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NUTRITIONAL ASSESSMENT OF PRE-SCHOOL CHILDREN OF KORAPUT BLOCK OF KORAPUT DISTRICT, ODISHA, INDIA: Z-SCORE ANALYSIS

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ABSTRACT

Background: Preschool years are characterized by striking changes in the physical development, language, cognitive and social behaviour. Nutritional anthropometry is widely used for the assessment of the nutritional status of preschool children. Subjects: Three hundred and eight children (o-5 years) were measured for this cross sectional study. Using Z-score value, the underweight, wasting and stunting status was evaluated. Results: Among the sampled children, the indicators of under-nutrition were as follows; underweight (42.9%), wasting (39.6%), and stunting (37.7%). Conclusion: Stunting was lowest among the studied preschool children. A nutrition intervention program should be developed and directed to this vulnerable group, preschool children, to combat these nutritional problems that might predispose children to under nutrition during adulthood.

INTRODUCTION

Environmental influences, mainly the diet, are directly involved in the normal preschool development. Improved nutrition is a key priority in development. Nutritional deprivation in early childhood often causes irreversible damage to physical and mental health. A good nutritional status (prenatal and postnatal) definitely reinforces normal childhood development, meanwhile, malnutrition problems reinforces abnormal growth development including underweight, stunting and wasting [1]. The preschool years, are the years when children are switched from breast feeding or supplementary formula into a steady diet of semisolid foods.

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Preschool children are usually identified by health workers as being the vulnerable group within the community, i.e. the most affected group for any malnutrition problem. Normal physical development, cognition and school performance among preschool children are greatly influenced by the amount of food, quality of the food and food habits (likes and dislikes) [2].

Recent studies have shown that good postnatal nutrition is associated with a low risk of protein energy malnutrition (PEM), autism and leukaemia. The rapid rate of growth during infancy must be matched with adequate food intake, the child (two years to six years of age) is gaining weight of 1.8-2.7 Kg/year and stature is increasing by 7.6 cm/ year [3, 4]. The recommended diet is the diet that includes a variety of foods with different textures and tastes provided throughout the day. Frequent and small meals are the best dietary habits that should be adopted by children,

because the volume of the consumed food at one time is limited by the small stomach capacity. Most of the cross-sectional studies have shown that many children do not receive recommended amounts of fruits and vegetables; instead they consume foods that are rich in sugar, food additives, cholesterol and sodium. Globally, more than one third of under-five deaths are attributable to under-nutrition. About 20 percent of children under-age five in India are wasted, 43 percent underweight and 48 percent stunted [5]. In terms of numbers about 54 million children under five years in India are underweight which constitutes about 37 percent of the total underweight children in the world. In India, 25 million children under five years are wasted and 61 million are stunted, which constitutes 31 percent and 28 percent of wasted and stunted children respectively in the world [6]. There is a critical window of opportunity to prevent under-nutrition – while the mother is pregnant and during child's first two years of life – when proven nutrition interventions offer children the best chance to survive and reach optimal growth and development; after that window closes, the damage to children is largely irreparable. There is a growing emphasis on the problem of stunting in the first two years of life as it not only impact child survival and growth, but also results in diminished cognitive development, school performance and physical development [7]. Anthropometry has an important role in targeting interventions through screening, in assessing the response to interventions, in identifying the determinants and consequences of malnutrition, and in conducting nutritional surveillance [8]. Anthropometric measurements include physical measurements like body weight and height of children and based on the weight and height, a number of indices have been suggested such as weight for age, height for age and weight for height. The US National Center of Health Statistics (NCHS) in 1975 has advocated expressing the deviation from anthropometric measurements of the reference median in terms of standard deviation or Z-scores. In 1978, the World Health Organization (WHO) urged the adoption of NCHS reference population data as normative value for international use [9-12]. The NCHS/WHO growth reference curves were transformed to Z-score presentation and used as a tool to estimate the prevalence rate of malnutrition among preschool aged children. The Z-score (standard deviation scores) represents how far the data of a particular population are distributed (higher or lower) around the reference median [13-17]. Following the classification of WHO database on child growth and using Z-scores analysis; malnutrition problems among preschool children, have been categorized into three categories: Stunting, reflecting a long term growth faltering. A stunted child is defined as one whose height for age Z-score (HAZ) is less than -2 SD of the reference median. Wasting, reflecting acute or recent growth disturbances.

A wasted child is defined as one with weight for height Z-score (WHZ) less than -2SD below the reference median. Underweight, reflecting a combination of disturbances in linear growth and body proportion, underweight child is defined as one with weight for age Z-score (WAZ) less than -2 SD of the reference median.

This study was designed to assess the nutritional status of a sample of preschool children in Koraput block of Koraput district of Odisha, using the most commonly used indices as compared to the NCHS/WHO reference standards in order to identify stunting, wasting and underweight malnutrition problems if exist.

METHODS

Study subjects and setting: This cross-sectional study was implemented in 13 villages of Koraput block of Koraput district. The names of villages are as follows: *Dumuriput, Padampur, Mohanpoda, Limca, Sana Limca, Manbar, Maliguda, Goudaguda, Bod Chindri, Sana Chindri, Duruguda, Boroguda, Lentimaliguda.* The target population was preschool children in the age group 0-5 years. The total sample was 308 children, recruited on voluntary basis with the consent of their parents.

Socio-demographic data: The data on residence, gender, age in months, and food habits were reported. In many areas, birth date was formally registered, and chronological age was obtained through interviews and verified from records. When birth dates were not commonly known or recorded, efforts made to approximate age as accurately as possible using local cultural designations or calendar related events as recommended by WHO (1995)[18]. Anthropometric assessment: The following measurements were carried out for every child according to procedures described by Jelliffe [2]. Weight was recorded to the nearest 0.1-0.5 Kg and height was measured to the nearest 0.1 cm.

Data analysis: The collected data were reviewed and entered into Excel sheets for analysis for computing for means, and standard deviation (SD). Statistical analysis was accomplished using statistical analysis software, spss v.20. Data were translated from Excel into Emergency Nutrition Assessment (ENA) program to calculate Z-scores of anthropometric measurements, height for age, and weight for height and weight for age as compared with the National Center of Health Statistics (NCHS/WHO) reference values.

RESULTS

The distribution of the study sample according to age and gender is presented in table-1, which reveals that the sampled children were 194 boys (representing 63.0 % of the total population) and 114 girls (37.0 % of the total population). The table-1 also represents age-group wise boys and girls percentage.

Table 1. Distribution of age and sex of sample

	Boys		Girls		Total		Ratio
AGE (mo)	**no.**	**%**	**no.**	**%**	**no.**	**%**	**Boy:girl**
6-17	4	100.0	0	0.0	4	1.3	
18-29	48	65.8	25	34.2	73	23.7	1.9
30-41	62	63.9	35	36.1	97	31.5	1.8
42-53	55	61.8	34	38.2	89	28.9	1.6
54-59	25	55.6	20	44.4	45	14.6	1.3
Total	194	63.0	114	37.0	308	100.0	1.7

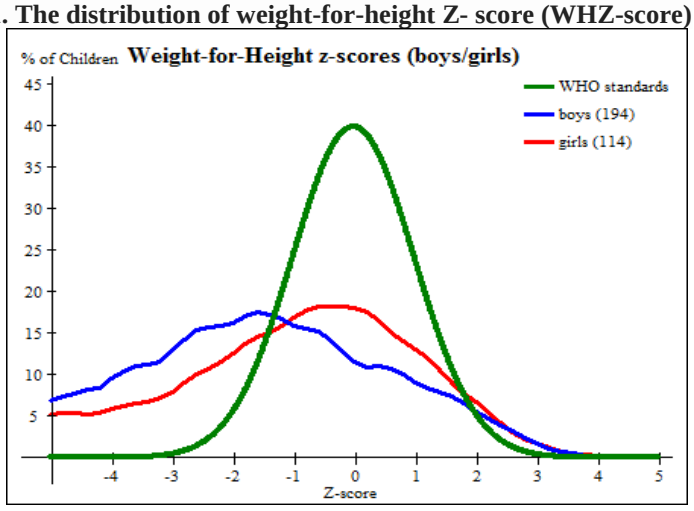
In table-2, the prevalence of acute malnutrition based on weight-for-height Z-score (wasting) and by sex is represented. Out of total 39.6% nutritionally wasted children 10.1% are moderately wasted and 29.5% are severely wasted. This trend is nearly equal for both sexes (boys and girls).

Table 2. Prevalence of acute malnutrition based on weight-for-height z-scores (wasting) and by sex

	All n = 308	**Boys** n = 194	**Girls** n = 114
Prevalence of moderate malnutrition (<-2 z-score and >=-3 z-score)	(31) 10.1 % (7.2 - 13.9 95% C.I.)	(22) 11.3 % (7.6 - 16.6 95% C.I.)	(9) 7.9 % (4.2 - 14.3 95% C.I.)
Prevalence of severe malnutrition (<-3 z-score)	(91) 29.5 % (24.7 - 34.9 95% C.I.)	(59) 30.4 % (24.4 - 37.2 95% C.I.)	(32) 28.1 % (20.6 - 36.9 95% C.I.)
Prevalence of Total malnutrition (<-2 z-score)	(122) 39.6 % (34.3 - 45.2 95% C.I.)	(81) 41.8 % (35.0 - 48.8 95% C.I.)	(41) 36.0 % (27.7 - 45.1 95% C.I.)

Figure (1) displays the distribution of weight-for-height Z-score (WHZ-score) of the children in relative to the reference population defined by (WHO) [15]. The figure shows that, the distribution of boys and girls is shifted to the left suggesting that the sampled children were highly tended to be wasted indicating, acute malnutrition. The overall percentages of acute malnutrition for all children (n=122) were 39.6 %, 34.3 to 45.2 Confidence Intervals (C.I)*. For boys (n=81) the percentage was 41.8% (35.0 to 48.8 C.I*.), meanwhile for girls (n=41) it was 36% (27.7 to 45.1 C.I*) *C.I ≥ 95% Confidence Interval.

Figure 1. The distribution of weight-for-height Z- score (WHZ-score)



In table-3, prevalence of acute malnutrition by age, based on weight-for-height z-scores is explained about the sampled population. Within age group 6-17 months, no child is nutritionally wasted. With the increase of age the wasting increases, though not in a continuous manner. In the age group of 54-59 months, maximum children (35.6%) are under severe wasting category.

Table 3. Prevalence of acute malnutrition by age, based on weight-for-height z-scores

		Severe wasting (<-3 z-score)		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	4	0	0.0	0	0.0	4	100.0
18-29	73	18	24.7	9	12.3	46	63.0
30-41	97	32	33.0	9	9.3	56	57.7
42-53	89	25	28.1	10	11.2	54	60.7
54-59	45	16	35.6	3	6.7	26	57.8
Total	308	91	29.5	31	10.1	186	60.4

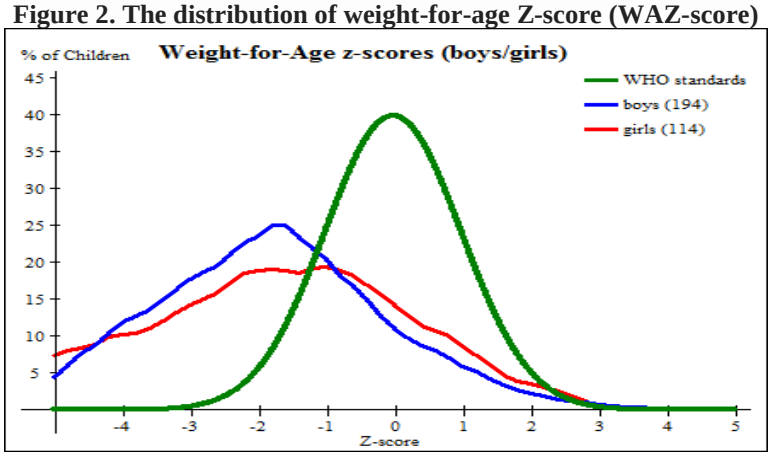
In table-4, the prevalence of underweight based on weight-for-age z-scores by sex is represented. Total 42.9% sampled children are underweight, out of which 16.2% are moderately underweight, whereas 26.6% are severely underweight. Total 43.3% boys and 42.1% girls are underweight.

Table 4. Prevalence of underweight based on weight-for-age z-scores by sex

	All n = 308	**Boys** n = 194	**Girls** n = 114
Prevalence of moderate underweight (<-2 z-score and >=-3 z-score)	(50) 16.2 % (12.5 - 20.8 95% C.I.)	(32) 16.5 % (11.9 - 22.4 95% C.I.)	(18) 15.8 % (10.2 - 23.6 95% C.I.)
Prevalence of severe underweight (<-3 z-score)	(82) 26.6 % (22.0 - 31.8 95% C.I.)	(52) 26.8 % (21.1 - 33.4 95% C.I.)	(30) 26.3 % (19.1 - 35.1 95% C.I.)
Prevalence of total underweight (<-2 z-score)	(132) 42.9 % (37.5 - 48.4 95% C.I.)	(84) 43.3 % (36.5 - 50.3 95% C.I.)	(48) 42.1 % (33.4 - 51.3 95% C.I.)

The distribution of the weight-for-age Z-score of the study sample relative to WHO reference population is illustrated in Figure (2). The results show that the distribution of both boys and girls is highly shifted to the left indicating a trend towards underweight. Prevalence of underweight for all children (n=132) is 42.9% (37.5 to 48.4 C.I*.), and data analysis shows that underweight is more prevalent among boys (n=84) 43.3% (36.5 to 50.3 C.I*) than girls (n=48) 42.1% (33.4 to 51.3 C.I*). *C.I ≥ 95% Confidence Interval.

Figure 2. The distribution of weight-for-age Z-score (WAZ-score)



In table-5, Prevalence of underweight by age, based on weight-for-age z-scores is explained about the sampled population. Within age group 6-17 months, no child is underweight. With the increase of age the underweight status increases. In the age group of 54-59 months, maximum children (60.0%) are severe underweight category and 24.4% are moderate underweight.

Table 5. Prevalence of underweight by age, based on weight-for-age z-scores

		Severe underweight (<-3 z-score)		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	4	0	0.0	0	0.0	4	100.0
18-29	73	7	9.6	2	2.7	64	87.7
30-41	97	17	17.5	15	15.5	65	67.0
42-53	89	31	34.8	22	24.7	36	40.4
54-59	45	27	60.0	11	24.4	7	15.6
Total	308	82	26.6	50	16.2	176	57.1

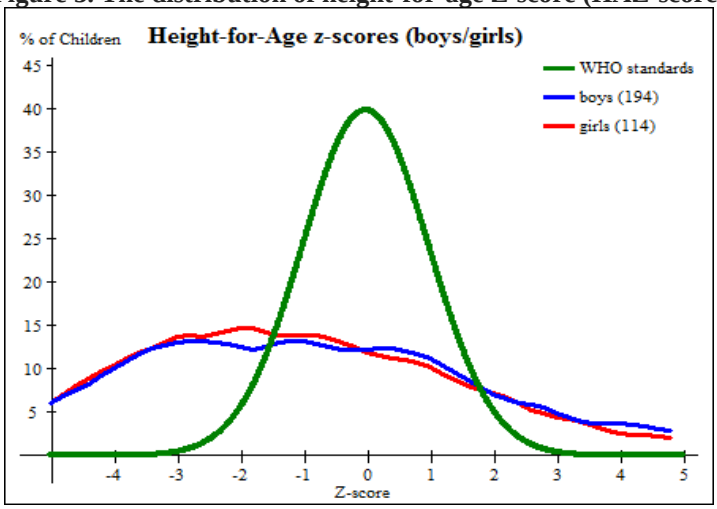
In table-6, the prevalence of underweight based on height-for-age z-scores by sex is represented. Total 37.7% sampled children are nutritionally stunting in nature, out of which 13.6% are moderately stunted, whereas 24.0% are severely stunted. Total 38.7% boys and 36.0% girls are stunted.

Table 6. Prevalence of stunting based on height-for-age z-scores (stunting) and by sex

	All n = 308	**Boys** n = 194	**Girls** n = 114
Prevalence of moderate stunting (<-2 z-score and >=-3 z-score)	(42) 13.6 % (10.2 - 17.9 95% C.I.)	(30) 15.5 % (11.1 - 21.2 95% C.I.)	(12) 10.5 % (6.1 - 17.5 95% C.I.)
Prevalence of severe stunting (<-3 z-score)	(74) 24.0 % (19.6 - 29.1 95% C.I.)	(45) 23.2 % (17.8 - 29.6 95% C.I.)	(29) 25.4 % (18.3 - 34.1 95% C.I.)
Prevalence of total stunting (<-2 z-score)	(116) 37.7 % (32.4 - 43.2 95% C.I.)	(75) 38.7 % (32.1 - 45.7 95% C.I.)	(41) 36.0 % (27.7 - 45.1 95% C.I.)

Figure (3) displays the height-for-age Z score (HAZ) as an indicator for stunting among the sampled children. Percentage of stunting for all sample (n=116) was 37.7% (32.4 to 43.2 C.I*.), for boys (n=75) it was 38.7% (32.1 to 45.7 C.I*.) and for girls (n= 41) it was 36.0% (27.7 to 45.1 C.I*.) *C.I. ≥ 95% Confidence Interval.

Figure 3. The distribution of height-for-age Z-score (HAZ-score)



In table-7, Prevalence of stunting by age, based on height-for-age z-scores is explained about the sampled population. Within age group 6-17 months and 18-29 months, no child is stunted. With the increase of age the stunting status increases. In the age group of 54-59 months, maximum children (66.7%) are severe stunted and 17.8% are moderate stunted.

Table 7. Prevalence of stunting by age based on height-for-age z-scores

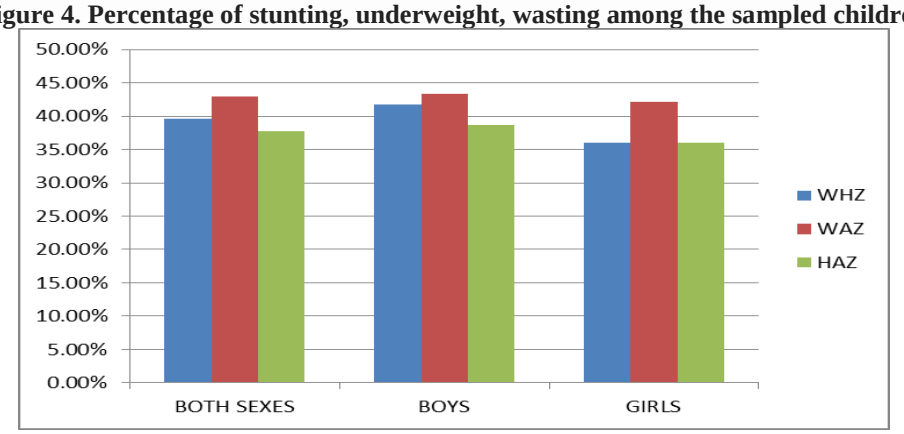
		Severe stunting (<-3 z-score)		Moderate stunting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	**Total no.**	**No.**	**%**	**No.**	**%**	**No.**	**%**
6-17	4	0	0.0	0	0.0	4	100.0
18-29	73	0	0.0	0	0.0	73	100.0
30-41	97	2	2.1	22	22.7	73	75.3
42-53	89	42	47.2	12	13.5	35	39.3
54-59	45	30	66.7	8	17.8	7	15.6
Total	308	74	24.0	42	13.6	192	62.3

Table 8. Distribution of the study sample by the WHZ, WHZ and HAZ scores

	BOTH SEXES	BOYS	GIRLS
WHZ	39.60%	41.80%	36.00%
WAZ	42.90%	43.30%	42.10%
HAZ	37.70%	38.70%	36.00%

The data on (figures 1, 2 and 3) were summarized in table-8 and it shows that WAZ (underweight indicator) was the highest, 42.9%, among sexes followed by WHZ (wasting indicator), 39.6% and HAZ (stunting indicator) 37.7%. Sex differences were statistically significant among boys (43.3%) and girls (42.1%) in relative to WAZ (Figure-4).

Figure 4. Percentage of stunting, underweight, wasting among the sampled children



DISCUSSION

In cross-sectional surveys, the use of appropriate anthropometric indicators allows the identification of the nature and extent of malnutrition among infants and young children in the sampled children. Periodical assessments are useful for follow-up of populations, comparison between groups, evaluation of dietary intervention programs and statistical comparisons in nutritional epidemiological research. NHCS/WHO advocated three anthropometric indices as indicators for under-nutrition among preschool children.

A child's growth responds to malnutrition in two ways that can be measured by anthropometry; (a) cessation of growth, stunting (short stature), results in low height-for age and it reflects past under nutrition. (b) Wasting, short-term response to inadequate intakes and commonly assessed by weight relative to height. Unlikely, weight for age reflects underweight and could be low because of stunting and/or wasting, thus children classified on the basis of weight for age criteria are a mixed group in terms of their nutritional status. The study results show that stunting indicator, HAZ, as well as underweight indicator, WAZ, was none significantly different among boys when compared with their girls' counterpart. According to the findings of this study the following recommendations were formulated:

a. A more detailed study covering a large sample is needed to confirm the prevalence of malnutrition among preschool children in Koraput.

b. Nutrition intervention programs should be developed and positively & assuredly directed to preschool children to combat malnutrition problems which may predispose to malnutrition problems during adulthood.

CONCLUSION

In conclusion, the results of this study indicate that: Overweight and obesity are not prevalent among the studied sample; Underweight (42.9%), stunting (37.7%) and wasting (39.6%) were in the sampled population; Underweight, stunting, and wasting were generally more prevalent among boys. Different anthropometric indices are equally important in addressing malnutrition among preschool children.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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