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*Short Communication*

# Very high prevalence of thinness using new international body mass index cut off points among 5-10 year old school children of nandigram, west Bengal, India

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## Abstract

**BACKGROUND:** To assess the prevalence of thinness among 5-10 year old school children of Nandigram, Purba Medinipur District of West Bengal, India.

**METHODS:** A total of 596 students (323 boys and 288 girls) aged 5-10 years were included in this cross-sectional study. Height and weight were measured and the body mass index (BMI) was computed. The new international BMI-based classification cut-off points proposed by Cole et al were utilized to identify thinness.

**RESULTS:** The overall (age-combined) mean BMI among boys and girls were 13.9 kg/m$^2$ (SD = 1.4) and 13.8 kg/m$^2$ (SD = 1.2), respectively. In general, mean BMI increased with age in both sexes. There was no significant sex difference in mean BMI. The overall (age-combined) prevalence of thinness was 62.9% and 61.6% in boys and girls, respectively.

**CONCLUSIONS:** The present study clearly indicated that the nutritional situation of these children was unsatisfactory.

**KEYWORDS:** Body mass index, undernutrition, thinness, IOTF cut off points, nandigram, West Bengal.

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During past 40 years, there have been slow but definite declines in the under-five and infant mortality rates in India.[1] Under-nutrition in childhood was and is one of the reasons behind the high child mortality rate in developing countries like India. It is also highly detrimental for health in those children who survive to adulthood.[2] The enhanced survival may be simply adding to the pool of under nourished children causing severe handicaps to future human resources. Chronic under-nutrition is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life.[3] The majority of deaths (89%) associated with malnutrition occur in children who are only or moderately malnourished.[2] Although India has adopted a multi-dimensional strategy to combat these problems and to improve the nutritional status of the population,[4] about half of the Indian children under the age of five years are moderately or severely malnourished, 30% of new born children are significantly under weight and nearly 60% of women are anaemic.

Usually childhood under nutrition is assessed by stunting (low height for age), underweight (low weight for age) or wasting (low weight for height) following different internationally and regionally recommended standards.[5-8] Body mass index (BMI), as measured by weight in kilogram (kg) divided by

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height in meter (m) squared, has been widely used for assessing nutritional status of adults[8,9] and thinness in adolescents[8] and more recently in children aged 0-5 years.[10] Very recently international cut offs child overweight and obesity for the age range of 2-18[11] and for underweight[12] have been produced. In the later study under nutrition has been termed as thinness (as in adults) defined as low BMI for age[12] and it has been graded as III, II, I (severe, moderate and mild, respectively) similar to adult chronic energy deficiency (CED) grades of CED I, II and III.

In view of the above, it seems that substantial information on the extent of thinness in children of developing countries like India is needed to be generated for national as well as international comparison. The aim of the present study was to evaluate the different grades of thinness using age and sex specific cut off values based on (BMI) recommended by Cole et al.[12] Hitherto, no study from India has used these cut-off values to assess thinness among children.

## Methods

### *Subjects*

Collection of data for the present study was done from November 2003 to March 2004 in Nandigram area of Purba Medinipur District, West Bengal. Local primary schools were approached for permission of data collection. After satisfaction of all the required conditions, authorities of three primary schools agreed for participation. Necessary approval was obtained from Vidyasagar University and school authorities prior to the commencement of the study. All students of those schools were invited to participate in the survey and the response rate was almost 80%. Absenteeism and illness were the main reasons for non-participation. All students who were present at the prior fixed dates and times of the survey were included in the study. All subjects belonged to Bengalee ethnic group. A total of 596 students (323 boys and 288 girls) aged 5-10 years could be included in this cross-sectional study. Information on age was authenticated from the students' register.

### *Anthropometry and assessment of thinness*

Height and weight were recorded to the nearest 0.1 cm and 0.5 kg, respectively, using standard anthropometer, and weight scale, respectively following the standard techniques.[13] The measurements were taken by two trained observers alternatively with the same instruments. Inter-observer errors were found to be within acceptable limits, and therefore, not considered in the analyses.[14] BMI was computed using the following standard equation: BMI = Weight (kg) / height ($m^2$). Thinness was evaluated following the recently published international BMI cut-off points given by Cole et al[12] as presented in table 1. Those children with BMI less than the cut off value corresponding to the respective age and sex were assigned to the particular grade of thinness and those having BMI value higher than or equal to the age and sex specific grade-I thinness value were considered normal.[12]

**Table 1.** Age and sex specific international cut off values of BMI to define different grades of thinness in children aged 5-10 years after Cole et al 2007.

| | THINNESS | | | | | |
|---|---|---|---|---|---|---|
| Age (Years) | Boy | | | Girl | | |
| | Grade I | Grade II | Grade III | Grade I | Grade II | Grade III |
| 5 | 12.58 | 13.22 | 14.13 | 12.40 | 12.99 | 13.86 |
| 6 | 12.45 | 13.10 | 14.04 | 12.28 | 12.90 | 13.82 |
| 7 | 12.41 | 13.09 | 14.08 | 12.27 | 12.95 | 13.93 |
| 8 | 12.45 | 13.17 | 14.24 | 12.37 | 13.08 | 14.14 |
| 9 | 12.57 | 13.34 | 14.49 | 12.53 | 13.29 | 14.43 |
| 10 | 12.77 | 13.58 | 14.80 | 12.78 | 13.59 | 14.81 |

Ref: Cole et al., 2007 (5)

**Table 2.** Mean BMI (SD) of the subjects by age and sex.

| Age (Year) | Boys | | Girls | | t * |
|---|---|---|---|---|---|
| | n | BMI (kg/m$^2$) | n | BMI (kg/m$^2$) | |
| 5 | 91 | 13.6 (1.4) | 83 | 13.3 (0.9) | 1.49 |
| 6 | 62 | 13.6 (1.6) | 56 | 13.8 (1.3) | -0.93 |
| 7 | 47 | 13.8 (1.2) | 41 | 13.8 (1.1) | -0.06 |
| 8 | 57 | 13.9 (1.2) | 44 | 14.0 (1.3) | -0.47 |
| 9 | 33 | 14.2 (1.5) | 34 | 13.9 (1.3) | 1.04 |
| 10 | 25 | 14.9 (1.3) | 23 | 14.9 (1.3) | 0.06 |
| Total | 315 | 13.9 (1.4) | 281 | 13.8 (1.2) | 0.39 |

* Sex differences of BMI not significant at any age

## Results

The mean BMI of the subjects is presented in table 2. The overall (age-combined) mean BMI among boys and girls were 13.9 (SD = 1.4) kg/m$^2$ and 13.8 (SD = 1.2) kg/m$^2$, respectively. There was no significant sex difference in mean BMI at any of the ages. Table 3 presents the frequency (absolute number) prevalence (%) of thinness by age and sex among the subjects. Overall (age-combined) prevalence of thinness was 62.9% and 61.6%, among the boys and the girls, respectively.

## Discussion

Undernutrition among children and adolescents is a serious public health problem internationally, especially in developing countries.[15-17] The recent study of Cole et al[12] has stated that undernutrition is better assessed as thinness (low body mass index for age) than as wasting (low weight for height). Prior to this report of Cole et al,[12] there were no suitable thinness cut-offs for this age group. These new cut-off points are suggested to encourage direct comparison of trends in child and adolescent thinness worldwide. These cut-offs provide a classification of thinness for public health purposes.

In spite of having some limitations such as low sample size in some age groups and inability to employ any strict sampling strategy, which makes the state level of the sample

**Table 3.** Prevalence of thinness by age and sex among the subjects.

| | THINNESS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grade-III | | Grade -II | | Grade -I | | Overall | | Normal | | n | | |
| Age (Years) Total | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls | B | G | |
| 5 | 17 (18.7) | 10 (12.0) | 13 (14.3) | 21 (25.3) | 28 (30.8) | 28 (33.7) | 58 (63.7) | 59 (71.1) | 33 (36.3) | 24 (28.9) | 91 | 83 | 174 |
| 6 | 10 (16.1) | 5 (8.9) | 8 (12.9) | 9 (16.1) | 23 (37.1) | 17 (30.4) | 41 (66.1) | 31 (55.4) | 21 (33.9) | 25 (44.6) | 62 | 56 | 118 |
| 7 | 6 (12.8) | 4 (9.8) | 11 (23.4) | 6 (14.6) | 11 (23.4) | 12 (29.3) | 28 (59.6) | 22 (53.7) | 19 (40.4) | 19 (46.3) | 47 | 41 | 88 |
| 8 | 3 (5.3) | 6 (13.6) | 10 (17.5) | 5 (11.4) | 23 (40.4) | 15 (34.1) | 36 (36.2) | 26 (59.1) | 21 (36.8) | 18 (40.9) | 57 | 44 | 101 |
| 9 | 2 (6.1) | 2 (5.9) | 9 (27.3) | 4 (11.8) | 9 (27.3) | 19 (55.9) | 20 (60.6) | 25 (73.5) | 13 (39.4) | 9 (26.5) | 33 | 34 | 67 |
| 10 | 0 (0) | 1 (4.3) | 2 (8.0) | 5 (21.7) | 13 (52.0) | 4 (17.4) | 15 (60.0) | 10 (43.5) | 10 (40.0) | 13 (56.5) | 25 | 23 | 48 |
| All ages | 38 (12.1) | 28 (10.0) | 53 (16.8) | 50 (17.8) | 107 (34.0) | 95 (33.8) | 198 (62.9) | 173 (61.6) | 117 (37.1) | 108 (38.4) | 315 | 281 | 596 |

n = Total sample
Percentages are presented in parentheses.

questionable, the results of the present study clearly indicated that the nutritional situation of these children was unsatisfactory with very high rates of thinness of 62.9 % and 61.6 % in boys and girls, respectively. A noteworthy point was that both sexes had similar rarest of thinness.

We propose that future investigations in India should utilize the cut-off points proposed by Cole et al[12] to determine the rates of thinness in children and adolescents. Such studies should provide data on prevalence of thinness which can be used for the formulation of effective public health policies. Moreover, they would also provide useful datasets for comparisons, both nationally and internationally.

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## Conflict of Interest
Authors have no conflicts of interest.

## Authors' Contributions
KB designed and supervised the study. He also contributed to statistical analyses and preparation of manuscript.
RCh undertook statistical analyses and prepared the manuscript.

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