Stunting, underweight and wasting among Integrated Child Development Services (ICDS) scheme children aged 3–5 years of Chapra, Nadia District, West Bengal, India

Kaushik Bose, Sadaruddin Biswas, Samiran Bisai, Sanjib Ganguli, Argina Khatun, Ashish Mukhopadhyay and Mithu Bhadra

Department of Anthropology, Vidyasagar University, West Bengal, India

Abstract

This study investigated age and sex variations in height and weight, levels of stunting, underweight and wasting among 533 (254 boys; 279 girls) 3- to 5-year-old rural children of Bengalee ethnicity at 11 Integrated Child Development Services centres of Nadia District, West Bengal, India. Height-for-age, weight-for-age and weight-for-height < –2 *z*-scores were used to evaluate stunting, underweight and wasting, respectively, following the National Center for Health Statistics (NCHS) Guidelines. Results revealed that boys were significantly heavier than girls at age 3 years. Significant age differences existed in mean height and weight in both sexes. Mean *z*-scores of height-for-age, weight-for-age and weight-for-height were lower than those of NCHS for both sexes at all ages. The overall (age and sex combined) rates of stunting, underweight and wasting were 23.9%, 31.0% and 9.4%, respectively. The rate of underweight and wasting was higher among girls (underweight = 35.1%, wasting = 12.2%) compared with boys (underweight = 26.5%, wasting = 6.3%). In general, the frequency of stunting increased with increasing age in both sexes. Based on the World Health Organization classification of severity of malnutrition, the overall prevalence of underweight was very high (≥30%). The prevalence rates of stunting (20–29%) and wasting (5–9%) were medium. In conclusion, the nutritional status of the subjects is unsatisfactory. There is scope for improvement in the form of enhanced supplementary nutrition.

Keywords: India, Bengalee, preschool children, stunting, underweight, wasting.

Introduction

Child growth is widely used to assess adequate nutrition, health and development of individual children, and to estimate overall nutritional status and health of populations. Compared with other health assessment tools, measuring child growth is a relatively inexpensive, easy-to-perform and non-invasive process (WHO 1995; Lee & Nieman 2003; Blössner *et al*. 2006). During the preschool age period, children have special nutritional needs because of their extensive growth and development (WHO 1995; Lee & Nieman 2003; Bishnoi *et al*. 2004). The legacy of malnutrition,

Correspondence: Dr Kaushik Bose, Reader and Head of Department, Department of Anthropology, Vidyasagar University, Midnapore – 721 102, West Bengal, India. E-mail: banda@vsnl.net

especially among preschool children, is a huge obstacle to overall national development (Bishnoi *et al*. 2004). Undernutrition among preschool children is an important health problem in rural India (Saxena *et al*. 1997; Yadav & Singh 1999; Mahapatra *et al*. 2000; Brahmbhatt *et al*. 2001; Rajaram *et al*. 2003; Kumar & Bhawani 2005; Ray 2005) including West Bengal (Mustaphi & Dobe 2005). However, there exists scanty information of the prevalence of undernutrition among preschool children in India (George *et al*. 2000; Bishnoi *et al*. 2004; Kumari 2005) and West Bengal (Shaikh *et al*. 2003; Mustaphi & Dobe 2005).

Three internationally recommended indicators most commonly used are child stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight-for-height) (WHO 1995; Lee & Nieman 2003). While stunting reflects a failure to reach linear growth potential due to suboptimal health and/or nutritional conditions, underweight reveals low body mass relative to chronological age, which is influenced by both, a child's height and weight. Underweight thus cannot distinguish between a child who is small in weight relative to his/her height and a child who is low in height relative to his/her age, but who may be normal in weight-for-height. On the other hand, wasting is an indicator of acute undernutrition, the result of more recent food deprivation or illness (WHO 1995).

The Integrated Child Development Services (ICDS) scheme is the largest national programme for the promotion of mother and child health and their development in the world (Kapil & Pradhan 1999). The beneficiaries include children below 6 years, pregnant and lactating mothers, and other women in the age group of 15–44 years (Kapil & Pradhan 1999). The package of services provided by the ICDS scheme includes supplementary nutrition, immunization, health check-up, referral services, nutrition and health education, and preschool education (Kapil & Pradhan 1999). The scheme services are rendered essentially through the 'Anganwadi' worker at a village centre called 'Anganwadi'. There is therefore an urgent need to evaluate the nutritional status of children at ICDS centres to determine whether they have low rates of stunting, underweight and wasting. Low rates of stunting, underweight and wasting would imply that the supplementary nutrition being administered to the children is effective in reducing the rates of undernutrition. However, very few investigations have done this (Bhasin *et al*. 2001; Mustaphi & Dobe 2005).

In view of this, the present investigation was undertaken to determine age and sex variations in height and weight, as well as to evaluate the levels of stunting, underweight and wasting, among 3- to 5-year-old ICDS children of Bengalee ethnicity from Chapra Block, Nadia District, West Bengal, India.

Materials and methods

Study area and subjects

The present study was undertaken at 11 ICDS centres in Chapra Block, Nadia District, West Bengal. The study area is situated at the India–Bangladesh international border, 140 km from Kolkata, the provincial capital of West Bengal. The area is remote and mostly inhabited by Muslims. All preschool children (3–5 years old) living in Chapra Block are enrolled at these centres. The ICDS authorities are allocated 80 paise (approximately 2 US cents) per head (child) per day by the Government of India to provide supplementary nutrition to the children. This financial assistance ensures that each child is given a porridge consisting of 41 g of rice and 17 g of lentils per day.

Formal ethical approval was obtained from Vidyasagar University and ICDS authorities prior to the commencement of the study. Subjects were randomly selected from 11 ICDS centres of Hatkhola Gram Panchyat of Chapra Block, Nadia District, West Bengal. A total of 545 children (male = 259; female = 286) aged 3–5 years were measured, out of whom 12 individuals (5 boys and 7 girls) were excluded because of missing data. The final sample size was 533 (254 boys and 279 girls). Age and ethnicity of the subjects were verified from official records.

Anthropometric measurements and evaluation of nutritional status

Height and weight measurements were taken on each subject following the standard techniques (Lohman *et al*. 1988). Technical errors of measurements (TEM)

were found to be within reference values (Ulijaszek & Kerr 1999). Thus, TEM was not incorporated in statistical analyses.

Three commonly used undernutrition indicators – stunting, underweight and wasting – were used to evaluate the nutritional status of the subjects. The United States National Center for Health Statistics (NCHS) (Hamill *et al*. 1979; WHO 1983) age- and sex-specific –2 *z*-scores were followed to define stunting, underweight and wasting. The following scheme was utilized:

Stunting: <–2 HAZ (*z*-score for height-for-age);
Underweight: <–2 WAZ (*z*-score for weight-for-age);
Wasting: <–2 WHZ (*z*-score for weight-for-height).

where HAZ, WAZ and WHZ refer to height-for-age, weight-for-age and weight-for-height age- and sex-specific *z*-scores, respectively, of NCHS.

We followed the World Health Organization (WHO 1995) classification for assessing severity of malnutrition by percentage prevalence ranges of these three indicators among children. The classification is shown in Table 1.

Statistical analyses

The distributions of height and weight were not significantly skewed, therefore not necessitating their normalization. Between sexes, differences in means of height and weight were tested by Student's *t*-test. One-way (Scheffe's Procedure) analyses were undertaken to test for age differences in mean height and weight in each sex.

Table 1. Classification assessment for severity of malnutrition by percentage prevalence ranges (WHO 1995)

Classifications	Low (%)	Medium (%)	High (%)	Very High (%)
Stunting	<20	20–29	30–39	≥40
Underweight	<10	10–19	20–29	≥30
Wasting	<5	5–9	10–14	≥15

Results

The means and standard deviations of height and weight by age and sex are presented in Table 2. Significant sex difference ($t = 2.14$, $P < 0.05$) was observed in mean weight at age 3 years. Significant ($P < 0.001$) age differences existed in mean height and weight in boys [height: $F_{(df1=2,df2=251)} = 80.836$; weight: $F_{(df1=2,df2=251)} = 50.232$] as well as girls [height: $F_{(df1=2,df2=276)} = 119.519$; weight: $F_{(df1=2,df2=276)} = 63.193$].

Table 3 presents the mean *z*-scores for height-for-age, weight-for-age and weight-for height. Results revealed that the mean HAZ, WAZ and WHZ were lower than (negative value) those of NCHS for both sexes at all ages. These values ranged from –0.754 (HAZ for boys aged 3 years) to –1.803 (WAZ for girls aged 5 years).

The frequencies of stunting, underweight and wasting are presented in Table 4. The overall (age and sex combined) rates of stunting, underweight and wasting were 23.9%, 31.0% and 9.4%, respectively. The rates of underweight and wasting were significantly higher among girls (underweight = 35.1%, wasting = 12.2%) compared with boys (underweight = 26.5%, wasting = 6.3%). In general, the frequency of stunted increased with increasing age in both sexes. Based on the WHO classification of severity malnutrition, the overall (age and sex combined) prevalence of underweight was very high (≥30%), while those of stunting (20–29%) and wasting (5–9%) were medium. It is noteworthy that, among girls, the prevalence of wasted was high (10–14%). Moreover,

Table 2. Means and standard deviations of anthropometric characteristics of the rural Bengalee preschool children of Chapra, Nadia District, West Bengal, India

Age	Sex	*n*	Height (cm)	Weight (kg)
3	Boys	66	91.2 (5.6)	12.2* (1.4)
	Girls	79	90.2 (4.9)	11.7* (1.3)
4	Boys	102	98.0 (5.1)	13.6 (1.4)
	Girls	111	97.4 (5.2)	13.5 (1.5)
5	Boys	86	102.2 (5.3)	14.7 (1.7)
	Girls	89	102.1 (4.9)	14.2 (1.5)

Standard deviations are presented in parentheses.
*Significant sex differences ($t = 2.14$, $P < 0.05$).

Table 3. Mean HAZ, WAZ and WHZ among the subjects

Age	Sex	HAZ	WAZ	WHZ
3	Boys	–0.754 (0.183)	–1.351 (0.112)	–0.964 (0.089)
	Girls	–0.996 (0.147)	–1.664 (0.102)	–1.173 (0.095)
	Total	–0.886 (0.116)	–1.521 (0.076)	–1.077 (0.066)
4	Boys	–0.900 (0.124)	–1.403 (0.081)	–0.999 (0.063)
	Girls	–1.040 (0.122)	–1.476 (0.084)	–0.998 (0.071)
	Total	–0.973 (0.087)	–1.442 (0.059)	–0.999 (0.048)
5	Boys	–1.400 (0.130)	–1.561 (0.095)	–0.980 (0.079)
	Girls	–1.413 (0.119)	–1.803 (0.082)	–1.286 (0.075)
	Total	–1.406 (0.088)	–1.684 (0.063)	–1.136 (0.056)
Overall	Boys	–1.031 (0.083)	–1.443 (0.054)	–0.984 (0.043)
	Girls	–1.146 (0.075)	–1.634 (0.052)	–1.139 (0.046)
	Total	–1.092 (0.056)	–1.543 (0.038)	–1.065 (0.032)

HAZ, height-for-age *z*-score; WAZ, weight-for-age *z*-score; WHZ, weight-for-height *z*-score.
Standard error of mean is presented in parentheses.

Table 4. Prevalence (%) of stunting, underweight and wasting among the children

Age	Sex	Stunting (HAZ < –2.0)	Underweight (WAZ < –2.0)	Wasting (WHZ < –2.0)
3	Boys	19.7	28.8	6.1
	Girls	19.0	38.0	16.5
	Total	19.3	33.8	11.7
4	Boys	21.6	22.6	7.8
	Girls	25.2	30.6	7.2
	Total	23.5	26.8	7.5
5	Boys	30.2	30.2	5.8
	Girls	27.0	38.2	14.6
	Total	28.6	34.3	10.3
Overall	Boys	23.7	26.5*	6.3**
	Girls	24.0	35.1	12.2
	Total	23.9	31.0	9.4

HAZ, height-for-age *z*-score; WAZ, weight-for-age *z*-score; WHZ, weight-for-height *z*-score.
*Significant sex differences of underweight ($\chi^2 = 4.76$, $P = 0.02913$).
**Significant sex differences of wasting ($\chi^2 = 5.42$, $P = 0.019899$).

while in boys the prevalence of underweight was high (20–29%), it was found to be very high (≥30%) among girls.

Discussion

Anthropometric indicators have been widely used in population-based studies directed to nutritional evaluation. Although they are proxy indicators (that is, they represent indirect measures of undernutrition that do not take into account nutrient intake or biochemical examination), their wide use is justified due to the ease of the method and its high sensitivity to nutritional alterations in a population (Post & Victoria 2001). Cohort studies, ideal for nutritional conditioning monitoring, suffer, in developing countries, from the logistic difficulties usually associated with population studies of large magnitude. In such cases, cross-sectional studies can provide relevant elements for understanding the connection between health status and physical conditions of life. These studies have the advantage of relatively low costs, and

they can also provide fundamental information for the implementation of health surveillance systems and the definition of long-term health intervention strategies (Waterlow *et al*. 1977; Satyanarayan *et al*. 1989; Martorel *et al*. 1996).

Undernutrition continues to be a cause of ill-health and premature mortality among children in developing countries like India (Nandy *et al*. 2005). The most commonly used indicators of undernutrition among children are stunting (low height-for-age), wasting (low weight-for-height) and underweight (low weight-for-age). Stunting is an indicator of chronic undernutrition, the result of prolonged food deprivation and/or disease or illness; wasting is an indicator of acute undernutrition, the result of more recent food deprivation or illness; underweight is used as a composite indicator to reflect both acute and chronic undernutrition, although it cannot distinguish between them (WHO 1995).

These indices are compared against an international reference population developed from anthropometric data collected in the United States by the NCHS (Hamill *et al*. 1979; WHO 1983). Children whose measurements fall below –2 *z*-scores of the reference population median are considered undernourished (i.e. to have stunting, wasting or to be underweight). These indices reflect distinct biological processes, and their use is necessary for determining appropriate interventions (WHO 1995).

The results of the present study clearly indicated that, based on the WHO classification of severity malnutrition, the overall (age and sex combined) prevalence of underweight was very high (≥30%) while those of stunting (20–29%) and wasting (5–9%) were medium. It is noteworthy that, among girls, the prevalence of wasted was high (10–14%). Moreover, while in boys the prevalence of underweight was high (20–29%), it was found to be very high (≥30%) among girls. The rates of underweight were lower than that reported from India (47%) by UNICEF (2006). Results on stunting indicated that, among these children, there existed a medium level of chronic undernutrition due to prolonged food deprivation. Regarding wasted, it was also observed that there existed a medium rate of acute undernutrition that was indicative of more recent food deprivation. Studies on underweight, which is used as a composite indicator to reflect both acute and chronic undernutrition, demonstrated that the level was very high. These findings suggested widespread adverse nutritional experience of the subjects. However, it must be noted here that the rates of underweight, wasting and stunting of the children of the present study were much lower than those reported among other children from various parts of India (Dolla *et al*. 2005).

It has been suggested that, as undernutrition is a function of both food deprivation and disease, which are in turn the consequences of poverty, anthropometric indices can serve only as proxies for evaluating the prevalence of undernutrition among children (Nandy *et al*. 2005). Efforts to reduce undernutrition, morbidity and mortality depend on reducing poverty and raising people's living standards by improving the quality of homes and by increasing access to clean drinking water and adequate sanitation. Such interventions have positive impacts on health, and implementing these also goes some way towards fulfilling people's basic human rights (Nandy *et al*. 2005). However, in the context of the present study, it should be noted that ICDS offers only supplementary nutrition to young children and controlling of other related factors of undernutrition is not within its ambit. As the nutritional status of the subjects of the present study is not satisfactory, it seems that there is scope for much improvement in the form of enhanced supplementary nutrition than what is currently being offered by the ICDS scheme in Chapra Block, Nadia District of West Bengal. Therefore, it is imperative that the ICDS authorities urgently consider the enhancement of the supplementary nutrition being currently given. It seems that the current food supplementation, consisting of 41 g of rice and 17 g of lentils, per child is insufficient and these amounts should be increased. This requires additional government funding.

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