

## **Dietary Intake and Growth Pattern of Children 9-36 Months of Age in an Urban Slum in Delhi**

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*This investigation deals with the dietary intakes and growth in early childhood in poor communities. Five hundred and forty five children, 9-36 months of age, and their caretakers (mothers) were selected randomly and invited to participate in the study. The food and nutrient intake of children was assessed using a 10-item food frequency and amount questionnaire (FAQ). The anthropometric nutritional status was assessed by the indices height-for-age (H/A), weight-for-age (W/A), weight-for-height (Wt/Ht) and MUAC, according to Indian and NCHS standards. The results showed that the intake of cereals, pulses, roots, green leafy vegetables (GLVs), other vegetables, fruits, sugar, fats and oils among children was grossly inadequate. The nutrient intake for energy was 56% of the current RDA. Anthropometric analysis revealed that the children were grossly undernourished. Seventy five per cent children were underweight ( $<-2$  SD), while 35% severely undernourished ( $<-3$  SD). Approximately, 74% children were having short stature (chronic malnutrition) with 39% severely stunted. Nineteen per cent children were excessively thin (wasted). The data regarding the degree of malnutrition among children demonstrated that 9.6% girls in 9-36 months of age had severe malnutrition as compared to 6.5% males. The maximum prevalence of severe malnutrition was in the age 31-36 months (10%) followed by 9.6% in 13-18 months. The moderate degree of malnutrition was around 30-33% in age group 13-36 months. The evidence from the study provides a strong basis to suggest low food intake as the main cause of under/malnutrition and growth retardation (stunting) in early childhood in poor communities.*

**Key words:** Dietary intakes, Nutritional status, Young children, Urban slum.

**I**t is now being recognized that the great majority of malnourished children (other than those born with low birth weights) become malnourished within a fairly narrow "age window" from several months after birth to about two years of age. Evidence from all over India suggests that the growth curve of many infants begin to falter as early as the

fourth month of life(1). This coincides with the time when foods other than breast milk are generally introduced into the diet. Integrated Child Development Services (ICDS) started over 20 years back and now operating in 400,000 villages of India, is reaching two-thirds of the nation's children in an attempt to improve their health, nutrition and

development, but has made little nutritional impact on very young children less than three years of age(2).

The present study was designed to study the feeding practices, dietary intake and growth pattern of children, 9-36 months of age, in an urban slum ICDS project in Delhi.

### Subjects and Methods

The study was conducted in the 41 anganwadis (AWs) of Nand Nagri ICDS project, located in North-East Delhi. Nand Nagri has a total population of 65,000 with approximately 2629 children in the age group 9-36 months. Five hundred and forty five children (545) were selected randomly and invited to participate in the study. Sample size was calculated based on a pilot study(3) and with SD of 1.9 and limit of error at 0.2. A 30% margin was added to allow for a maximum estimated non-response, giving a sample size of  $\geq 510$  subjects.

The food and nutrient intake (including dietary supplement intake) of children was assessed using a ten-item food frequency and amount questionnaire (FAQ). The reliability of the dietary intake data was assessed by correlating the mean intake of the major nutrients derived from the FAQ record with the mean nutrient intake derived from the 2-3 day diet record method for approximately one-fifth of the total sample. Except for vitamin C, high correlation was obtained for all other nutrients.

Food models and series of photographs were used to help mother's quantify the amount of food consumed. Nutrient intake of children was computed using the 'Food Composition Tables'(4) of the Indian Council of Medical Research (ICMR). The quantity of breast milk consumed was estimated based on data specific to Indian children(5). The mean values of food and nutrients consumed were

assessed for adequacy by comparing with the Balanced Diet for Children, as per the Dietary Guidelines for Indians(6).

Data on children's growth status was obtained by measuring weight, height and mid-arm circumference using standard techniques(7). Measuring scales were calibrated daily, and standardization was rechecked at the completion of the field work.

The weight and height measurements were converted into weight for age, height for age percentage of standard for each child using both Indian(8) and NCHS standards. The children were grouped into different grades of nutrition status based on the classification recommended by Indian Academy of Pediatrics (IAP)(9).

All data were analyzed using the SPSS statistical software package. Means and standard deviations were calculated. Two sample t test and chi-square test was used to evaluate the statistical difference. Mean  $\pm$  SD, geometric mean was computed using the log transformed nutrient intake observations. Statistical significance was defined as  $P < 0.05$ .

### Results

Complete anthropometric and dietary intake data could be obtained from 522 and 242 children, respectively. The mean intake of cereals, pulses, flesh foods, milk, GLV, other vegetables, fruits, nuts and oil seeds, sugar and visible fat was 52g, 10g, 4g, 410g, 5g, 15g, 27g, 3g, 14g and 6g, respectively. The mean intake of cereals, pulses, roots, GLVs, other vegetables, fruits, sugar, fats and oils was grossly inadequate, meeting only 43%, 33%, 48%, 13%, 39%, 28%, 56% and 40%, respectively of the recommendations of balanced diet for children aged 6-36 months(6). The deficit in the case of GLVs was as high as 87%. The mean milk intake of

the sample was almost adequate, showing a deficit of 18% only.

Data related to sex-wise consumption of various foods showed no significant difference in the food intake for boys and girls. Food consumption data according to age in three age categories - 9-12, 13-24 and 25-36 months - suggest that the food intake of children at 13-24 months was not very different than food intake of children at 9-12 months of age. At 25-36 months of age, children were found to be consuming significantly more amounts of cereals, flesh foods, fruits, fats and oils as compared to children in 9-12 and 13-24 age categories. Such findings may perhaps lead us to conclude -late introduction of family food in the diet of the children, as a result the child is continued to be fed large amounts of liquid food, most often milk (a poor source of iron). The animal milk intake of children at 13-24 months (290g/day) was the same as milk intake by children 9-12 months of age (291g/day).

The geometric mean daily intake of energy, protein, fat, carbohydrate, iron, vitamin C, retinol and calcium among children was 758 Kcal, 20 g, 15 g, 98 g, 5 mg, 36 mg, 468 mg and 339 mg, respectively. Based on the ICMR recommended allowances(6), nutrient intake ranged from 56% for energy, 45% for iron, to 143% (for vitamin C) of RDA. Regarding vitamin C intake, although the intake derived from the FAQ method (mean intake  $36 \pm 27$  mg) was well above the RDA for the group, a poor correlation recorded with the 2-3 day diet record method (mean intake  $21 \pm 13$  mg), perhaps suggests that the daily vitamin C intake may have been lower.

The nutritional status of children as per standard deviation classification for height for age, weight for age and weight for height is summarized in *Table I*. Seventy five per cent children were underweight/malnourished (< median -2 SD weight for age of NCHS), while 35% severely undernourished (<-3SD). Using height for age criteria, the overall

**TABLE I**—Nutritional Status of Children\* According to Sex.

	<-3SD	-3SD to -2SD	-2SD to 2SD	2SD to 3SD	>3SD
<b>Height for age</b>					
Boys	38.0	35.20	26.0	—	0.80
Girls	40.23	35.34	23.64	0.38	0.38
Total	39.15	35.27	24.81	0.19	0.58
<b>Weight for age</b>					
Boys	37.20	37.20	25.20	0.40	—
Girls	33.46	42.11	24.06	0.38	—
Total	35.27	39.73	24.61	0.39	—
<b>Weight for height</b>					
Boys	2.40	15.6	82.0	—	—
Girls	3.01	16.17	79.7	0.75	0.38
Total	2.71	15.89	80.81	0.39	0.19

\*Figures indicate percentage of children.

prevalence of stunting was around 74% (<-2SD) with 39% severely stunted (<-3SD), indicating long duration malnutrition. Approximately 19% children were suffering from short duration malnutrition (wasting), with 2.7% severely wasted (<-3SD).

The mean weights for boys and girls were  $8.7 \text{ kg} \pm 1.4$  and  $8.1 \text{ kg} \pm 1.5$ , respectively, which were significantly different ( $P < 0.01$ ), and these values were also significantly lower ( $P < 0.05$ ) as compared to the Indian standard for boys and girls(8). The mean  $\pm$  SD weight for the children of both sexes combined was  $8.4 \text{ kg} \pm 1.5$ . The mean  $\pm$  SD height for boys and girls was  $74.9 \text{ cm} \pm 5.7$  and  $73.4 \text{ cm} \pm 5.9$ , respectively, and was found to be significantly different ( $P < 0.01$ ). When compared with Indian standard(8) the mean height for boys and girls was significantly lower ( $P < 0.01$ ). The mean height for the total population was  $74.1 \text{ cm} \pm 5.8 \text{ cm}$ .

With the mid-arm circumference as the criteria for assessing malnutrition, 383 (73.4%) children (69.9% boys and 76.8% girls) were found to be malnourished. The mean  $\pm$  S.D MUAC for the total population was  $12.7 \text{ cm} \pm 1.03$ , which was significantly lower than the standard ( $P < 0.01$ ). The mean

MUAC for boys and girls being  $12.9 \text{ cm} \pm 0.9$  and  $12.5 \text{ cm} \pm 1.1 \text{ cm}$ , respectively.

*Table II* presents the degree of malnutrition among children, (based on weight-for-age criteria, using IAP classification)(9) according to age category. (This analysis is based on complete data for weight obtained from 540 subjects). The moderate degree malnutrition was around 30-33% in age group 13-30 months. Number of children with normal nutrition was 37.7% at 9-12 months of age falling to 21% and 20% at 25-30 and 31-36 months of age, respectively. The mean weight in each of the age category: 9-12, 13-18, 19-24, 25-30 and 31-36 months was  $7.1 \text{ kg} \pm 1.2$ ,  $7.5 \text{ kg} \pm 1.2$ ,  $8.6 \text{ kg} \pm 1.2$ ,  $9.2 \text{ kg} \pm 1.1$  and  $9.9 \text{ kg} \pm 1.2$ , respectively. With respect to the degree of malnutrition among males and females, significant difference (Chi square value =12.68,  $P = 0.005$ ) was found in the distribution with more females (9.6%) suffering from severe malnutrition as compared to males (6.5%).

## Discussion

The results for food/nutrient intake reported in the present study are similar to those found in other analysis of diet during

**TABLE II**—Degree of Malnutrition Among Children based on IAP Classification.

Age Group (months)	n	Normal n (%)	Grade I n (%)	Grade II n (%)	Grade III and IV n (%)	Mean $\pm$ SD
9-12	86	29 (37.7)	31 (36.0)	21 (24.4)	5 (5.8)	$7.1 \pm 1.2$
13-18	145	29 (20.0)	55 (37.9)	47 (32.4)	14 (9.6)	$7.5 \pm 1.2$
19-24	121	26 (21.5)	48 (39.7)	37 (30.6)	10 (8.2)	$8.6 \pm 1.2$
25-30	119	25 (21.0)	50 (42.0)	36 (30.3)	8 (6.7)	$9.2 \pm 1.1$
31-36	69	14 (20.3)	25 (36.2)	23 (33.3)	7 (10.1)	$9.9 \pm 1.2$
Total	540	123 (22.8)	209 (38.7)	164 (30.4)	44 (8.1)	$8.4 \pm 1.5$
(Male)	260	62 (23.8)	97 (37.3)	84 (32.3)	17 (6.5)	
(Female)	280	61 (21.8)	112 (40.0)	80 (28.6)	27 (9.6)	

### Key Messages

- Prevalence of underweight, stunting and wasting was found to be 75%, 74% and 19%, respectively among children, 9-36 months of age.
- Nutrient intake of children ranged from 45% (for iron) to 143% (for vitamin C) of Indian RDA, with energy and iron (which provided 56% and 45%, respectively) falling below the current RDA.
- As a consequence of prolonged breast feeding, dependence on liquid food most often milk, late introduction of family food, undernutrition occurs at an early age among children.
- Chronic calorie deficit basic cause of poor nutritional status among children under three years of age.

early childhood years carried out in the different parts of the country(10,11). All of these studies have reported a disparity between nutrient intake, particularly the energy and iron intake, and RDA's.

The poor child feeding practices adopted may largely explain the low nutrient intake, recorded in the present study. Our data supported by the National Family Health Survey findings(12) confirmed prolonged breastfeeding, late introduction to complementary feeding, high reliance on diluted top milk, delay in putting the child on to the family food, which may have contributed to the calorie (56% of RDA) and other nutrients (iron 46% of RDA) deficit recorded in the study.

Inadequate food/nutrient intake as a major contributory factor of malnutrition has been identified. Analysis for difference in dietary intake among those who were undernourished/stunted and those normal revealed low intake for most nutrients in the undernourished/stunted group with significant differences in the energy intake ( $t = 2.127$ ,  $P = 0.035$ ). Poor nutrition may have thus contributed to the deficit found in weight and height leading to underweight (75%) and stunting (74%) among these children. In particular, the level of severely malnourished

children ( $<-3$  SD) in our study population was much higher (35% underweight and 39% severely stunted) as compared to those in the population studied by NFHS (18% and 23%, respectively)(12). A high incidence of underweight and stunting was also reported with significant sex differences, girls reporting lower values (9.6% girls in 9-36 months of age had severe malnutrition as compared to 6.5% males). Several other studies(13,14) have shown that boys have higher weights and lengths than girls of the same age.

The prevalence of moderate to severe forms of malnutrition (30-40%) was found to be consistently higher during the second/third year of life, a finding corroborated with recent finding(15,16) that children under 3 years of age are more vulnerable and at risk of developing malnutrition, and that they tend to respond more to intervention than older children. Such findings provide strong basis for targeting preventive strategies for children 0-3 years of age.

Recognizing the link between malnutrition and child feeding practices/nutrient intake, intervention programs to improve child feeding behavior need to be specially designed and implemented. Evidence(17) suggests that comprehensive multifaceted

intervention approaches involving breast-feeding promotion and improved complementary feeding can identify affordable and acceptable means for caretakers to improve infant feeding, improve caretaker knowledge and beliefs regarding optimal infant feeding, improve child feeding practices, increase total energy intake and improve the nutritional status of young children

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