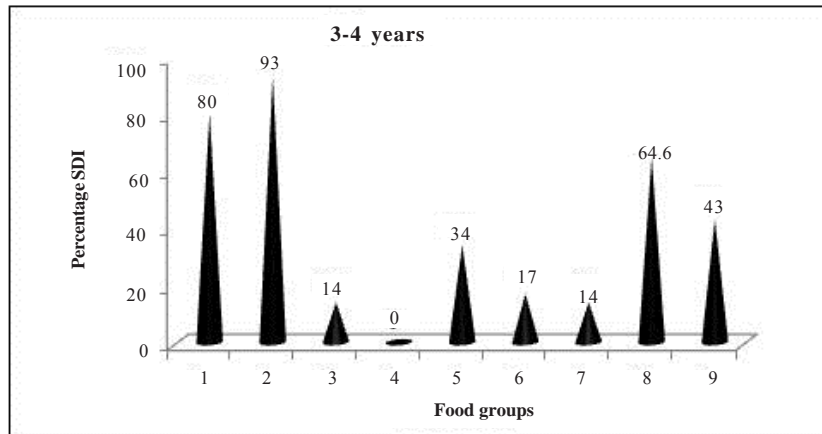
Food groups (g)	Age group			SDI*	Overall (3-6years) (n = 120)
	3-4 years (n = 39)	4-5 years (n = 35)	5-6 years (n = 46)		
<i>Cereals</i>					
Range	40-160	50-180	80 - 180	120	40 - 180
Mean±SD	95.89 ± 34.74	118.14 ± 31.81	125.87 ± 27.55		113.88 ± 33.12
<i>Pulses and Legumes</i>					
Range	10 - 45	10 - 60	10 - 60	30	10 - 60
Mean±SD	27.95 ± 26.79	29.71 ± 12.36	24.67 ± 9.04		27.21 ± 17.26
<i>Milk and Milk Products</i>					
Range	10 -100	25-100	50 - 100	500	10 - 100
Mean±SD	67.82 ± 30.37	66.43 ± 29.22	59.24 ± 20.46		64.13 ± 26.64
<i>Green Leafy Vegetables</i>					
Range	-	-	-	-	-
<i>Roots and Tubers</i>					
Range	10-110	6 - 40	10 - 45	100	6 - 110
Mean±SD	33.97 ± 19.87	26.33 ± 10.12	26.96 ± 12.43		29.0 ± 15.0
<i>Other Vegetables</i>					
Range	10 - 70	10 - 95	10 - 100	100	10 - 100
Mean±SD	16.9 ± 15.5	22.5 ± 19.4	26.6 ± 20.3		17.56 ± 18.87
<i>Fruits</i>					
Range	0 - 80	0 - 65	0 - 85	100	0 - 85
Mean±SD	14.4 ± 16.6	13.4 ± 23.1	16.2 ± 14.4		21.06 ± 25.99
<i>Fats and Oils</i>					
Range	10 - 25	7 - 20	10 - 30	25	7 - 30
Mean±SD	16.15 ± 9.07	14.54 ± 3.72	17.28 ± 8.67		16.12 ± 7.74
<i>Sugar and Jaggery</i>					
Range	5 - 25	5 - 25	5 - 25	20	5 - 25
Mean±SD	8.51 ± 4.77	10.14 ± 5.62	8.48 ± 5.36		8.97 ± 5.24

\*Suggested Dietary Intake (SDI) by ICMR (2010)

and Figure 1. The daily intake of cereals and pulses by the preschool children ranged from 40g to 180g and 10g to 60g, respectively. The mean consumption of cereals among the preschool children of 3 to 4, 4 to 5 and 5 to 6 years was 95.89g, 118.14g and 125.87g with mean adequacy of eighty, ninety-eight and one hundred and give percent, respectively. The corresponding values for pulses and legumes were 27.95, 29.71 and 24.67, with percent adequacy of ninety-three, ninety-nine and eighty-two percent, respectively. The mean intake of cereals was less in group of 3 to 4 and 4 to 5 years children, whereas pulses and legumes was found to be less in all three age groups when compared to suggested value of 120g and 30g. Manu and Khetarpaul (2006) and Kulsum et al. (2008) reported low intake of cereals in age group of 4 to 5-year-old children when compared with the suggested intake. Bathla (2012) reported adequate intake of pulses only in 3 to 4 years age group while in 4 to 6 years age group, intake of pulses was inadequate.

The daily consumption of milk and milk products ranged from 10g to 100g with the mean values of 67.8g, 66.4g and 59.2g in age group of 3 to 4, 4 to 5 and 5 to 6 years, respectively. The results revealed that the daily consumption of milk and milk products was inadequate in all three age groups, the adequacy being fourteen, thirteen and twelve percent, respectively. Inadequate consumption of milk and milk products could be attributed to lower income of migrant laborers. A very low intake of milk and milk products, that is, 44g was also reported by Lakshmi and Padma (2004) in the age group of 4 to 5 years.

The consumption of green leafy vegetables was negligible in all three age groups of children. Children of both domestic and construction laborers did not consume green leafy vegetables. This can be due to lesser availability of greens during summer season when the survey was carried out. The daily intake of roots and tubers and other vegetables by the preschool children ranged from 6 to 110g and 10 to 100g respectively, with the mean values of 33.97, 26.33, 26.96g and 16.9, 22.5, 26.6g, in the age group of 3



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|---------------------------|---------------------------|----------------------|
| 1. Cereals                | 4. Green leafy vegetables | 7. Fruits            |
| 2. Pulses and legumes     | 5. Roots and tubers       | 8. Fats and oils     |
| 3. Milk and milk products | 6. Other vegetables       | 9. Sugar and jaggery |

to 4, 4 to 5 and 5 to 6 years, respectively. The consumption of green leafy vegetables was negligible in all three age groups of children. The data further revealed that the mean daily intake of roots and tubers and other vegetables was lower than the recommendations as suggested by ICMR (2010) in all the three age groups. Inadequate consumption of roots and tubers, that is, 78g in the age group of 3 to 6 years (Kulsum et al. 2008) and 15g in the age group of 4 to 6 years was reported by Lakshmi et al. (2005). Bathla (2012) reported inadequate intake of other vegetables in 3 to 4 years rural preschool children but adequate intake in 4 to 6 years age group.

The mean daily intake of fruits by the preschool children ranged from 0 to 85g with the mean value of 14.4, 13.4 and 16.2g in 3 to 4, 4 to 5 and 5 to 6 years old children, respectively. The results indicated that the fruit consumption was negligible by all the children as compared to suggested intake of 100g. The lesser consumption of fruits by the children could be due to higher prices. A very low intake of fruits and vegetables in the age group of 3 to 6 years was also reported by Lakshmi and Padma (2004), Nigam et al. (2010) and Chege et al. (2015).

The mean intake of fats and oils by the preschool children was inadequate (16.15, 14.54 and 17.28g) in all three age groups against the suggested intake of 25g, which could be due to the low purchasing power of the subjects. Lower intake of fats and oils (3g) was reported by Lakshmi et al. (2005) in 3 to 4 years age group, whereas Bathla (2012) reported lower intake of fats and oils in 4 to 6 years age group.

The daily intake of sugar and gaggery by the 3 to 4, 4 to 5 and 5 to 6 years children ranged from 5 to 25g with the mean values of 8.51, 10.14 and 8.48g, respectively. The consumption of sugar and gaggery was inadequate in all three age groups, the adequacy being forty-three, 50.7 and forty-two percent, respectively. Inadequate intake of sugar and gaggery was also reported by Bathla (2012).

The results revealed that as age increases, intake of cereals and other vegetables increases but intake of milk and milk products decreases. This study shows that the illiteracy among mothers may be one of the reasons for insufficient food intake. The fact that majority of the mothers were illiterate is an indication of adoption of poor food intake. Another reason was the low income and size of families for inadequate food

intake especially milk and milk products and fruits and vegetables. Due to too less intake of milk and milk products as well as fruits and vegetables, the gross deficiency of micronutrients is inevitable in preschool children.

### Nutrient Intake

The average daily nutrient intake and its percent adequacy have been presented in Table 2 and Figure 2. The daily intake of energy by 3 to 4, 4 to 5 and 5 to 6 years old children ranged from 254 to 800, 303 to 912 and 352 to 1028 kcal with the mean values of 520, 527 and 550 kcal, respectively. Inadequate consumption of energy as compared to the Recommended Dietary Allowances of ICMR (2010) was observed, the adequacy being 38.5, 39 and 40.7 percent, respectively. The lesser energy intake was attributed to inadequate intake of fats and sugar by the children. Similar low intake of energy at fifty-six percent of RDA among 1-5 years of children was reported by Kapur et al. (2005) and Lakshmi et al. (2005).

The daily intake of protein by 3 to 4, 4 to 5 and 5 to 6 years old children ranged from 2.1 to 21.5, 8.95 to 28.6 and 9.1 to 29.1g with the mean values of 14, 15 and 15g, respectively. The results revealed inadequate protein intake, the adequacy being seventy-two, 75.6, seventy-five percent, respectively. Similar low intake of protein, that is, seventy-seven percent of the recommended dietary allowances was reported by Lakshmi et al. (2005) in Indian preschool children (1-5 years).

The intake of beta carotene ranged from 26.5 to 1786, 21.2 to 1907 and 15.9 to 1484 $\mu$ g/day with the mean values of 227, 377 and 230  $\mu$ g/day among 3 to 4, 4 to 5 and 5 to 6 years old children, respectively. The adequacy of beta carotene among 3 to 4 years, 4 to 5 years and 5 to 6 years old children was 7.1, 11.8 and 7.2 percent, respectively. The low intake of beta carotene was due to lack of green leafy vegetables in the diet. Low intake of beta carotene by under five children was also reported by Mitra et al. (2007) and Baranwal et al. (2012).

The mean daily intake of thiamine, riboflavin and niacin in all three age groups ranged from 0.1 to 0.5, 0.1 to 0.4 and 1.0 to 4.1 mg, respectively. Results revealed that the intake of thiamine, riboflavin and niacin was inadequate in 3 to 4, 4 to 5 and 5 to 6 years, the percent adequacy be-



**Table 2: Average nutrient intake by preschool children of 3-6 years**

Nutrients	Age group			RDA*	Overall (6-6 years) (n = 120)
	3-4 years (n = 39)	4-5 years (n = 35)	5-6 years (n = 46)		
<i>Energy (kcal)</i>					
Range	254 - 800	303 - 912	352 - 1028	1350	254 - 1028
Mean±SD	520 ± 171	527 ± 128	550 ± 125		533 ± 142
<i>Protein (g)</i>					
Range	2.1 - 21.5	8.95 - 28.6	9.1 - 29.1	20.1	2.1 - 29.1
Mean±SD	14 ± 5.0	15 ± 4.5	15 ± 3.9		14.9 ± 4.4
<i>Beta carotene (µg)</i>					
Range	26.5 - 1786	21.2 - 1907	15.9 - 1484	3200	15.9 - 1907
Mean±SD	227 ± 316	377 ± 495	230 ± 369		278 ± 393
<i>Thiamine (mg)</i>					
Range	0.1 - 0.5	0.2 - 0.4	0.2 - 0.4	0.7	0.1 - 0.5
Mean±SD	0.25 ± 0.08	0.27 ± 0.07	0.25 ± 0.06		0.26 ± 0.07
<i>Riboflavin (mg)</i>					
Range	0.1 - 0.4	0.2 - 0.4	0.1 - 0.4	0.8	0.1 - 0.4
Mean±SD	0.22 ± 0.08	0.22 ± 0.08	0.21 ± 0.06		0.22 ± 0.07
<i>Niacin (mg)</i>					
Range	1.03 - 4.63	0.94 - 2.9	1.0 - 4.1	11	1.0 - 4.1
Mean±SD	2.14 ± 1.1	2.13 ± 0.8	2.15 ± 0.8		2.13 ± 0.89
<i>Vitamin C (mg)</i>					
Range	4.4 - 28	1 - 28.2	4.6 - 28.8	40	1 - 28.75
Mean±SD	10.96 ± 5.97	13.15 ± 7.25	10.61 ± 5.72		11.47 ± 6.32
<i>Vitamin B<sub>12</sub> (µg)</i>					
Range	0.1 - 0.5	0.1 - 0.5	0.02 - 0.7	0.2-0.8	0.02 - 0.7
Mean±SD	0.14 ± 0.14	0.14 ± 0.14	0.16 ± 0.2		0.14 ± 0.16
<i>Folate (µg)</i>					
Range	6.5 - 92.8	19.65 - 64.1	11.4 - 77.04	100	6.5 - 77.04
Mean±SD	38.94 ± 18.67	41.97 ± 15.50	38.18 ± 14.97		39.53 ± 16.35
<i>Calcium (mg)</i>					
Range	45 - 210	61 - 187	62 - 246	600	45 - 246
Mean±SD	125.97 ± 42.14	133.87 ± 49.72	125.83 ± 40.89		128.2 ± 43.80
<i>Iron (mg)</i>					
Range	0.65 - 4.9	1.3 - 7.1	1.9 - 7.2	13	0.65 - 7.2
Mean±SD	3.09 ± 1.38	3.30 ± 1.27	3.1 ± 1.11		3.15 ± 1.24
<i>Zinc (mg)</i>					
Range	0.7 - 3.2	0.8 - 2.9	1.2 - 3.0	7	0.7 - 3.0
Mean±SD	1.7 ± 0.59	1.92 ± 0.51	1.86 ± 0.44		1.82 ± 0.5

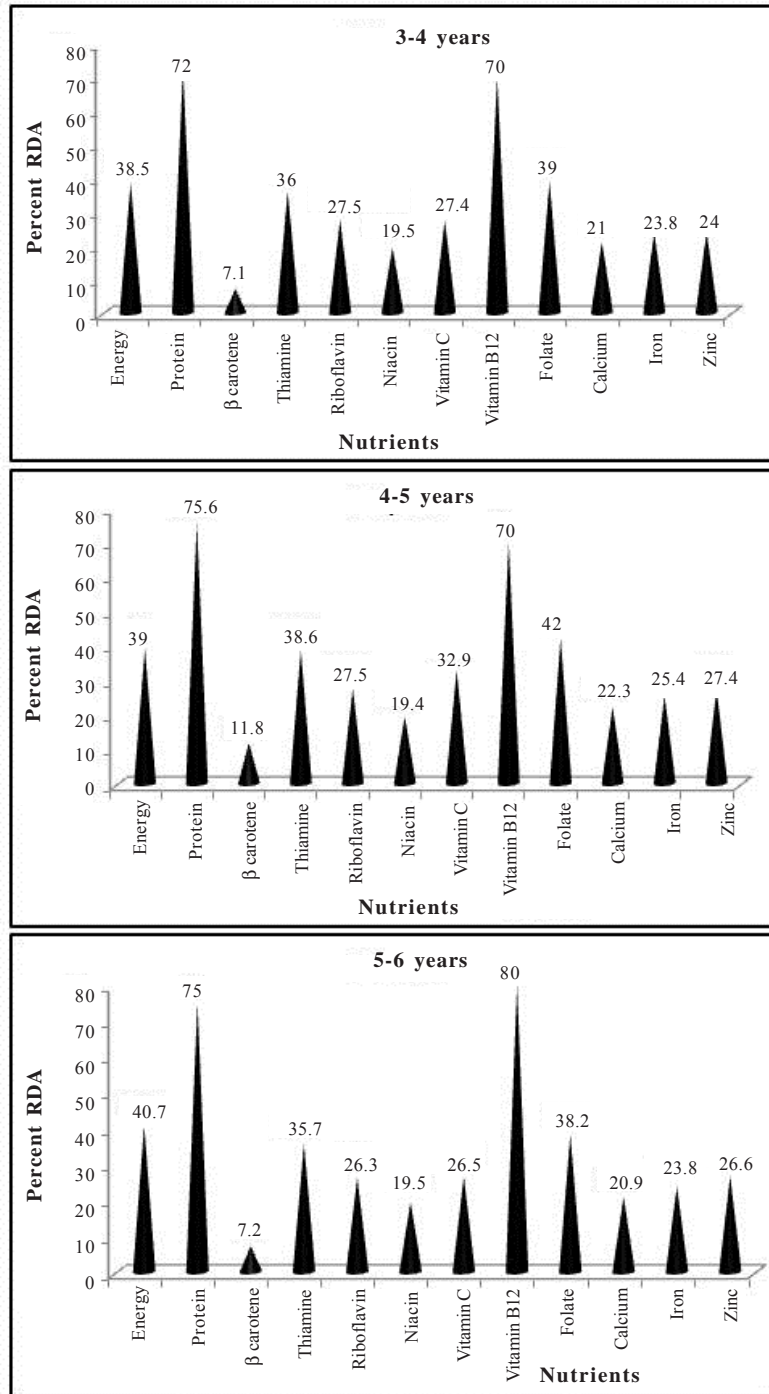
Recommended Dietary Allowance (RDA) by ICMR 2010

ing thirty-six, 38.6 and 35.7 percent, 27.5, 27.5 and 26.3 percent, 19.5, 19.4 and 19.5 percent, respectively. The present results were supported by Mitra et al. (2007) reported lower intake of riboflavin and niacin in 1 to 5 years old children.

The intake of vitamin C by 3 to 4, 4 to 5 and 5 to 6 years old children ranged from 4.4 to 28, 1 to 28.2 and 4.6 to 28.8 mg/day with the mean values of 10.96, 13.15 and 10.61 mg/day, respectively. The findings further revealed that the intake of vitamin C was inadequate in all the age groups when compared to Recommended Dietary Allowances, the adequacy being 27.4, 32.9 and 26.5 percent, respectively. Inadequate intake of vitamin C was also reported by Maqsood et al. (2004) and Mitra et al. (2007).

The mean intake of folate and vitamin B<sub>12</sub> by 3 to 4, 4 to 5, 5 to 6 years old children ranged from 6.5 to 92.8, 19.65 to 64.1, 11.4 to 77.04 and 0.1 to 0.5, 0.1 to 0.5 and 0.02 to 0.7 µg/day, respectively. The corresponding mean values were 38.94, 41.97, 38.18 and 0.14, 0.14, 0.16 µg/day, respectively. The intake of folate was inadequate in all three age groups, the adequacy being thirty-nine, forty-two and 38.2 percent in 3 to 4, 4 to 5, 5 to 6 years old children respectively, whereas vitamin B<sub>12</sub> was marginally inadequate in 3 to 5 years age group but marginally adequate in 5 to 6 years age group as per Jood et al.'s (1999) classification.

The daily intake of calcium by 3 to 4, 4 to 5, 5 to 6 years old children ranged from 45 to 210, 61



**Fig. 2. Percent adequacy of nutrient intake by preschool children**  
 Source: Author

to 187 and 62 to 246 mg with the mean values of 125.97, 133.87 and 125.83mg, respectively. The results further showed that the calcium intake was inadequate in all three age groups, the adequacy being twenty-one, 22.3 and 20.9 percent, respectively. Similar findings were reported by Lakshmi et al. (2005) and Mitra et al. (2007).

The average daily intake of iron by 3 to 4, 4 to 5, 5 to 6 years old children ranged from 0.65 to 4.9, 1.3 to 7.1 and 1.9 to 7.2 with the mean values of 3.09, 3.30 and 3.1mg, respectively. Iron intake was inadequate in all three age groups when compared to the RDA given by ICMR (2010), the percent adequacy being 23.8, 25.4 and 23.8 in 3 to 4, 4 to 5 and 5 to 6 years age group, respectively. Low iron intake was due to poor consumption of green leafy vegetables, which was negligible. Inadequate intake of iron that is 8.25mg was also reported by Lakshmi and Padma (2004) and Rana and Hussain (2001). The daily intake of zinc was 1.7, 1.92 and 1.86mg by 3 to 4, 4 to 5, 5 to 6 years old children, the adequacy being twenty-four, 27.4 and 26.6 percent respectively, indicating inadequate intake of zinc by the children.

The food intake of the children showed inadequacy of all the food groups except cereals intake in 5 to 6 years age group children. On the whole, intake of all nutrients in all three age groups was found to be inadequate when compared with the Recommended Dietary Allowances of ICMR (2010) due to low intake of food. According to the categorization of NAR percent given by Jood et al. (1999), it was found that among 3 to 4 years old preschool children protein and vitamin B<sub>12</sub> intake was marginally inadequate whereas among 4 to 5 and 5 to 6 years age group protein intake was marginally adequate. The intake of vitamin B<sub>12</sub> was marginally inadequate among 4 to 5 years age group whereas it was marginally adequate in 5 to 6 years age group (Fig. 2).

### CONCLUSION

The study concluded that the food intake (except cereals and pulses) and nutrient intake of preschool children of both domestic and construction women laborers were inadequate.

### RECOMMENDATIONS

The study recommends that the mothers should be educated about appropriate feeding practices and selection of right food for their

children in order to achieve optimum health for their children with their limited resources.

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