

## Report on “anthropometric failure” among rural 2-6 years old Indian Bauri caste children of West Bengal

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**ABSTRACT** This study was undertaken to determine the overall prevalence of undernutrition using the composite index of anthropometric failure (CIAF) among the Bauri caste rural preschool children of the Purulia District, West Bengal, India. A total of 347 children (185 boys and 162 girls) aged 2-6 years were measured. Stunting, underweight and wasting were used to evaluate the nutritional status of the subjects (compared with children of the United States NCHS reference sample) and CIAF for the total children. Among the studied Bauri children, 39.2% were stunted, 51.2% – underweight and 26.6% – wasted. The CIAF showed a higher prevalence of undernutrition, with a total of 66.3% of Bauri caste preschool children suffering from at least one type of “anthropometric failure”. Among the studied children only 33.7% showed no failure. Valuable health and nutrition promotional programs can be formulated based on the CIAF findings with the ultimate objective of reducing childhood undernutrition in a population of India.

**KEY WORDS:** CIAF, stunting, underweight, wasting, undernutrition

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Undernutrition, a type of malnutrition, occurs due to inadequate intake of nutrients required for proper growth, maintenance and development of the body. Chronic hunger and undernutrition is the worst tribulation of the poverty that still plagues millions of households in India, and the plight of children is of special concern. Undernutrition in childhood is one of the reasons for the high child mortality rate and is also highly detrimental for the future of those

who survive [Pelletier 1994]. 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]. Undernutrition is hence not only a consequence of poverty but also a cause.

India has the highest incidence of childhood malnutrition in the world [Bamji 2003: 1137]. One half of the children under

the age of five years in India are moderately or severely malnourished, 30% of newborn children are significantly underweight and nearly 60% of women are anemic [*Economic Survey 2002–2003*]. Malnutrition makes a child susceptible to infections and delays recovery, thus increasing mortality and morbidity [Chatterjee *et al.* 2008]. It is therefore logical to direct increasing attention to the quality of life of the survivors [Sachdev 1995].

The current study uses the z-score system and the composite index of anthropometric failure (CIAF) to estimate the magnitude of undernutrition among 2–6 years Bauri caste rural preschool Indian children in Purulia, West Bengal.

## Materials and methods

The present study was a community based, cross-sectional study conducted in nine different villages of Nituria and Kashipur Blocks, Purulia District, that are situated about 250 km from Kolkata, the capital of West Bengal, India. The Bauris are a comparatively well known sizeable caste group in West Bengal. The total Bauri population in West Bengal is 1,091,022 constituting 5.9% of the total scheduled caste population of the state. In Purulia District, the Bauri population is 209,080 constituting 8.2% of the total scheduled caste population of the district. The Bauri is a cultivating and earth-working caste. They are mainly engaged as low wage laborers in the paddy fields of the higher caste groups and in the construction of roads. Some of them are also engaged in selling various items of merchandise in trains and buses in Purulia. Their other main occupation is palanquin-bearing. The socio-economic status and literacy rate of Bauris is very low [Risley 1981]. Their features and complexion

identify them as of non-Aryan descent, although evidence tends to affiliate them to any particular tribe now in existence. Bauri profess to be Hindus of the Sakta sect, but in Western Bengal, their connection with Hinduism is tenuous.

The present study was carried out from January to August 2008. A total of 347 (185 boys and 162 girls) preschool children (aged 2–6 years) were measured. Data were collected after obtaining necessary approval from the parents, villages and block authorities, and parents were 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 were found to be within reference values [Ulijaszek and Kerr 1999] and thus not incorporated in statistical analyses. Three commonly used undernutrition indicators, i.e., stunting (low height-for-age), underweight (low weight-for-age) and wasting (low height-for-weight) were used to evaluate the nutritional status of the subjects and CIAF for the total children.

Internationally accepted growth charts of the National Center for Health Statistics (NCHS) [Hamill *et al.* 1979] (see also WHO [1983]) were used as reference data because growth charts displaying the NCHS percentile provide health personnel with reliable, up-to-date records 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  $-2$ .

**Table 1.** CIAF classification (B–Y) of children with “anthropometric failure” [Nandy *et al.* 2005]

Group	Description	Wasting	Stunting	Underweight
A	No failure	–	–	–
B	Wasting only	✓	–	–
C	Wasting and underweight	✓	–	✓
D	Wasting, stunting & underweight	✓	✓	✓
E	Stunting & underweight	–	✓	✓
F	Stunting only	–	✓	–
Y	Underweight only	–	–	✓

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.

For assessing the CIAF, Peter Svedberg’s [2000] model of six groups of children (A to F) was used. These groups include children with height and weight appropriate for their age (i.e., 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 (i.e., 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 children who are wasted, stunted, or underweight, and their combinations (groups B–F); see Table 1. It therefore provides a single measure with which to estimate the overall prevalence of undernutrition [Nandy *et al.* 2005]. (Nandy *et al.* [2005] modified Svedberg’s [2000] model identifying an additional subgroup – one that includes children who are only underweight – group Y).

One-way ANOVA analyses were undertaken to test for age differences in mean height and weight. Chi-square tests were done to test significant age group difference between CIAF and no failure. All statistical analyses were undertaken using the Statistical Package for Social Science and Emergency Nutrition Assessment program.

## Results and discussion

Table 2 presents the mean height, weight and rates of stunting, underweight and wasting among the studied Bauri caste rural preschool children. There are significant mean differences between different age groups in height ( $F = 82.64$ ;  $p < 0.001$ ) and weight ( $F = 70.32$ ;  $p < 0.001$ ). Table 2 also shows the rate of undernutrition as measured by the CIAF. Among the studied children, 39.2%, 51.2% and 26.6% were stunted, underweight and wasted, respectively. The CIAF showed a higher prevalence of undernutrition for these three categories (stunting, underweight and wasting), with 66.3% of the studied children suffering from “anthropometric failure”. This higher prevalence was noticed in every age group.

The proportions of children with anthropometric failure in each of the subgroups are presented in Table 3. Out of those six

**Table 2.** Mean height (cm), weight (kg) and prevalence of undernutrition among the Bauri caste children, aged 2-6 years

Age (in years)	2			3			4			5			6			Total	
	(N = 57)			(N = 72)			(N = 69)			(N = 90)			(N = 59)			(N = 347)	
	M	SE	SD	M	SE	SD	M	SE	SD	M	SE	SD	M	SE	SD		
Height*	85.4	1.2	9.1	90.5	1.1	9.5	95.7	1.0	8.3	103.3	0.8	7.5	108.4	0.8	6.1		
Weight**	10.3	0.2	1.8	11.5	0.2	1.9	12.7	0.3	2.2	14.5	0.3	2.6	15.9	0.3	2.1		
Category	(%)			(%)			(%)			(%)			(%)			(%)	
Stunted	40.4			38.9			46.3			33.3			39.0			39.2	
Underweight	52.6			51.4			55.1			50.0			47.5			51.2	
Wasted	26.3			29.1			29.0			26.7			20.3			26.6	
CIAF	73.7			70.8			66.7			61.1			61.0			66.3	

\* F = 82.64; p < 0.001    \*\* F = 70.32; p < 0.001

subgroups with undernourished children, group E (containing children who are stunted and underweight) was the highest (25.4%). Among the studied children only 33.7% showed no failure. There was no significant age group difference ( $\chi^2 = 3.9$ ;  $df = 4$ ) between no failure (A) and CIAF (B-Y).

Figure 1 shows the comparative prevalence of anthropometric failure among the three different studies done by other scholars

and the present study. Previous studies done by Nandy *et al.* [2005] using data from the 1998–99 National Family Health Survey (NFHS-2) for India, have reported a lower prevalence of anthropometric failure (CIAF = 59.8%) than the present study (66.3%). However, two studies, from Tamil Nadu [Seetharaman *et al.* 2007] and West Bengal [Mandal and Bose 2009], have reported a higher prevalence, i.e., 68.6% and 73.1%, respectively.

**Table 3.** Anthropometric failure among the Bauri children by age and category

Group*	Age (yrs.)												Total	
	2		3		4		5		6					
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
A	15	26.3	21	29.2	23	33.3	35	38.9	23	39.0	117	33.7		
B	8	14.0	6	8.3	5	7.2	4	4.4	3	5.1	26	7.5		
C	3	5.3	9	12.5	6	8.7	9	10.0	2	3.4	29	8.4		
D	6	10.5	6	8.3	9	13.0	11	12.2	7	11.9	39	11.2		
E	19	33.3	18	25.0	21	30.4	17	18.9	13	22.0	88	25.4		
F	3	5.3	8	11.1	3	4.3	6	6.7	5	8.5	25	7.2		
Y	3	5.3	4	5.6	2	2.9	8	8.9	6	10.2	23	6.6		
CIAF (B-Y)	42	73.7	51	70.8	46	66.7	55	61.1	36	61.0	230	66.3		

\* For group description see Table 1

No significant age group difference ( $\chi^2 = 3.9$ ;  $df = 4$ ) between no failure (A) and CIAF (B-Y)

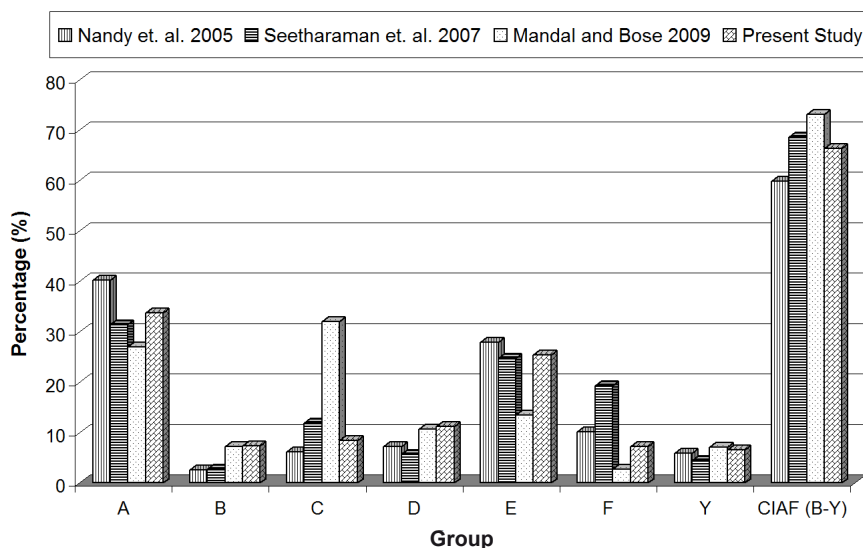


Fig. 1. Comparative prevalence (%) of children with anthropometric failure in four studies.

Figures 2a, 2b show the combined sex comparison of median height and weight for age of the Bauri children and the reference population (95th, 50th and 5th percentiles; Hamill *et al.* [1979]). It is clear from these figures that the Bauri rural preschool children were, on average, much shorter and lighter compared to the NCHS data. The medians for height and weight measurements of the Bauri children are in fact, close to the 5th percentile of the reference United States children of the same age.

The relevance of the present study arises from the fact that, until now, CIAF anthropometric data on Bauris was non-existent. Except for the study of Nandy *et al.* [2005] which recommended the use of CIAF for investigations dealing with undernutrition, only two other studies: Seetharaman *et al.* [2007] and Mandal and Bose [2009] have been reported that have dealt with CIAF in India. In view of this, the present study was undertaken to evaluate the levels of stunting, underweight and wasting and, especially, to assess the overall prevalence of

undernutrition by using CIAF among rural 2-6 years old Indian Bauri caste children of Purulia District. The rate of stunting in the present study (39.2%) was much higher than that reported in a study among the children of Integrated Child Development Services (ICDS) centers aged 3-5 years in Chapra, Nadia District, West Bengal (23.9%) [Bose *et al.* 2007]. For wasting, the rate (26.6%) is also much higher than that reported in the same study (9.4%). For underweight, the level of 51.2% was also very high as compared with 31.0%.

As evidenced by the current study, the use of underweight as the sole criterion for identifying undernourished children may underestimate the true impact of undernutrition. Use of the CIAF helps researchers to visualize the extent of the underestimation. CIAF provides an overall estimate of the number of undernourished children in a population, which is not provided by any of the conventional indices. Attempts at estimating the overall prevalence of undernutrition in a population must integrate

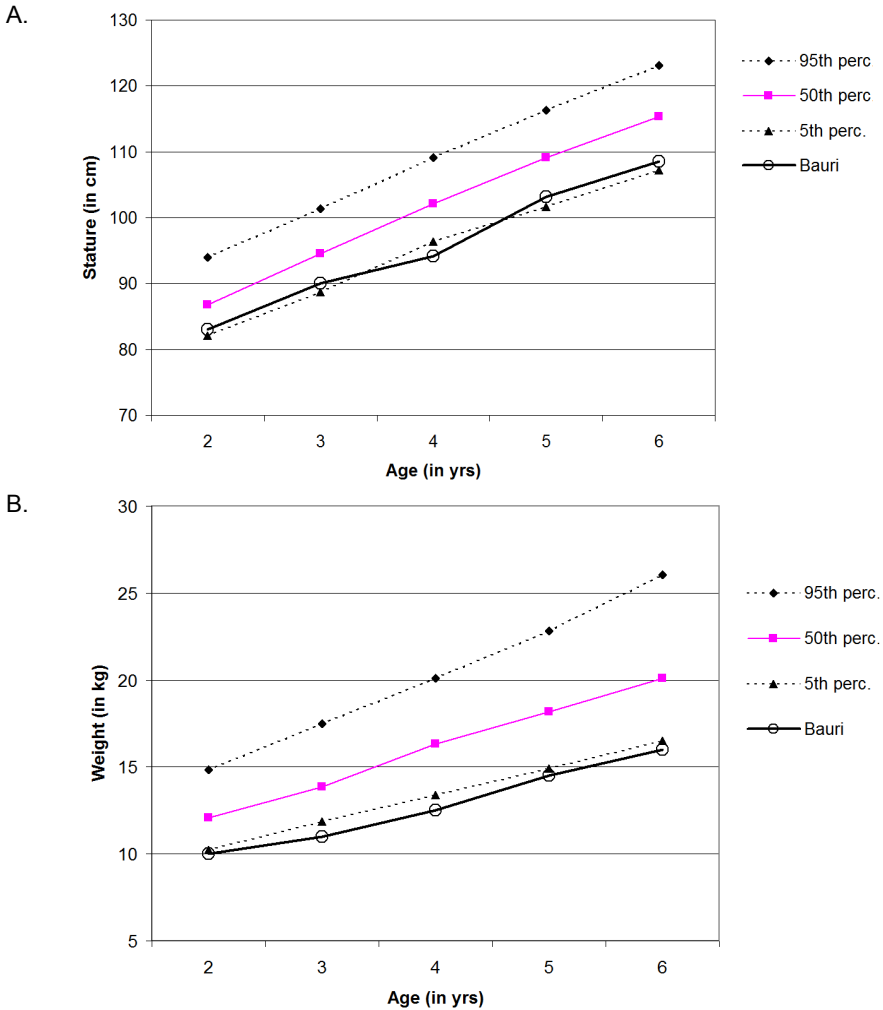


Fig. 2. Height (cm) and weight (kg) of Bauri children compared to United States NCHS data.

such an aggregate index of undernutrition [Seetharaman *et al.* 2007]. It should be mentioned, however, that in Bhattacharyya's [2006] opinion, the usefulness of the CIAF classification should be considered in relation to Waterlow's [1974] stunting-wasting classification.

The present study is limited by its small sample size, being from one area of West Bengal, India. 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 CIAF among preschool children from different parts of India be undertaken. Such investigations will allow us not only to compare the rates of three conventional measures of undernutrition with CIAF, but also help to express the improved effectiveness and use

of CIAF. Since the overwhelming majority of the Indian population inhabit rural areas where the rates of childhood under-nutrition are very high, such studies should focus on rural preschool children. Valuable health and nutritional promotion programs can be formulated based on the findings of these researches with the ultimate objective of decreasing childhood undernutrition in these areas.

### Notes

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## Streszczenie

Badania wykonano w celu określenia poziomu niedożywienia wiejskich indyjskich dzieci w wieku przedszkolnym, należących do kasty Bauri (kasta o niskim statusie, której przedstawiciele są głównie najemnymi pracownikami fizycznymi), w dystrykcie Parulia w Bengalu Zachodnim. Niedożywienie określano kompleksowym wskaźnikiem „fiaska antropometrycznego” (CIAF). Zbadano 347 dzieci (185 chłopców i 162 dziewczynki) w wieku 2-6 lat. Przypadki skrajnego niedożywienia rejestrowano w trzech kategoriach: „niedorastania”, „wychudzenia” i „wyniszczenia” (układem odniesienia były normy rozwojowe dzieci ze Stanów Zjednoczonych z lat 60.–70.), z których powstają grupy składające się na wskaźnik CIAF. Wśród zbadanych dzieci kasty Bauri, 39,2% kwalifikowało się do kategorii „niedorośniętych”, 51,2% – „wychudzonych” i 26,6% – „wyniszczonych”. Wskaźnik CIAF, uwzględniający wystąpienie u dziecka co najmniej jednej ze wspomnianych wyżej kategorii, osiągnął wartość 66,3% – za ledwie 33,7% dzieci pod względem żadnej z badanych cech nie znalazło się poniżej progu, jaki stanowi wartość 5. centyla uwzględnionych norm.