

# Prevalence of Thinness among Rural Bengalee Pre-school Children in Chapra, Nadia District, West Bengal, India

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## ABSTRACT

This cross-sectional study investigated the age and sex variations in thinness among 2016 (930 boys and 1086 girls) 3-5 years old rural children of Bengalee ethnicity. The children were randomly recruited from 66 Integrated Child Development Service (ICDS) centres of Chapra Block, Nadia District, West Bengal, India. The area is remote and mostly inhabited by Bengalee Muslims. All pre-school children (3-5 years old) living in Chapra Block are enrolled at these centres. Anthropometric measures taken included height and weight using standard techniques and then body mass index (BMI) was computed. Age and sex specific cut-off values of body mass index (BMI) were utilised to identify thinness. Overall prevalence of thinness was 49.68 % and 51.57 % among boys and girls, respectively. There were significant ( $p < 0.05$ ) sex differences in height, weight and BMI. In general, the frequency of thinness increased with increasing age in both sexes. The rates of Grade-III and Grade-II thinness were higher among girls (Grade-III = 7.46 %, Grade-II = 13.44 %) compared with boys (Grade-III = 5.48 %, Grade-II = 11.72 %). In contrast, Grade-I thinness was higher among boys. The results from this study indicate that the nutritional status of rural Bengalee pre-school children is unsatisfactory. These children are experiencing marked nutritional stress. There is scope for much improvement in the form of enhanced supplementary nutrition.

**Keywords:** Bengalee, BMI, India, pre-school children, thinness, West Bengal

## INTRODUCTION

Children are the most important assets of a country because they will be tomorrow's youth and provide the human potential required for its development. Nutrition in the early years of life plays a big role in physical, mental and emotional development. Poor and inadequate nutrition leads to malnutrition, morbidity and mortality among preschool children (Vaid & Vaid, 2005). Child growth is the universal means

to assess adequate nutrition, health and development of individual children, and to estimate overall nutritional status and health of populations. Compared to other health assessment tools, measuring child growth is a relatively inexpensive, easy to perform and non-invasive process. During the pre-school age period, children have special nutritional needs because of their extensive growth and development (WHO, 1995; Blössner, de Onis & Uauy, 2006). The legacy of malnutrition, especially among

pre-school children, is a huge obstacle to overall national development (Bishnoi, Sehgal & Kwatra, 2004).

Under-nutrition among pre-school children is an important health problem in developing countries (Pryer, Rogers & Rahman, 2004) including rural India (Kumar & Bhawani, 2005; Ray, 2005). Half of all children under-five suffer from malnutrition and 53% of children are underweight (India Fact File, 2002). Also in West Bengal, half of the children in this age group suffer from different types of under-nutrition (Bose *et al.*, 2008; Bisai, Bose & Ghosh, 2008). However, there is scanty information on the prevalence of under-nutrition among preschool children in India (Bishnoi *et al.*, 2004; George *et al.*, 2000; Kumari, 2005) and West Bengal (Shaikh *et al.*, 2003; Mustaphi & Dobe, 2005).

Generally, 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 (WHO, 1995). The body mass index (BMI) provides a simple measure of a person's 'fatness' or 'thinness', allowing health professionals to discuss over- and under-weight problems more objectively with their patients. Therefore it has been widely used for assessing nutritional status of adults (WHO, 1995; WHO, 2000) and more recently in children aged 0-5 years (WHO Multicentre Growth Reference Study Group, 2006). Very recently, international cut-offs of child overweight and obesity for the age range of 2-18 (Cole *et al.*, 2000) and for underweight or thinness (Cole *et al.*, 2007) have been developed. In the latter study, under-nutrition has been termed as thinness (as in adults) defined as low BMI for age and it has been graded as III, II, I (severe, moderate and mild, respectively) similar to adult chronic energy deficiency (CED) grades of CED III, II and I. BMI is measured by weight in kilogram (kg) divided by height in meter squared.

The Integrated Child Development Services (ICDS) scheme of the Government of India is the largest national programme in the world for the promotion of mother and child health and their development (Kapil & Pradhan, 1999). The beneficiaries include children below 6 years, pregnant and lactating mothers, and other women in the reproductive age group, and the package of services provided by the scheme includes supplementary nutrition, immunisation, health check-up, referral services, nutrition and health education, and pre-school education (Kapil & Pradhan, 1999). The services are rendered essentially through trained workers at village centres termed *Anganwadi*. There is, therefore, an urgent need to evaluate the nutritional status of children at ICDS centres to determine whether they have a low rate of thinness. A low rate of thinness would imply that the supplementary nutrition being administered to the children is effective in reducing the under-nutrition rate in the form of thinness.

To-date, there are few investigations on thinness in young children in India. (Mustaphi & Dobe, 2005; Kumari, 2005; George *et al.*, 2000; Shaikh *et al.*, 2003., Kapil and Pradhan, 1999). Therefore, the objective of the present study was to assess the prevalence of different grades of thinness using the recently recommended age and sex specific cut-off values of BMI (Cole *et al.*, 2007). There exists no published literature that has utilised these cut-off points to evaluate the rates of thinness among children at ICDS. Thus, the results of the present study will be useful for national and international comparisons of rates of thinness among pre-school children.

## METHODOLOGY

### Location and subjects

This cross-sectional study was undertaken at Chapra Block, Nadia District, West Bengal, India. The study area is situated at the India-Bangladesh international border,

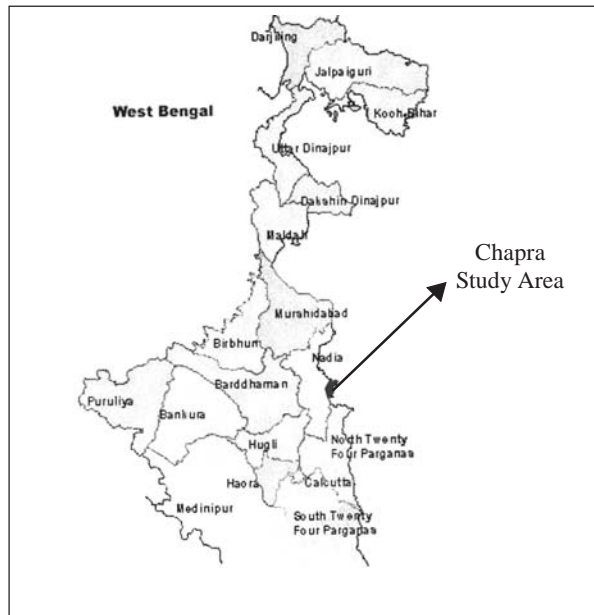


Figure 1. The study area

140 km from Kolkata, the provincial capital of West Bengal (Figure 1). The area is remote and mostly inhabited by Bengalee Muslims. All pre-school 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.

Sixty-six ICDS centres were randomly selected from the 186 centers of the Chapra Block. The response rate was approximately 95%. A total of 2028 children (935 boys and 1093 girls) aged 3–5 years were measured, of whom 12 individuals (5 boys and 7 girls) were excluded because of missing data. The final sample size was 2016 (930 boys and 1086 girls). Age and ethnicity of the subjects were verified from official records. Formal ethical approval was obtained from Vidyasagar University and ICDS authorities prior to the commencement of the study.

### Anthropometry and assessment of thinness

Height and weight measurements were taken by first author (SB) on each subject following the standard techniques (Lohman, Roche & Martorell, 1988). The BMI was computed following the internationally accepted standard equation as weight in kg divided by square in height in meter. Nutritional status was evaluated using the age and sex specific cut-off points (Table 1) of BMI as described by Cole *et al.* (2007). Thinness (as in adults) was defined as low BMI for age and was graded as III, II, I (severe, moderate and mild, respectively) defined to pass through BMI values of 16.0, 17.0, and 18.5 kg/m<sup>2</sup>, respectively, at age 18 (Cole *et al.*, 2007). Technical errors of measurements (TEM) were found to be within reference values (Ulijaszek & Kerr, 1999) and thus not incorporated in statistical analyses. Student's *t*-tests were used to see the significance of differences in means between the sexes at each age group as well as between sexes on an overall basis. One-way ANOVA tests were done to evaluate the

**Table 1.** Age and sex specific international cut-off values of BMI (kg/m<sup>2</sup>)

THINNESS						
Age(Years)	Boys			Girls		
	Grade III	Grade II	Grade I	Grade III	Grade II	Grade I
3.0	13.09	13.79	14.74	12.98	13.60	14.47
3.5	12.97	13.64	14.57	12.86	13.47	14.32
4.0	12.86	13.52	14.43	12.73	13.34	14.19
4.5	12.76	13.41	14.31	12.61	13.21	14.06
5.0	12.66	13.31	14.21	12.50	13.09	13.94
5.5	12.58	13.22	14.13	12.40	12.99	13.86

Source: Cole et al. (2007).

**Table 2.** Mean (SD) of height, weight and BMI according to age and sex

Age (years)	Boys				Girls			
	n	Height (cm)	Weight (cm)	BMI (kg/m <sup>2</sup> )	n	Height (cm)	Weight (cm)	BMI (kg/m <sup>2</sup> )
3.0	190	89.31 (4.37)	12.00* (1.33)	15.03** (1.14)	195	89.07 (4.54)	11.61 (1.37)	14.62 (1.17)
3.5	132	93.48** (4.30)	12.74** (1.40)	14.56 (1.05)	159	91.70 (4.34)	12.19 (1.43)	14.47 (1.10)
4.0	172	96.21* (4.75)	13.42*** (1.47)	14.49* (1.14)	237	94.90 (4.28)	12.86 (1.40)	14.27 (1.09)
4.5	141	98.95 (4.27)	13.96* (1.50)	14.26* (1.03)	161	98.65 (4.93)	13.60 (1.53)	13.97 (1.09)
5.0	182	101.35 (4.63)	14.66* (1.66)	14.25* (1.15)	208	100.86 (4.94)	14.19 (1.84)	13.91 (1.13)
5.5	113	104.20 (4.56)	15.32* (1.56)	14.10** (0.98)	126	103.68 (5.03)	14.75 (1.70)	13.69 (0.94)
Overall mean		96.81* (6.68)	13.59*** (1.85)	14.48*** (1.40)		96.10 (6.75)	13.12 (1.87)	14.18 (1.14)
F <sup>^</sup>		225.508	103.91	15.187		240.537	100.950	17.304

<sup>^</sup>p<0.001, Significant age difference.

Significant sex differences in t-test: \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05.

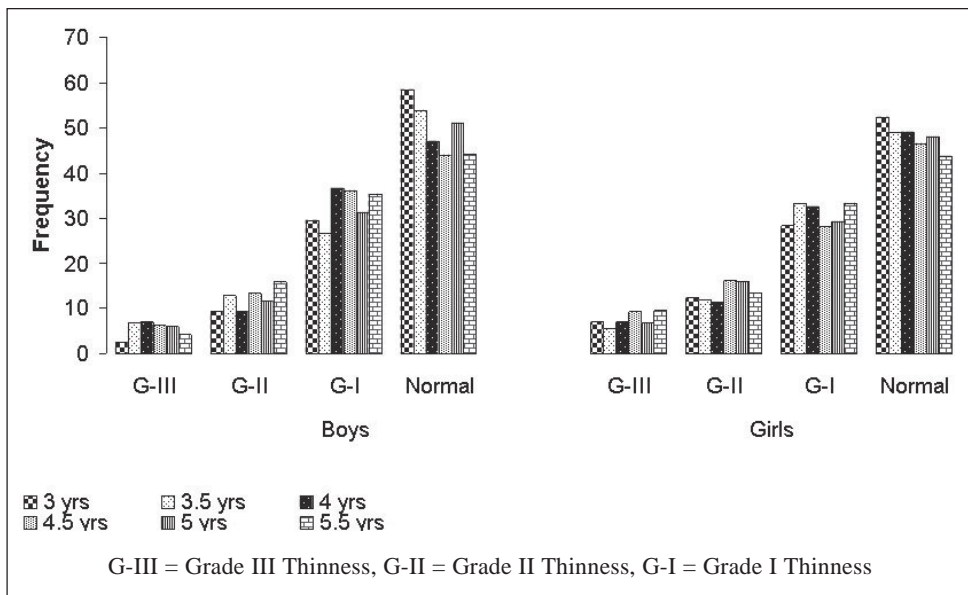
SD denotes standard deviation.

significance of differences in means for each sex as well as for the sex-combined mean values across the age groups. Proportion tests were undertaken to test for sex differences in overall thinness in each age group and age combined, respectively. Statistical significance was set at p < 0.05.

## RESULTS

### Anthropometric characteristics

The mean weight, height and BMI of the subjects are presented in Table 2. There was a significant sex difference (age-combined) in all parameters, that is, height, weight and



**Figure 2.** Nutritional status of the children

BMI ( $p < 0.05$ ). Thus, the boys were heavier and taller than girls at all ages. Significant sex difference ( $p < 0.05$ ) was observed in mean height at age 3.5 and 4.0 years. Significant ( $p < 0.001$ ) age difference existed in mean height and weight in boys (height:  $F = 225.508$ ; weight:  $F = 103.91$ ) as well as in girls (height:  $F = 119.519$ ; weight:  $F = 63.193$ ). The mean BMI ( $\pm$ ) among boys and girls were  $14.48 \pm 1.40$  and  $14.18 \pm 1.14$ , respectively. Mean BMI decreased from 3 to 5.5 years in both sexes. There was a significant sex difference in mean BMI ( $p < 0.001$ ) at all age groups excluding at 3.5 years. Significant ( $p < 0.001$ ) difference in mean values was found across age groups in mean BMI in boys ( $F = 15.187$ ) as well as in girls ( $F = 17.304$ ).

### Nutritional status

Table 3 and Figure 2 present the prevalence of thinness by age and sex among the subjects. Overall prevalence of thinness was 49.68 % and 51.57 % among boys and girls, respectively. The rates of Grade-III and Grade-II thinness were higher among girls (Grade-III = 7.46 %, Grade-II = 13.44 %) compared with boys (Grade-III = 5.48 %,

Grade-II = 11.72 %). In contrast, the frequency of thinness Grade-I was higher among boys (32.47 %) than girls (30.66 %). In general, the frequency of thinness increased with increasing age up to 4.5 years in both sexes and decreased at 5.0 years, and again rose at age 5.5 years.

### DISCUSSION

Under-nutrition continues to be a problem of considerable magnitude in most developing countries of the world (Som *et al*, 2006). Several studies worldwide have shown that dietary and environmental constraints are the major determinants of differences in growth performance between children of developing and developed countries.

During last three decades, there have been slow but definite declines in the under-five and infant mortality rates in India (Costello & Manandhar, 2000). However, under-nutrition in childhood was and is one of the reasons behind the high child mortality rate in developing countries such as India. It is also highly detrimental for

**Table 3.** Prevalence of under-nutrition among the children based on Cole *et al.* (2007)

Age group	Boys				Girls				Overall (Sex combined)		
	n	Thinness			n	Thinness					
		III	II	I		Total	III	II		I	Total
3.0	190	5 (2.63)	18 (9.47)	56 (29.47)	79 (41.58)	195	14 (7.18)	24 (12.31)	55 (28.21)	93 (47.70)	172 (44.66)
3.5	132	9 (6.82)	17 (12.88)	35 (26.52)	61 (46.21)	159	9 (5.66)	19 (11.95)	53 (33.33)	81 (50.94)	142 (48.80)
4.0	172	12 (6.98)	16 (9.30)	63 (36.63)	91 (52.91)	237	17 (7.17)	27 (11.39)	77 (32.49)	121 (51.05)	212 (51.83)
4.5	141	9 (6.38)	19 (13.48)	51 (36.17)	79 (56.03)	161	15 (9.32)	26 (16.15)	45 (27.95)	86 (53.42)	165 (54.63)
5.0	182	11 (6.04)	21 (11.54)	57 (31.32)	89 (49.90)	208	14 (6.73)	33 (15.87)	61 (29.33)	108 (51.93)	197 (50.10)
5.5	113	5 (4.42)	18 (15.93)	40 (35.40)	63 (55.75)	126	12 (9.50)	17 (13.50)	42 (33.30)	71 (56.30)	134 (56.10)
Overall (Age combined)	930	51 (5.48)	109 (11.72)	302 (32.47)	462 (49.68)	1086	81 (7.46)	146 (13.44)	333 (30.66)	560 (51.57)	1022 (50.69)

Figures in parentheses indicate percentages.

**Table 4.** Overall comparison of the prevalence (%) of under-nutrition among pre-school children

<i>Study children</i>	<i>Age group</i>	<i>n</i>	<i>Methods</i>	<i>Prevalence (%)</i>	<i>References</i>
Pre-adolescent children of Madhyamgram, India	1-12	1206	Z- Score	50.5 %	Bose <i>et al.</i> (2008)
Children of Central Orissa, India	1-5	292	Thinness by BMI	48.0 %	Mishra & Mishra (2007)
Slum children of Midnapur town	3-6	113	Z-Score	63.70 %	Bisai <i>et al.</i> (2008)
Lodha children Paschim Midnapur	1-14	165	Z-Score	34.5 %	Bisai <i>et al.</i> (2008)
ICDS children of Bali-Gram Panchayat, Hooghly, Arambag	2-6	1012	Thinness by BMI	85.2	Mandal <i>et al.</i> (2009)
N.R.S. Medical college, Kolkata India	0-5	55	Thinness by MUAC	36.4 %	Chaterjee & Saha (2008)
Pre-school children, Dhaka, Bangladesh	0-5	392	Z-Score	73.2	Pryer <i>et al.</i> (2004)
Pre-school children of Chapra Block, WB	3-5	2016	Thinness by BMI	50.69 %	Present study

health in those children who survive to adulthood. The enhanced survival may be simply adding to the pool of under-nourished children severely handicapping future human resources. The majority of deaths (89%) associated with malnutrition occur in children who are only or moderately malnourished (Pelletier, 1994). India has adopted a multi-dimensional strategy to combat these problems and to improve the nutritional status of the population (Government of India, 2002-03).

Under-nutrition among children is a serious public health problem internationally, especially in developing countries (Pelletier and Frongillo, 2003; El-Ghannam, 2003; Staton and Harding, 2004). The recent study of Cole *et al.* (2007) has stated that under-nutrition is better assessed as thinness (low body mass index for age) than as wasting (low weight for height). Prior to this report, there were no suitable thinness cut-offpoints for this age group. These new cut-off points were 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. It must be mentioned here that these cut-off points were derived from multi-centre data from United States, Great Britain, Hong Kong and the Netherlands including data from Brazil (developing country). Thus, these cut-off values are valid for use among Indian children including these children (Table 1).

Under-nutrition in the form of thinness was found to be widely prevalent among pre-school children of ICDS centres of Chapra Block, Nadia District, West Bengal. The overall age-combined prevalence of thinness was 49.68 % and 51.57 %, in boys and girls respectively. In general, the frequency of thinness increased with increasing age up to 4.5 years in both sexes and decreased at 5.0 years, and again rose up at age 5.5 years.

Some of the other studies show (Table 4) more or less similar prevalence of under-



nutrition (Bose *et al.*, 2008, Mishra & Mishra 2007). On the other hand some of the studies show very high prevalence of under-nutrition compared to this study (Mandal, Bose & Bisai, 2009, Pryer *et al.*, 2004, Bisai, Bose & Dikshit, 2008). Thin children are more likely to grow into thin adults with a low BMI which would have an impact on their work productivity as well as lead to greater rates of morbidity and mortality.

This additional governmental funding is mandatory and requires political and administrative willingness to reduce the rates of thinness. Unless and until such proactive measures are taken, it is unlikely, that in future, there would be an appreciable decline in these rates. We also suggest that similar studies be undertaken among children of other populations of not only West Bengal but also from other parts of India. Children of rural areas should be given priority.

The findings of this study have important implications for public health policy-makers, planners and organisations seeking to meet national and international developmental targets. Of paramount importance is to increase the amount of food supplementation given to these children.

In conclusion, our study provided evidence that these children were under acute and chronic nutritional stress in the form of thinness indicating the requirement for immediate appropriate public health nutritional intervention programmes.

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