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Feeding Practices of Preschool Children in Western Orissa IV. Nutritional Anthropometry

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ABSTRACT The paper reports on the anthropometric measurements and nutritional status of preschool children of Western Orissa through various body-mass indices. There was closeness in the measurements of height, weight, mid-arm circumference and chest circumference between industrial and urban communities whereas the measures were lower by 10-15% in case of rural communities compared to the above two. In general the mean height, weight and mid-arm circumference were higher among the male in all the age-groups than the female children. The ratio index (height/weight) increased with increase in age in all the communities and in both the sexes. Around 68%, 57% and 48% of children belonged to normal class of Body-mass index (weight/height^2) in industrial, urban and rural communities, respectively whereas 72%, 67% and 57% belongs to normal class of mid-arm circumference (>13.5 cm). On the basis of Dugdale's index, 23% in industrial, 25% in urban and 44.5% in rural communities belonged to malnourished class (<88). Means height, weight, Dugdale's index, weight for age (% of Harvard standard) and Body-mass index were higher in case of colostrun-fed babies. Analysis revealed that exclusive breast-feeding beyond six months of age resulted in a higher percentage of malnourished children.

INTRODUCTION

Anthropometric measurements have become an indispensible approach for evaluation of nutritional status of children (Johnson et al., 1981; Frisancho, 1984; Vijayaraghavan, 1987). Many measures are currently being used to determine the nutritional status among children. Among the measures in use are height, weight, weight/height and power variations of the relationship, various body circumference and various skin folds or fatfolds. Perhaps the simplest and most commonly used measures are height and weight (Expert Committee on Medical Assessment, 1963; Jelliffe, 1966). Growth and physical development of infants and preschoolers are widely used as indicators of overall health and nutritional stutus of a community. The present paper reports the height, weight, mid-arm-circumference and chest-circumference and nutritional indices of the infants and preschoolers of western Orissa.

MATERIALS AND METHODS

The survey was undertaken in industrial,urban and rural communities of western Orissa during 1989-90 by collecting information through a pretested schedule. The details of the study area, demographic features, breast-feeding and supplementary feeding practices have been reported earlier (Mishra 1993 a,b,c).

All the measurements were obtained under standard conditions and with utmost care. While taking measurements minimal clothing was allowed whenever it was possible.

Height Measurement : The height was recorded nearer to 0.5 cm in a upright standing posture.The child was required to stand bare foot with his back towards a smooth wall and heels, buttocks, upper part of back and the rear of head in contact with the wall. The highest point was marked by putting a scale on the head horizontally. The distance between the lowest and the highest points were measured directly

with a measuring tape. But in a small percentage of cases where the child did not stand either due to non-cooperation, illness or in case of young infants, the sleeping height was measured instead of standing height. In the latter case the child was laid down on a smooth floor with face upward and legs touching the wall. The scale was put in a vertical manner and the measurement was taken as mentioned above.

Weight Measurement : The weight was taken by standard weighing machine (lever type) having units in metric system and the measurement was taken nearer to 0.5 kg.

Chest Circumference : Chest circumference was measured by putting the measuring tape horizontally around the chest just across the nipples. The lowest measurement recorded during normal breathing process (not during crying, laughing or sneezing etc.) was only taken into consideration.

Arm Circumference : The left upper arm was measured, while hanging freely at its mid-point. The midpoint of the upper arm was assessed by measuring the distance between the acromial process of the scapula and the olecranon process of the ulna and taking the midpoint of that distance. The tape was placed gently but firmly round the midpoint avoiding compression of the soft tissues. There were no clothes on the arm while the measurement was taken (Park and Park, 1977).

Dugdale's Nutritional Index (1971) has been calculated basing on a power relationship between weight (in Kilogram) and height (in centimeter),

$$\frac{\text{Weight}}{\text{Height}^{1.6}} \times 10^4$$

and the children were classified as malnourished if their nutritional index value was 88 or below. A nutritional index of 110 or above would signify obesity.

Similarly nutritional index through Gomez classification (1955, 1956) has been made on the basis of the calculation,

$$\frac{\text{Weight of the child}}{\text{Standard weight of child}} \times 100$$

The Harvard standard of weight (Jelliffe, 1966) in relation to age of the child has been considered for calculation of Gomez's nuritional index (Ghosh, 1976). The Gomez classification is as follows :

Grade of malnutrition	*Body weight % of standard*
Normal	> 90%
Grade I (Mild)	> 75–≤ 90%
Grade II (moderate)	> 60–≤ 75%
Grade III (severe)	≤ 60%

Body mass index of Keys et al. (1972) has been calculated as weight/(height)^2 and ratio index (Fisch et al., 1975) as weight/height.

The data collected were analysed with the help of a PC/(AT) 80286. The measure of association (Chi-square test) and test of analysis of variance (F ratio) were done as per Gupta (1982). The data were reported as significant on the basis of significance levels of 0.05 and 0.01.

RESULTS AND DISCUSSION

The mean and standard deviation of anthropometric measurements in different age groups are presented in tables 1-4 for male and female children separately. There was closeness in the measurements relating to industrial and urban communities whereas for rural community the measures are lower by 10-15% compared to the industrial and urban community. The mean height and weight of male children in different age-groups were higher than the female children. Measurements of mid-arm-circumference also showed similar trend but not with chest circumference.

Table 5 presents the mean anthropometric measurements (grand average of three communities) in different age-groups of male and female children. Male children had a higher height, weight and mid-arm circumference than the female children in all the age-groups indicating better nutritional status. Similar results were obtained by Bhargava et al. (1980). Bhat and Dhahiya (1985) and Kakker et al. (1987).

Table 1 : Anthropometric measurements of pre-school children. Height (cm) (Mean±SD)

Age (in months)	*Industrial*	*Urban*	*Rural*
		MALE	
≤6	64.75±4.50	59.50±6.40	59.33±6.65
>6–≤12	66.60±4.38	67.63±5.83	67.0±4.60
>12–≤18	73.25±3.97	74.79±4.41	71.10±.93
>18–≤24	75.81±5.26	78.90±3.21	74.90±4.54
>24–≤30	83.75±4.28	84.30±3.84	77.39±3.33
>30–≤36	85.50±6.35	87.57±4.50	83.86±6.30
>36–≤42	88.50±4.87	89.35±5.90	86.50±5.46
>42–≤48	90.68±3.95	91.10±6.30	89.50±4.56
>48–≤54	92.48±3.42	92.05±5.34	90.93±3.85
>54–≤60	93.50±5.65	94.05±3.76	91.35±4.80
		FEMALE	
≤6	64.74±5.45	60.54±5.80	59.69±6.80
>6–≤12	66.30±6.30	67.20±3.70	65.29±3.87
>12–≤18	71.56±5.89	71.79±4.80	70.53±4.83
>18–≤24	74.76±5.54	73.84±5.40	71.94±5.44
>24–≤30	81.50±5.63	81.30±6.20	75.23±5.89
>30–≤36	84.31±4.56	84.48±6.50	80.21±6.63
>36–≤42	86.84±5.44	87.93±5.70	84.36±4.30
>42–≤48	88.38±3.90	90.30±6.40	86.25±4.33
>48–≤54	90.46±5.56	91.36±3.70	87.29±4.39
>54–≤60	92.79±6.43	92.10±5.80	89.59±4.20

Table 2 : Anthopometric measurements of pre-school children. Weight (kg) (Mean±SD)

Age (in months)	*Industrial*	*Urban*	*Rural*
		MALE	
≤6	6.13±4.2	5.89±3.8	5.56±5.3
>6–≤12	7.72±1.4	7.10±2.3	6.34±2.8
>12–≤18	8.60±1.8	8.40±2.5	7.63±3.4
>18–≤24	9.40±2.4	9.71±4.3	8.22±3.6
>24–≤30	10.30±1.5	9.98±1.9	8.69±2.5
>30–≤36	10.90±2.8	10.53±2.3	9.15±1.8
>36–≤42	11.50±2.5	11.10±2.9	9.90±1.8
>42–≤48	12.01±3.8	11.86±5.4	10.60±4.6
>48–≤54	12.05±2.8	12.36±3.6	10.89±4.1
>54–≤60	13.01±3.5	13.7±3.3	11.85±4.6
		FEMALE	
≤6	-6.45±1.4	5.85±5.3	5.24±3.9
>6–≤12	7.85±2.3	6.73±2.6	6.64±3.1
>12–≤18	8.2±1.2	7.60±2.3	7.38±1.8
>18–≤24	9.0±2.5	8.20±3.1	7.95±4.0
>24–≤30	9.5±2.6	8.80±2.3	8.50±3.5
>30–≤36	10.1±3.9	9.40±3.6	9.10±2.8
<36–≤42	10.9±3.5	10.20±1.6	9.60±3.5
>42–≤48	11.6±1.8	10.70±2.5	9.80±2.6
>48–≤54	12.1±5.3	11.38±3.5	10.28±4.6
>54–≤60	12.5+–5.9	12.26±4.7	10.53±4.5

Table 3 : Anthropometric measurements of pre-school children. Mid-arm circumference (cm) (Mean ±SD)

Age (in months)	*Industrial*	*Urban*	*Rural*
		MALE	
<6	12.6±1.2	12.3±0.9	11.5±1.1
>6–≤12	12.9±1.6	12.7±2.4	11.9±2.1
>12–≤18	13.2±1.6	12.9±1.3	12.3±2.1
>18–≤24	13.5±1.3	13.4±1.5	12.7±1.5
>24–≤30	13.5±1.3	13.8±1.8	14.2±2.4
>30–≤36	13.9±2.3	14.2±2.4	13.2±1.8
>36–≤42	14.2±1.8	14.3±1.3	13.6±1.5
>42–≤48	14.5±1.1	14.4±0.8	13.9±0.9
<48–≤54	14.6±1.5	14.7±1.6	14.0±1.2
>54–≤60	14.8±1.8	14.9±1.6	14.1±1.3
		FEMALE	
≤6	12.1±2.4	12.2±2.8	11.2±1.8
>6–≤12	12.4±1.5	12.5±1.9	11.5±1.7
>12–≤18	12.8±2.1	12.9±1.8	11.7±1.6
>18≤24	13.2±3.5	13.5±2.6	11.9±1.6
>24–≤30	13.5±1.6	13.4±1.4	11.9±0.9
>30–≤36	13.7±3.4	13.6±2.8	12.2±1.5
>36–≤42	13.8±2.5	13.9±2.2	12.5±1.8
>42–<=48	13.8± 1.7	14.1± 1.6	12.7± 1.8
>48–≤54	14.1±2.1	14.2±2.2	12.9±1.8
>54–≤60	14.2±1.3	14.4±2.3	13.0±1.6

Table 4 : Anthropometric measurements of pre- school children. Chest circumference (cm) (Mean±S.D)

Age (in months)	*Industrial*	*Urban*	*Rural*
		MALE	
≤6	39.5±3.8	38.9±4.5	37.3±2.8
>6–≤12	40.8±2.8	40.5±2.7	38.8±3.1
>12–≤18	42.8±1.8	41.8±2.4	40.6±2.8
>18–≤24	44.3±3.1	43.5±3.3	40.80±3.6
>24–≤30	45.3±2.5	45.1±2.8	41.5±3.9
>30–≤36	45.9±2.1	45.7±2.1	42.1±3.5
>36–≤42	46.8±2.3	46.6±3.5	42.4±6.5
>42–≤48	48.1±5.3	47.9±4.8	43.8±4.6
>48–≤54	48.9±2.5	48.6±2.3	44.8±2.8
>54–≤60	49.4±3.2	49.0±3.1	46.2±3.5
		FEMALE	
≤6	39.6±2.8	8.6±3.2	37.1±2.7
>6–≤12	40.9±2.6	40.5±3.3	38.7±2.9
>12–≤18	42.5±2.8	42.9±2.6	39.9±2.7
>18–≤24	44.4±2.8	44.1±2.5	40.8±3.1
>24–≤30	44.9±3.5	44.8±3.2	41.9±2.6
>30–≤36	45.8±4.3	46.3±1.8	43.2±2.6
>36–≤42	47.3±3.8	47.5±2.7	44.7±2.6
>42–≤48	47.9±2.9	48.2±1.8	46.1±3.6
>48–≤54	48.6±3.3	49.2±3.5	46.5±2.9
>54–≤60	49.8±2.8	49.7±2.9	47.5±3.1

Height is a measure of growth and poor or inadequate nutrition might be indicated by failure to increase height appropriately. Weight is also a measure of growth and is a more sensitive indicator than height in respect of child's health situation. Weight is influenced by many entities like height, frame size, proportion of fat, muscle and bone, pathological edema, current calorie intake and environmental factors. Yarbrough et al. (1974) in a study on Guatemelan preschool children found that weight was very easy to measure and that even with varying sensitivities in scales, differences in the weights of a population of children could be detected with the variability of the instrument causing less than 1% variance in the weights of the children. They also found that 60% of the differences in weight were due to differences in height and that 40 per cent of weight differences were due to non-height and non-nutritional differences. In terms of the extremes of severe undernutrition and overnutrition, these researchers concluded that weight was a good index of the nutritional status of a population.

Foman (1977) suggested that weight for height or weight for age interpreted in relation to height for age can be useful indicators of excess body-weight and if above the 95th percentile, may be used as indicators of obesity.

Weight for height ratio (ratio index) and body-mass index (weight/height^2) have been used by some investigators as age-independent indices of body-build (Buzina, 1974). The mean values of ratio index and body-mass index in different age-groups in the three communities are presented in table 6. The ratio index increased with increase in age in all the communities and in both the sexes. The ranges of ratio index were 0.09 - 0.14, 0.098 - 0.15 and 0.09 - 0.13 for male against 0.1 - 0.13, 0.11 - 0.13 and 0.09 - 0.12 for female children of industrial, urban and rural communities, respectively. This shows that health status of male was better than that of the female children and the rural children had lower health status compared to the industrial and urban children.

Body mass index is used to differentiate a normal child form the undernourished and an index of 0.0015 or above is the characteristics of a normal child (Cherian et al., 1988). Table 6 shows that in case of urban infants and preschoolers upto 24 months of age, the index is 0.0015 or above but in subsequent years it decreases. In rural community the index was normal upto 30 months (perhaps as long as the child was breast-fed) and subsequently decreased gradually. In industrial community the index was in normal category in most of the age groups. The decrease in body-mass index after 24 or 30 months of age, as the case may be might be related to negative attributes of supplementary feeding practices.

Table 7 presents the distribution of malnourished children in different communities on the basis of classification of body-mass index and mid-arm cirumference (Gopaldas and Sheshadri, 1987). Around 68%, 57% and 48% children belonged to normal class of body-mass index and 72%, 67% and 57% belonged to normal class of mid-arm-circuference in industrial, urban and rural communities, respectively. The percentage of undernourished children according to the above two indices was the maximum in rural followed by urban and industrial communities.

Table 8 presents the mean Gomez percentage (percentage weight of Harvard standard) in different age groups of male and female children separately. The average Gomez percentages of all the age groups were 90.63, 89.79 and 84.04 in males against 90.99, 84.63 and 84.6 in females in industrial urban and rural communities, respectively. The test of Analysis of Variance (two-way Classification) shows that the figures are different significantly between different age groups ($F_1 = 5.05$ $p < 0.05$ in male and $F_1 = 0.96$, $p<0.05$ in female) whereas the difference between different communities is only significant in female children ($F_2 = 1.76$ in males and $F_2 = 4.10$, $p <0.05$ in females).

Table 5 : Mean anthropometric measurements of all communities

Age (in months)	*Sex*	*Height (cm)*	*ICMR (1984)*	*Weight (kg)*	*ICMR (1984)*	*Arm circum-ference (cm)*	*ICMR (1984)*	*Chest circum-ference (cm)*	*ICMR (1984)*
≤6	M	61.19	—	5.86	—	12.13	—	38.56	—
	F	61.32	—	5.84	—	11.83	—	38.44	—
>6–≤12	M	67.00	—	7.05	—	12.50	—	40.03	—
	F	66.26	—	7.07	—	12.13	—	40.06	—
12–≤18	M	73.04	70.8	8.21	7.8	12.80	12.1	41.39	43.1
	F	71.29	69.3	7.72	7.3	12.46	12.1	41.76	42.1
>18–≤24	M	76.53	74.2	9.11	8.5	13.20	12.7	42.86	44.5
	F	73.51	73.3	8.38	8.0	12.86	12.5	43.10	43.4
>24–≤30	M	81.80	78.2	9.65	9.4	13.40	13.0	43.96	45.4
	F	79.35	77.1	8.93	9.0	12.93	12.8	43.86	44.4
>30–≤36	M	85.64	81.8	10.19	9.8	13.76	13.0	44.56	46.6
	F	82.00	80.8	9.53	9.7	13.16	13.0	45.10	45.5
>36,–≤48	M	89.27	86.2	11.16	11.1	14.16	13.4	45.92	48.1
	F	87.34	84.9	10.40	10.7	13.46	13.4	46.95	46.9
>48–≤60	M	92.36	93.9	12.38	13.2	14.51	14.0	47.81	49.6
	F	90.59	92.6	11.50	12.6	13.79	13.9	48.55	48.6

M = Male F = Female

Table 6 : Weight/height ratio and weight/height^2 in different age periods

Age (in months)	*Industrial*		*Urban*		*Rural*	
	Ratio wt/ht	*wt/ht^2*	*wt/ht*	*wt/ht^2*	*wt/ht*	*wt/ht^2*
			MALE			
≤6	0.09	0.0014	0.10	0.0016	0.09	0.0015
>6–≤12	0.12	0.0017	0.10	0.0016	0.09	0.0016
>12–≤18	0.12	0.0016	0.11	0.0015	0.10	0.0015
>18–≤24	0.12	0.0016	0.12	0.0016	0.11	0.0015
>24–≤30	0.12	0.0016	0.12	0.0014	0.11	0.0015
>30–≤36	0.13	0.0015	0.12	0.0014	0.11	0.0013
>36–≤42	0.13	0.0015	0.12	0.0014	0.11	0.0013
>42–≤48	0.13	0.0015	0.13	0.0014	0.12	0.0013
>48–<=54	0.13	0.0015	0.13	0.0014	0.12	0.0013
>54–<=60	0.14	0.0015	0.15	0.0015	0.13	0.0014
			FEMALE			
≤6	0.10	0.0016	0.11	0.0016	0.09	0.0015
>6–≤12	0.12	0.0018	0.11	0.0015	0.10	0.0015
>12–≤18	0.11	0.0016	0.11	0.0015	0.10	0.0015
>18–≤24	0.12	0.0016	0.11	0.0015	0.11	0.0015
>24–≤30	0.12	0.0014	0.11	0.0013	0.11	0.0015
>30–≤36	0.12	0.0014	0.11	0.0014	0.11	0.0014
>36–≤42	0.12	0.0014	0.11	0.0013	0.11	0.0013
>42–≤48	0.13	0.0015	0.12	0.0013	0.12	0.0013
>48–<=54	0.13	0.0015	0.12	0.0014	0.12	0.0013
>54–≤60	0.13	0.0014	0.13	0.0014	0.12	0.0013

Table 7 : Percentage distribution of malnourished children on the basis of body-mass index and mid-arm circumference

Particulars	*Industrial*	*Urban*	*Rural*
Body-mass Index			
>0.0015 (Normal),	68	57	48
≥0.0013–≤0.0015 (Moderate)	29	35	37
<0.0013 (Severe)	3	8	15
Mid-arm-Circumference			
>13.5 cm (Normal)	72	67	57
≥12.5–≤13.5 cm (Moderate)	23	29	32
<12.5 cm (Severe)	5	4	11

Table 8 : Mean Gomez percentage in different age group

Age (in months)	*Industrial*	*Urban*	*Rural*
	MALE		
≤6	98.13	103.3	101.09
>6–≤12	98.97	87.65	81.28
>12–≤18	90.52	84.84	84.77
>18–≤24	92.15	89.90	83.03
>24–≤30	87.28	84.57	83.55
>30–≤36	89.34	83.57	77.54
>36–≤42	89.84	86.71	79.83
>42–≤48	89.62	88.50	80.91
>48–≤54	90.57	91.02	81.26
>54–≤60	92.92	97.85	87.13
Average	90.63	89.79	84.04
	FEMALE		
≤6	93.47	97.00	91.92
>6–≤12	104.66	86.28	92.22
>12–≤18	89.13	82.60	82.00
>18–≤24	90.90	84.53	86.41
>24–≤30	83.33	78.57	85.85
>30–≤ 36	85.59	79.66	82.72
>36–≤42	87.90	80.95	81.35
>42–≤48	92.06	81.67	80.32
>48–≤54	92.36	84.92	82.90
>54–≤60	90.57	90.14	80.38
Average	90.99	84.63	84.60

Table 9 presents mean Dugdale's Index in different age-groups of male and female children. The grand averages were 88.47, 86.3 and 80.79 for male and 87.88, 81.30 and 80.86 for female children in industrial, urban and rural community, respectively. There was significant difference in index values between various age-groups in both the sexes but not in different communities (F_1=13.79, $p < 0.05$, F_2 = 2.04 for male and F_1 = 15.91 $p<0.05$ and F_2 = 1.5) for female children.

Percentage distribution of children according to various classes of Dugdale's index is presented in table 10. About 23% in industrial, 25% in urban and 44.5% in rural communities belonged to mal-nourished class.

Table 9 : Mean Dugdale's Index in different age-groups

Age (in months)	*Industrial*	*Urban*	*Rural*
	MALE		
≤6	77.53	85.28	82.18
>6–≤12	93.33	83.77	75.92
>12–≤18	89.20	84.35	83.08
>18–≤24	92.37	89.51	82.35
>24–≤30	86.31	82.75	82.62
>30–≤36	88.36	82.15	76.51
>36–≤42	88.22	83.86	78.77
>42–≤48	88.61	86.86	79.87
>48–≤54	89.37	89.18	80.28
>54–≤60	91.40	95.35	86.41
Average	88.47	86.30	80.79
	FEMALE		
≤6	83.65	82.53	75.48
>6–≤12	95.59	80.20	82.87
>12–≤18	88.37	81.49	81.40
>18–≤24	90.44	84.05	84.96
>24–≤30	83.15	77.32	84.56
>30–≤36	83.75	77.68	81.71
>36–≤42	86.19	79.06	79.51
>42–≤48	89.18	79.48	78.34
>48–≤54	89.63	82.97	80.62
>54–≤60	88.90	88.24	79.21
Average	87.88	81.30	80.86

Tables 11-13 present the percentage of children in the various grades of malnutrition (according to Gomez classification) in relation to maternal education, economic status and

status and caste. In both industrial and urban communities around 70% of the children belonged to normal and 20.25% belonged to mild category (Grade-I) of malnutrition whereas in rural community 64% belonged to normal, 26.5% to mild category. The children coming under moderate and severe grades of malnutrition (9.5% in rural, 10% in urban and 4% in industrial community) were mostly from illiterate, low economic groups and SC/ST families. A comparison of the various indices showing the percentage of children belonging to under-nourished (mild, moderate and severe) group in the three communities is presented in table 14. The figures show that irrespective of the index, in general higher percentage of rural children belongs to under-nourished/malnourished class followed by those in urban and industrial communities.

Table 10 : Percentage distribution of children according to Dougdale's index class

Community	*Malnourished* <88	*Normal* ≥88–≤10	*Obesity* >110
Industrial	23.0	71.0	6.0
Urban	25.0	68.0	7.0
Rural	44.5	53.0	2.5

Table 11 : Prevalence of various grades of malnutrition (Through Gomez Classification)

Industrial social vairables	*Number and percentage (%) Gomez classification*			
	Normal	*Mild*	*Mode-rate*	*Severe*
Maternal Education				
Illiterate	12(48)	7(28)	4(16)	2(8)
Upto High school	50(59)	32(38)	2(3)	—
College and above	71(87.5)	10(12.5)	—	—
Per Capita Income (Rs),				
≤200	28(56)	18(36)	2(4)	2(4)
>200–≤500	65(72)	23(25.5)	2(2.5)	—
>500	40(80)	8(16)	2(4)	—
Caste				
Upper	59(61.5)	32(33.5)	4(4)	1(1)
Lower	58(67.5)	26(30)	1(1)	1(1)
SC/ST	6(75)	1(12.5)	1(12.5)	—
Total	133(70)	49(26)	6(3)	2(1)

Table 12 : Prevalence of various grades of malnutrition (through Gomez Classification)

Urban social variables	*Number and percentage (%) Gomez classification*			
	Normal	*Mild*	*Moderte*	*Severe*
Maternal Education				
Illiterate	10(52.5)	2(10.5)	6(31.5)	1(5)
Upto High School	57(72)	18(23)	3(4)	1(10)
College and above	133(71)	38(20)	14(7.5)	2(1)
Per capita Income (Rs)				
≤200	16(59)	4(15)	6(22)	1(4)
>200–≤500	103(74)	28(20)	6(5)	1(1)
>50	81(67.5)	26(21.5)	11(9)	2(2)
Caste				
Upper	132(74)	33(18.5)	12(6.5)	1(0.5)
Lower	53(66.5)	18(22.5)	8(9.5)	2(2.5)
SC/ST	15(57.5)	7(27)	3(11.5)	1(4)
Total	200(70)	58(20)	23(8.5)	4(1.5)

Table 13 : Prevalence of various grades of malnutrition (through Gomez Classification)

Rural social variables	*Number and percentage (%) Gomez classification*			
	Normal	*Mild*	*Mode-rate*	*Severe*
Maternal Education				
Illiterate	119(65)	48(26)	12(6.5)	3(1.5)
Upto High School	33(59)	16(28.5)	3(5.0)	4(7)
College and above	1(50)	—	1(50)	—
Per capita Income (Rs)				
≤200	117(63)	51(27.5)	13(7)	4(2)
>200–≤500	34(60)	13(23)	3(5)	1(2)
>500	2(100)	—	—	—
Caste				
Upper	11(58)	6(32)	1(5)	1(5)
Lower	66(69.5)	20(21)	7(7.5)	2(2)
SC/ST	76(60)	38(30)	8(6)	4(4)
Total	153(64)	64(26.5)	16(6.5)	7(3)

Feeding Patterns and Nutritional Index

It is interesting to note that the mean height, weight, Dugadale's Index, weight for age (% of Harvard Standard) and Body-mass index were higher in colostrum-fed babies than the babies not fed with colostrum, in all the communities.

Although the differences in the mean-values between the two groups may not be statitically significant,the trend of having higher anthropometric measurements and higher nutritional status indicates the importance of colostrum for the growth of the child.

Table 14 : Comparison of different nutritional indices

Particulars	*Percentage of children belonging to under nourished class (except normal)*		
	Industrial	*Urban*	*Rural*
Body-mass Index	32	43	52
Mid-arm-circumference	28	33	43
Dugdale's Index	23	25	44.5
Gomez-Class	30	30	36.0

Table 15 : Height, weight, Dugdale's index and percent age weight of Harvard standard of underfive children in relation to rejection of colostrum

Particulars	*Industrial*	*Urban*	*Rural*
(a) Height (cm)			
Colostrum given	86.5	86.64	80.06
Colostrum rejected	86.0	82.53	77.70
(b) Weight (kg)			
Colostrum given	12.3	12.85	11.60
Colostrum rejected	12.2	11.97	10.65
(c) Dugdale's Index			
Colostrum given	107	106	94
Colostrum rejected	98	96	86
(d) Weight-Percent of Harvard standard			
Colostrm given	94	96	89
Colostrum rejected	93	91	82
(e) Body-mass Index			
Colostrum given	0.00153	0.00148	0.00141
Colostrum rejected	0.00142	0.00142	0.00133

Table 16 presents the percentage distribution of malnourished children (Classified according to Dugdale's Index 88 and Gomez classification ≤90) in relation to three major feeding practices. The data reveal that exclusive breast-feeding beyond six months of age results in a higher percentage of malnourished children. In rural community the percentage of malnourished children were 36 in DI class and 16 in GZ class form ≤6 months exclusive breast-feeding against 53 DI class and 56 GZ class from >6 months of exclusive breast feeding. Similarly, there was a wide difference in the distribution of malnourished children between two groups of children divided on the basis of total duration of breast-feeding (≤ 12 months and >12 months) and age of introduction of supplementary food (≤6 and >6 months) in rural community. Chi-square analysis revealed a significant association between duration of exclusive and total breast-feeding and number of malnourished children ($\chi^2 = 7.1$ with DI and 42.46 with GZ, $p<0.05$ in exclusive breast-feeding, and $\chi^2 = 7.2$ with DI and 3.8 with GZ $p<0.05$ in total breast-feeding duration). Thus, the duration of exclusive breast-feeding, total breast-feeding and age of introduction of supplementary food have much more impact on the rural children than on the industrial and urban children. Factors like poverty, poor nutritional knowledge and feeding practice and inadequate health care might be contributing to such low nutritional status of rural children of western Orissa.

In a country as diverse as ours with respect to food habits as well as availability and utilization of health and medical services, regional variations in growth and development, particularly of young children are to be expected. If such variations are significant it would become necessary to take them into consideration in the interpretation of regional data in the context of national standard. Growth retardation is not only an important and objective manifestation of malnutrition but also is the first response to nutritional deprivation.

It has now been generally accepted that nutritional anthropometry has a significant role in the direct assessment of nutritional status in preschool children. It is necessary and important to identify individuals with nutritional disorders or risk of them so that adequate measures can be initiated and programme planning and evaluation can be facilitated.

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Table 16 : Percentage distribution of malnourished children in relation to feeding practices.

Feeding Practices	*Industrial*		*Urban*		*Rural*	
	DI=<88	GZ=<90%	DI=<88	GZ=<90%	DI=<88	GZ=<90%
Exclusive Breast-feeding duration (months)						
≤6	17	26	19	22	36	16
>6	29	34	31	38	53	56
Total breast-feeding duration (months)						
≤12	21	28	27	32	39	27
>12	25	32	23	28	60	45
Age of introduction of supplementary food						
≤6	16	25	22	20	37	30
>6	30	35	28	40	62	42

DI = Dugdale's index GZ = Gomes classification

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