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Assessment of Nutritional Status by Anthropometric Indices in Santal Tribal Children

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ABSTRACT An ethnic based cross-sectional study was undertaken to determine the rate of stunting, underweight and wasting using new anthropometric indices (stunting index, underweight index and wasting index) with respect to the overall undernutrition among the Santal children. A total of 251 (116 boys and 135 girls) aged 2-6 years were measured. Three commonly undernutrition indicators among children, that is, stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight-for-height) and new composite index, namely Composite Index of Anthropometric failure (CIAF) were used to evaluate the nutritional status. Present data was also compared with the other studies using CIAF. Among the studied Santal children, 26.3 % (stunted), 38.2 % (underweight), 12.7 % (wasted) and 43.4 % were CIAF. The underweight index showed a higher rate (0.881) followed by stunting index (0.606) then wasting index (0.294) out of the overall undernutrition. Other studies also validate that there were more underweight children than stunted and wasted. Supportive health and nutrition promotional programs can be formulated based on the findings of the new anthropometric indices with the ultimate objective to enhance the childhood undernutrition (particularly underweight) in all population of India.

INTRODUCTION

Health is a prerequisite for human development and is an essential component for the well-being of the mankind. The health problems of any community are influenced by interplay of various factors including biological, social, economic and political ones. The common beliefs, customs, practices related to health and dise-ase in turn influence the health seeking behaviour of the community (Gopalan 2008). Infants and young children grow rapidly and require nutrients not only for maintenance of healthy and active life but also for growth. They require relatively more nutrients (2-3 times) per kilogram body weight than adults. Age, gender and body weight largely determine the nutrient requirement of an individual. Body weights and heights of children reflect their state of health, nutrition and growth rate (ICMR 2009). Weights and heights of adults represent what can be attained by an individual with normal growth (ICMR 2009). Chronic undernutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life and also the economic productivity of people (Scrimshaw 1996). According to recent National Family Health Survey (NFHS-3 2005-2006) and UNICEF Reports (2000), 46% of preschool children and 30% of adults in India suffer from moderate and severe grades of protein-calorie malnutrition as judged by anthropometric indicators. Global comparative data indicate that contrary to common perception, prevalence of undernutrition is highest in South Asian children (SCN 2004). The three most commonly used internationally recommended anthropometric indicators are stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight-for-height) (WHO 1995). Stunting (ST) reflects a failure to reach linear growth potential due to sub-optimal health and/or nutritional conditions, underweight (UW) reveals low body mass relative to chronological age, which is influenced by both, a child's height and weight. ST is an indicator of chronic undernutrition, the result of prolonged food deprivation and/or disease or illness. UW thus cannot distinguish between a child that is small in weight relative to his/her height and a child that is low in height relative to his/her age, but who may be normal in weight-for-height. On the other hand, wasting (WS) is an indicator of acute undernutrition, the result of more recent food deprivation or illness; UW is used as a composite indicator to reflect both acute and chronic undernutrition, although it cannot distinguish between them (WHO 1995).

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However, because they overlap, none is able to provide a comprehensive estimate of the number of undernourished children in a population; some children who are ST will also have WS and/or be UW; some children who are UW will also have WS and/or be ST; and some children who have WS will also be ST and/or UW (Nandy et al. 2005).

The objective of the present study is to evaluate the nutritional status of the Santal children aged 2-6 years of Purulia using new anthropometric indices (stunting index, underweight index and wasting index) and to compare the findings with the other studies on the nutritional status (assessed by z-score) of children.

MATERIAL AND METHOD

The present study was a community based, cross-sectional study conducted in twelve different villages (namely Bidhakata, Amdiha, Kendberia, Dubrajpur, Gundlubhita, Duhugura, Banglakuli, Tusuliam, Muktipur, Eriyakusum, Moroldih and Moroldih-2) of Santuri block, Purulia District, that are situated about 250 km from Kolkata, the capital of West Bengal, India. This study was carried out from November 2009 to February 2010. A total of 251 (116 boys and 135 girls) of age 2-6 years Santal tribal preschool children were measured. Data were collected after obtaining necessary approval from the parents, villages and block authorities, and parents informed of the aims of the study prior to commencement of measurement. The institutional ethical committee gave approval to the data schedule. Information on age, gender, weight and height was collected on a pre-tested questionnaire by house-to-house visit, following interview and examination. Height and weight measurements were taken for each subject by the first author (S.D.) following standard techniques (Lohman et al. 1988). Technical errors of measurement found to be within reference values (Ulijaszek and Kerr 1999) and thus not incorporated in statistical analyses. Three commonly used undernutrition indicators, that is, stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight-for-height) were used to evaluate the nutritional status of the subjects and CIAF for the total children. According to the 2001 census, the district has a population of 25, 36,516, out of which 89.93 % are residing in rural areas and 10.07% are in urban areas. Out of this total population, 19.22 % belongs to Scheduled Tribes. Purulia district is having the second highest percentage of tribal population (18.3%) in West Bengal. Santals belong to the Proto-Australoid group with dark skin colour, sunken nose and lower forehead. Santals comprise 62.66 % of the total tribal population of Purulia, West Bengal. Anthropometry is an essential component of child health supervision and the epidemiological assessment of the nutritional status of a defined population of children. Therefore, use of anthropometrical charts in public health clinics, supplemental feeding programs, community health and nutrition surveys and in physicians' offices can assist in identification of individuals with growth or nutritional abnormalities. Internationally accepted growth reference of the National Center for Health Statistics (NCHS) (Hamill et al. 1979) was used as reference data for the assessment of physical growth. The reference population consisted of the children from various segments of the United States population measured in the 1960s and 1970s. The criterion of failure was a z-score below–2. Z-scores were calculated following the standard formula:

Z-score = X-Median of NCHS/Standard deviation of NCHS

Where X is an individual value, three Z scores were calculated: HAZ = Height-for-age Z-score; WAZ = Weight-for-age Z-score; WHZ = Weight-for height Z-score

Based on WHO (1995), undernutrition was defined as follows:

Stunting: HAZ < - 2SD (standard deviation);
Underweight: WAZ < - 2SD;
Wasting: WHZ < - 2SD.

For assessing the CIAF (Nandy et al. 2005) model of seven groups of children (A to G) was used. These groups include with height and appropriate for their age (that is, above –2 z-scores) and who are not in "anthropometric failure", and those children whose height and weight for their age are below the norm (that is, below–2 z-scores) and thus experiencing one or more forms of "anthropometric failure". The CIAF excludes those children not in anthropometric failure (group A) and includes all who are stunted or underweight or wasted and their combinations (groups B–G) (see Table 1). All statistical analyses were undertaken using the Statistical Package for Social Science and Emergency Nutrition Assessment program. In this paper, we use the three new indices of childhood undernutrition.

The formulas of the three indices are (Bose and Mandal 2010):
Stunting Index (SI) = Stunting / CIAF
Underweight Index (UI) = Underweight / CIAF
Wasting Index (WI) = Wasting / CIAF
These indices do not have any unit.

Table 1: Classification of children with anthropometric failure (CIAF)*

Group name	*Description*	*Wasting*	*Stunting*	*Underweight*
A	No failure	No	No	No
B	Wasting only	Yes	No	No
C	Wasting and underweight	Yes	No	Yes
D	Wasting, stunting and underweight	Yes	Yes	Yes
E	Stunting and underweight	No	Yes	Yes
F	Stunting only	No	Yes	No
Y	Underweight only	No	No	Yes

* Classification following Nandy et al. 2005

RESULTS

Table 2 presents the prevalence of ST, UW, WS and CIAF among the Santal preschool children. Results revealed that 26.3 %, 38.2 % and 12.7 % were suffering from ST, UW and WS. The CIAF showed a higher prevalence of undernutrition with 43.4 % of the Santal children suffering from anthropometric failure (CIAF), in comparison to other three indicators (ST, UW and WS).

Table 3 presents the sex-specific as well as sex-combined values of the three new indices, SI, UI and WI. These sex-combined overall values of SI, UI and WI were 0.606, 0.881 and 0.294, respectively. The corresponding values among boys were 0.655, 0.836 and 0.309. Among girls they were 0.556, 0.926 and 0.278, respectively.

DISCUSSION

Figure 1 shows the comparative rate of undernutrition among the five different studies done by other scholars and the present study. We have calculated SI, UI and WI from the previous studies done by the scholars from different parts of India, have reported higher rate of SI 0.756 (Nandy et al. 2005), 0.723 (Seetharaman et al. 2007), 0.799 (Biswas et al. 2009) and lower rate of SI 0.364 (Mandal and Bose 2009), 0.591 (Das and Bose 2009) than the present study (0.606). Reported rate of UI was lower among the other studies 0.788 (Nandy et al. 2005), 0.681 (Seetharaman et al. 2007), 0.866 (Mandal and Bose 2009), 0.799 (Biswas et al. 2009), 0.774 (Das and Bose 2009) than the present study (0.881). Similarly, the rate of WI was higher among the studies were (0.684 (Mandal and Bose 2009), 0.400 (Das and Bose 2009); lower among the (0.266 (Nandy et al. 2005), 0.175 (Biswas et al. 2009) and equal with the 0.294 (Seetharaman et al. 2007) present study (0.294).

Usually, ST, UW and WS have been used as anthropometric indicators of undernutrition among children (Bhattacharya 2000; Lee and Nieman 2003; Bose et al. 2007). However, in studies evaluating childhood nutritional status, the CIAF has also been utilised and validated by investigations from Kenya (Berger et al. 2006), South Asia and Sub-Saharan Africa (Harttgen and Misselhorn 2006), China (Dang and Yan 2007),

Table 2: Prevalence (%) of undernutrition among the Santal children aged 2-6 years

Category	*Age (Years)*					
	2 (n = 36)	*3 (n = 59)*	*4 (n = 38)*	*5 (n = 45)*	*6 (n = 73)*	*Total (n = 251)*
Stunted	22.2	33.9	28.9	24.4	21.9	26.3
Underweight	33.3	49.2	34.2	40.0	32.9	38.2
Wasted	8.3	20.3	7.9	20.0	6.8	12.7
CIAF	38.9	57.6	39.5	44.4	35.6	43.4

Table 3: Values of SI, UI and WI among the Santal children

Index	*Boys (CIAF = 55)*	*Girls (CIAF = 54)*	*Overall sex combined (CIAF = 109)*
SI = Stunting / CIAF	36/55= 0.66	30/54 = 0.57	66/109 = 0.61
UI = Underweight / CIAF	46/55 = 0.84	50/54 = 0.93	96/109 = 0.88
WI = Wasting / CIAF	17/55 = 0.31	15/54 = 0.28	32/109 = 0.29

Boys: n = 116; Girls: n = 135

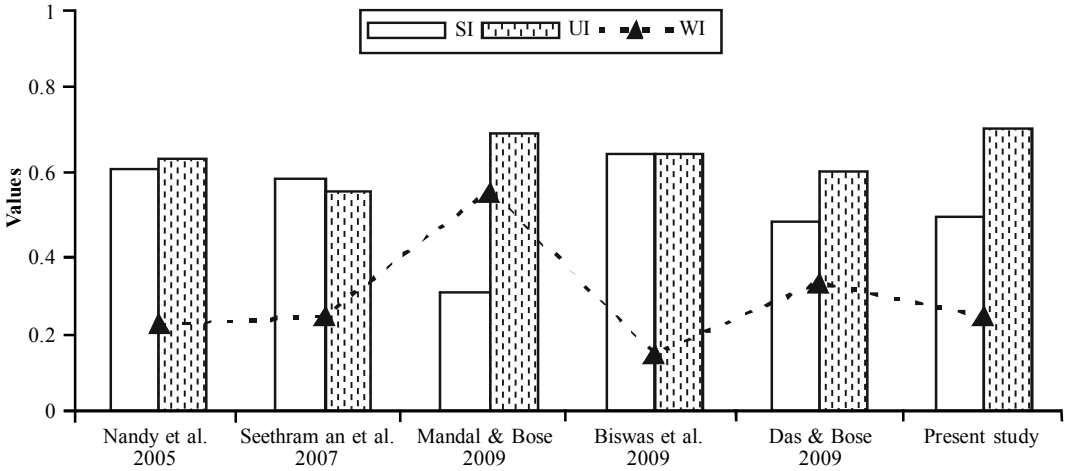

Fig. 1. Comparison of SI, UI, and WI of different studies

India (Seetharaman et al. 2007), Botswana (Mahgoub et al. 2009), Cameroon (Emina 2009) and West Bengal (Mandal and Bose 2009). In view of this, the present study was undertaken to evaluate the levels of stunting, underweight, wasting and CIAF and, especially, to assess the overall rate of undernutrition by using three new indices SI, UI, and WI among rural 2-6 years old Indian Santal tribe of Purulia District. The rate of SI in the present study (0.606) was higher than that reported in two studies 0.364 (Mandal and Bose 2009) and 0.591 (Das and Bose 2009) and lower than other three studies 0.756 (Nandy et al. 2005), 0.723 (Seetharaman et al. 2007) and 0.799 (Biswas et al. 2009). For UI, the rate (0.881) is also much higher than that reported in the other studies 0.788 (Nandy et al. 2005), 0.681 (Seetharaman et al. 2007), 0.866 (Mandal and Bose 2009), 0.799 (Biswas et al. 2009) and 0.774 (Das and Bose 2009). For WI, the rate of 0.294 was also high as compared with 0.266 (Nandy et al. 2005) and 0.175 (Biswas et al. 2009) and lower than 0.684 (Mandal and Bose 2009) and 0.400 (Das and Bose 2009). Anthropometric indices (SI, UI and WI) provide an overall estimate of the rate of undernourished children in a population, which is not provided by any of the conventional indices.

As evidenced by the current study, the use of stunting, underweight, wasting and CIAF as the criterion for identifying undernourished children may underestimate the true impact of undernutrition. Use of the SI, UI and WI helps the researchers to envisage the extent of the underestimation. The present study is limited by its small sample size, being from one area of West Bengal, India. Though, what we suggest is that they provide additional information on the rate of different forms of undernutrition relative to the total level of undernutrition in a particular population. These results may, therefore, only be representative of a small community and not representative of the state or country. To obtain a broader representation, we suggest that more studies involving SI, UI and WI among preschool children from different parts of India be undertaken. Valuable health and nutritional promotion programs can be formulated based on the findings of these researches with the ultimate objective of decreasing undernutrition in these areas.

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