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Assessment of nutritional status in respect of Anthropometric Profile among the Indigenous Santal children of Santuri Block, Purulia, West Bengal

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Abstract
Background: The prevalence of undernutrition is higher among the tribal population with respect to all anthropometric measures. The prevalence is twice as high among the economically indigent families. The situation is worse among the girl children. Santals are predominantly distributed in different parts of West Bengal. Therefore, the present cross-sectional study aimed to assess age and sex variation in nutritional status with respect to anthropometric profile among the Santal primary school-going children aged 5 to 9 years of Santuri block, Purulia, West Bengal.
Materials and methods: A total of 200 children (58 boys and 142 girls) were included. Height, weight and body mass index of the children were converted into age-specific Z-scores. Under- (stunting, underweight and thinness) and over-nutrition (overweight and obesity) based on age and sex-specific Z-score were assessed as per the criteria of WHO, 2003.
Results: The majority of the children were found with normal HAZ, WAZ and BMIZ. Prevalence of under-nutrition (3% stunting, 0.5% underweight and 1% thinness) and over-nutrition was very low. It is noteworthy that the prevalence of both under- and over-nutrition is higher among girls than boys; all the over-nourished children were girls.
Conclusion: The population is mostly normal in nutritional status. Effective measures should be taken to eradicate the existence of malnutrition with a special focus on girls.
***Keywords**:* Children, India, Malnutrition, Nutritional status, Santal, West Bengal.

Introduction

During the pre-adolescence period, the nutritional requirements increase with the increasing growth rate. A nutritious and safe diet, healthy nutritional practices and vital

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nutrition services ensure proper growth and development during this period. Contrarily, malnutrition during pre-adolescence leads to long-term adverse consequences in physical and mental health (UNICEF, 2021). Malnutrition (both under and over-nutrition) is a serious public health burden in developing countries viz. India. Despite several nutritional and social development programs actively operating among the vulnerable groups, India has been reported with a very high prevalence of malnutrition among children in respect of height and weight. About 61 million children in India are stunted, 101 million are underweight and 52 million are wasted (Mollah et al., 2020, Mollah et al., 2021). Malnutrition adversely affects the immune system leading to poor immune response and the development of lethal infection among children (Goswami et al., 2022). Recent findings suggest that about one-third of child deaths in India are caused by undernutrition (Mukhopadhyay and Biswas, 2011). This situation is worse in the indigenous population on almost every measure (Mahapatra et al., 2019). Several factors including illiteracy, financial insufficiency, social-cultural backwardness, reliability on only traditional way of treatment etc. hinder them to adapt with the mainstream population. Due to this, despite having certain constitutional reservations in educational and professional sectors, the rate of engagement in such areas is still scanty. Consequently, their health and nutritional status have not improved significantly (Goswami et al., 2022).

India is the homeland of nearly 705 indigenous populations comprising 86% of the total population (Mollah et al., 2020). Around 48% of the tribal population of West Bengal comprises the Santal community; among them 94% are rural. Purulia is a Santal-dominated district where ~63% of the tribal communities are Santal who are predominantly rural residents (98.87%). Santuri is a community development block of Purulia where ~32% population are tribal (Census of Government of India, 2011). Our present research was undertaken in five villages of Santuri Block, Purulia. The subsistence pattern of the under-study rural population is solely dependent on daily labour jobs. They barely consume foods other than rice, vegetables, puffed rice, and tea due to their incapability to afford other food items. Therefore, it was hypothesized that there might be a higher prevalence of undernutrition among the children in the population due to financial and nutritional insufficiency.

Anthropometry is widely used to assess body size and composition because it is a simple, cost-effective and non-invasive method which provides essential information on short-term nutritional disorders and specific nutrient deficiencies (Gibson, 2021). Considering the above facts, our study aimed to assess age and sex variation in nutritional status in respect of anthropometric profile among the Santal primary school-going children aged 5 to 9 years of Santuri block, Purulia, West Bengal.

Materials and Methods

Study area and people: The present community-based, cross-sectional study was conducted among two hundred (200) Santal primary school-going children aged 5 to 9 years (58 boys and 142 girls) living in five randomly selected villages (Garsika, Kendthol, Kharbar, Kherat and Shaloni) of Santuri Block, Purulia, West Bengal.
Data collection: Data was collected by house-to-house visits and the sample size was based on the availability of children. Prior approval was taken from local community leaders and other administrative authorities. Besides, parents' verbal consent was taken before data collection.
Socio-demographic information: The age and sex of the children and the educational and occupational status of the parents were recorded. Age was calculated based on the date of birth noted in the local school register or Birth Certificate.
Anthropometric measurements: Anthropometric measurements i.e. height and weight were recorded using standard protocol (Lohman et al., 1988). Height and weight were measured to the nearest 0.1 cm and 0.5 kg, respectively.
Statistical analyses: The height and weight of the children were converted into age-specific Z-scores using WHO Anthro+ software and all analyses were performed using SPSS (PC+ v.16). Children were divided into 5 age groups and age group variation in anthropometric profiles were analyzed by one-way analysis of variance (ANOVA). Independent sample t-tests were performed to analyze sex variation in anthropometric profiles. Furthermore, a chi-square test was performed to find out age group variation in nutritional status based on three anthropometric indices i.e. height-for-age, weight-for-age and BMI-for-age. Yates correction was performed before the chi-square analysis to prevent the overestimation of statistical significance. Under- and over-nutrition based on age and sex-specific Z-score was assessed as per the criteria of the World Health Organization (WHO, 2006) which are as follows-
<-2 Z-score= Stunted (low HAZ), underweight (low WAZ), and Thin (low BMIZ);
>+2 Z score= Over-nutrition.

Results

Age and sex-specific descriptive statistics of anthropometric variables are presented in Tables 1 and 2. One-way ANOVA revealed that the differences in height and weight among the five age groups were statistically significant at 0.001 level. The mean height and weight were higher among the boys than the girls. The independent sample t-test revealed a statistically significant difference in height at 0.03 level.
The age and sex combined prevalence of stunting was 3% (no boys vs. 3% girls), underweight 0.50% (0.50% boys vs. no girls), and thinness 1% (0.50% boys and

0.50% girls). Based on height-for-age, 2% of children were over-nourished, based on weight-for-age, 4% of children were overweight 0.50% were obese and based on BMI-for-age, 1% of children were over-nourished and 1% were obese; all of the children were girls.

Nutritional status based on HAZ represented in Table 3 shows that the majority of the population obtained normal height based on their age while 13.90% of children of 5 years, 4% of children of 6 years were stunted and 6.50% of children of 9 years of age were over-nourished. Again, among the stunted children of the 5 and 6 years of age group, only the girls were found as stunted. However, there were no statistically significant age group differences in the nutritional status based on HAZ.

Nutritional status based on WAZ represented in Table 4 shows that all the children aged 5 to 7 years attained normal weight for age. 95.80% of the children aged 8 years attained normal weight for age while only 4.20% of children were overweight. The majority i.e. 87.10% of the children aged 9 years were of normal weight for age, 1.60% were underweight, 9.70% were overweight and 1.60% were obese. The only child found underweight among the age group of 9 years was a boy; all the overweight and obese children of this age group were girls. There were strong statistically significant differences in the nutritional status based on WAZ ($p<0.001$).

Nutritional status based on BMIZ represented in Table 5 shows that the majority of the children of all age groups attained a normal BMI for age. 3.40% of children of 7 years of age were moderately thin; 2.10% of children of 8 years of age were over-nourished and 2.10% were obese. 1.60% of children of 9 years of age were over-nourished and 1.60% were obese. The only thin child in the age group of 7 years was a girl. All the overweight and obese children of 8 years were girls. The only thin child in 9 years age group was a boy and the overweight and obese children were girls. There were no statistically significant age group differences in the nutritional status based on BMIZ.

Discussions

According to the classification of WHO (WHO, 1995), the prevalence of under-nutrition and over-nutrition is low (<20%) in the study population. The majority of the children were found with normal HAZ, WAZ and BMIZ. However, it is notable that the prevalence of both under- and over-nutrition is higher among girls than boys. Similar outcomes can be found in some other studies also (Mitra et al., 2000; Choudhury et al., 2000; Chowdhury et al., 2008).

The prevalence of malnutrition among children from economically indigent families is twice as high as that of children from economically affluent families (Asim and Nawaz, 2018). Further, the percentage of malnourished girl children is higher as

compared to the boys. The foremost reason for this is gender inequality in the disbursement of food, education and health expenses (Smith and Haddad, 2015). Among the poor families, the predilection towards the boy children is apparently observed in child care as they think that the boys will play an important role in their economic development. On the other hand, the girl children are incidentally treated as a burden (Shafiq et al., 2022). Children with severe acute malnutrition are prone to several diseases like diarrhoea, malaria, pneumonia, etc. (Haq et al., 2022). Shafiq et al., reported a higher number of girl child mortality due to diarrhoea in Bangladesh as they were more prone to malnutrition, incomplete or non-immunization, electrolyte deficiency, etc. (Shafiq et al., 2022).

Stunting is a measure of long-term under-nutrition while underweight may be due to recent weight loss. On the other hand, overweight and obesity have several harmful health consequences in adult life. Hence, optimum nutrition is highly expected irrespective of sex to maintain the healthy physical and mental state of the children. With the formulation and implication of several health policies, the prevalence of stunting has decreased by 14% and the prevalence of underweight has decreased to 22.6% (UNICEF, 2021). Despite the financial and nutritional insufficiency ubiquitously existing in the under-study population, a major proportion of the children have normal nutritional status concerning anthropometric profile. Therefore, future studies may have scope to reveal the underground biological factors which played an advantageous role in obtaining an apparently healthy nutritional status.

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***Authors' contribution*:** MM is responsible for data collection and analysis. AM and MM are responsible for preparing the manuscript.

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TABLES

Table 1: Age group variation in anthropometric variables among the children

Age (years)	n	Height (cm)		Weight (kg)	
		Mean±SD	Range	Mean±SD	Range
5	36	102.52±7.64	28.90	14.34±2.39	9.00
6	25	110.42±7.30	33.20	16.42±2.53	9.50
7	29	112.33±6.404	22.80	18.38±2.32	8.50
8	48	114.60±8.15	38.10	17.93±3.70	19.00
9	62	123.80±7.57	32.70	21.67±4.48	30.50
F-value		48.702*		29.855*	

*significant at 0.001 level.

Table 2: Sex variation in anthropometric variables among the children

Age (years)	n	Height (cm)		Weight (kg)	
		Mean±SD	Range	Mean±SD	Range
Boys	58	116.12±8.31	32.10	18.31±3.56	17.50
Girls	142	113.74±11.30	54.70	17.92±4.69	29.00
t-value		4.756**		2.787	

**significant at 0.03 level.

Table 3: Assessment of nutritional status based on Height for Age among age-groups

Age (in years)	Stunted			Normal			Over-nourished		
	Boys n (%)	Girls n (%)	Overall n (%)	Boys n (%)	Girls n (%)	Overall n (%)	Boys n (%)	Girls n (%)	Overall n (%)
5	0 (0.00)	05 (100.00)	05 (13.90)	09 (29.03)	22 (70.96)	31 (86.10)	0 (0.00)	0 (0.00)	0 (0.00)
6	0 (0.00)	01 (100.00)	01 (4.00)	05 (20.83)	19 (79.16)	24 (96.00)	0 (0.00)	0 (0.00)	0 (0.00)
7	0 (0.00)	0 (0.00)	0 (0.00)	07 (24.13)	22 (75.86)	29 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
8	0 (0.00)	0 (0.00)	0 (0.00)	16 (33.33)	32 (66.66)	48 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
9	0 (0.00)	0 (0.00)	0 (0.00)	21 (36.20)	37 (63.79)	58 (93.50)	0 (0.00)	04 (100.00)	04 (6.50)
Total	0 (0.00)	06 (3.00)	06 (3.00)	58 (29.00%)	132 (66.00)	190 (95.00)	0 (0.00)	04 (2.00)	04 (2.00)
χ^2 value	589.113								

Table 4: Assessment of under-nutrition based on weight for Age among age-groups

Age (in years)	Underweight			Normal			Overweight			Obese		
	Boys n (%)	Girls n (%)	Overall n (%)	Boys n (%)	Girls n (%)	Overall n (%)	Boys n (%)	Girls n (%)	Overall n (%)	Boys n (%)	Girls n (%)	Overall n (%)
5	0 (0.00)	0 (0.00)	0 (0.00)	09 (25.00)	27 (75.00)	36 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
6	0 (0.00)	0 (0.00)	0 (0.00)	05 (20.00)	20 (80.00)	25 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
7	0 (0.00)	0 (0.00)	0 (0.00)	07 (24.13)	20 (68.96)	29 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
8	0 (0.00)	0 (0.00)	0 (0.00)	16 (34.78)	30 (65.21)	46 (95.80)	0 (0.00)	02 (100.00)	02 (4.20)	0 (0.00)	0 (0.00)	0 (0.00)
9	01 (100.00)	0 (0.00)	01 (1.60)	20 (37.03)	34 (62.96)	54 (87.10)	0 (0.00)	06 (100.00)	06 (9.70)	0 (0.00)	01 (100.00)	01 (1.60)
Total	01 (0.50)	0 (0.00)	01 (0.50)	57 (28.50)	131 (65.50)	190 (95.00)	0 (0.00)	08 (4.00)	08 (4.00)	0 (0.00)	01 (0.50)	01 (0.50)
χ^2 value	248.406*											

*significant at 0.001 level.

Table 5: Assessment of under-nutrition based on BMI for Age among age-groups

Age (in years)	**Thin**			**Normal**			**Over-nourished**			**Obese**		
	Boys n (%)	**Girls n (%)**	**Overall n (%)**	**Boys n (%)**	**Girls n (%)**	**Overall n (%)**	**Boys n (%)**	**Girls n (%)**	**Overall n (%)**	**Boys n (%)**	**Girls n (%)**	**Overall n (%)**
5	0 (0.00)	0 (0.00)	0 (0.00)	09 (25.00)	27 (75.00)	36 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
6	0 (0.00)	0 (0.00)	0 (0.00)	05 (20.00)	20 (80.00)	25 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
7	0 (0.00)	01 (100.00)	1 (3.40)	07 (25.00)	21 (75.00)	28 (96.60)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
8	0 (0.00)	0 (0.00)	0 (0.00)	16 (34.78)	30 (65.21)	46 (95.80)	0 (0.00)	01 (100.00)	01 (2.10)	0 (0.00)	01 (100.00)	01 (2.10)
9	01 (100.00)	0 (0.00)	1 (1.60)	20 (33.89)	39 (66.10)	59 (95.20)	0 (0.00)	01 (100.00)	01 (1.60)	0 (0.00)	01 (100.00)	01 (1.60)
Total	01 (0.50)	01 (0.50)	02 (1.00)	57 (28.50)	137 (68.50)	194 (97.00)	0 (0.00)	02 (1.00)	02 (1.00)	0 (0.00)	02 (1.00)	02 (1.00)
χ^2 value	768.403											

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