

Prevalence of undernutrition in slum areas, children of central and north Kolkata, West Bengal: A cross-sectional study

Sulagna Hatai¹, Sutanu Dutta Chowdhury^{1*}, Pratiti Ghosh²

ABSTRACT

Objectives: The study aimed to evaluate the nutritional status of children residing in slum areas in central and northern Kolkata, West Bengal. **Methodology:** A total of 507 children from slum areas (264 boys and 243 girls) aged 5 to 10 years were selected from randomly chosen schools in North and Central Kolkata. The nutritional status of these children was assessed using Z-scores based on height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) reference data from the World Health Organization (WHO). **Results:** Undernutrition (<-1 z-score) was prevalent among children from slum areas as follows: 45.03% stunted, 58.22% underweight, and 45.82% wasted. Severe undernutrition (z-score <- 3) was identified in the following percentages: 5.87% for stunting, 4.58% for underweight, and 5.78% for wasting. Notably, the prevalence of underweight (62.54%) and wasting (52.9%) was higher among girls than among boys (45.82% underweight and 45.83% wasting). **Conclusion:** Undernutrition remains a significant issue among children from slum areas in Kolkata, likely due to their poor socioeconomic status.

Keywords: Slum children, Stunting, Underweight, Wasting, Undernutrition.

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INTRODUCTION

Nutrition is the most important factor in children's growth. The growth patterns of children can provide valuable information about a community's health and nutritional status. Hence, a growth study can be used as a powerful tool to assess the health and nutritional status of any community. There are several socially disadvantaged communities in India, among which slum populations are the most deprived ones. Approximately 1.4 million people, or one-third of Kolkata's population, reside in slum areas such as Rajabazar, Sovabazara, Khidderpore, and Kasba.¹ Children living in these urban slums are particularly vulnerable to growth and nutritional issues due to factors such as overcrowding, inadequate sanitation, poor access to clean drinking water, etc. The socioeconomic conditions in these areas are highly challenging, with residents often facing poverty, illiteracy, and nutritional deficiencies. Health data of this community in Kolkata is sparse, with only a few studies addressing their situation. Mondal *et al.* found that about 44 and 40% of children from slum areas aged 5 to 14 years in Kolkata were found to be underweight and stunted, respectively.² Recently, Roy Chowdhury *et al.* reported that 17.8, 16.3, and 9.3% of preschool-aged children from slum areas (under 5 years of age) in Kolkata were found to be underweight, stunted, and wasted, respectively.³ The occurrence of vulnerable nutritional status among children is an important indicator of overall community health. However, recent investigations into the nutritional status of children in Kolkata's slum areas are lacking. This study aims to assess the severity of undernutrition among children aged 5-10 in these slum areas of Kolkata, West Bengal.

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METHODS

The study involved 507 children from slum areas (264 boys and 243 girls) aged 5 to 10 years from three primary schools [(1). Paikpara Raja Manindra Memorial Primary School, 18, Barrackpore Trunk Rd, East Kolkata Township, Sawdagarh Pally, Cossipore, Kolkata-700002; (2). Adi Mahakali Pathsala, 35C, Kailash Bose St, Simla, Machuabazar, Kolkata-700006; and (3). Metropolitan institution [Primary] for Boys, 39 Shankar Ghosh Lane, Simla, Machuabazar, Kolkata-700006, in North and Central Kolkata of West Bengal. Subjects were recruited by announcement, and data were collected after obtaining informed consent from children, parents, and school authorities. Children with disabilities, any systemic disease, or with primary surgical operations of neurological, sensory, or motor problems that could influence their measurements were excluded from participating in the study. The socioeconomic status of each participant was assessed using a modified version of Kuppuswamy's scale⁴. The scale

is based on monthly family income, parental education, and parental occupation. Structured questionnaires were used to collect information on socioeconomic characteristics of subjects' families from their parents and/or school authorities. The Institutional Ethical Committee approved the study for human experimentation (WBSU/IHEC/07/2024/11 dated 28.08.2024). It adhered to the ethical guidelines for human experimentation set forth by the Indian Council of Medical Research (ICMR 2017). The anthropometric measurements, including height and weight of each child, were taken using standard techniques.⁵ Height was measured by using a non-stretchable tape fixed to a vertical wall, with the participant standing on a level surface, and it was measured to the nearest 0.1 cm. Weight was measured to the nearest 0.1 kg in an analog weighing machine (Model No. GVC_663, GVC, India). The nutritional status of the children was evaluated using age-specific height and weight reference values from the World Health Organization (WHO).⁶ Undernutrition was assessed using indices such as stunting, underweight, and wasting calculated by Z-score based on WHO reference values of height-for-age, weight-for-age, and weight-for-height, respectively. The severity of undernutrition was classified according to WHO standards based on z-scores.⁷ Descriptive statistics were used to compute the mean, median, and standard error of mean (SEM) for different parameters by age and sex. A Student's t-test was used to compare anthropometric data and nutritional groups between the sexes, with alpha set at 0.05. Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 23.0.

RESULTS

About 29.22% of children from the slum area (31.42% boys and 27.02% girls) were present in the lower (score 0–5) socioeconomic category, and 37.41% of slum children (34.28% boys and 40.55% girls) were present in the upper-lower (score 6–10) socioeconomic category (Table 1).

Age- and sex-specific means and standard errors of the mean for height and weight among slum children are presented in Figure 1. The height and weight (except for boys aged 7 and 9) of children from slum areas increase with age. There are no significant differences in height or weight (excluding a 5-year age difference) between slum boys and girls.

When compared to the WHO reference data, the mean height of slum boys remains above the 15th percentile at younger

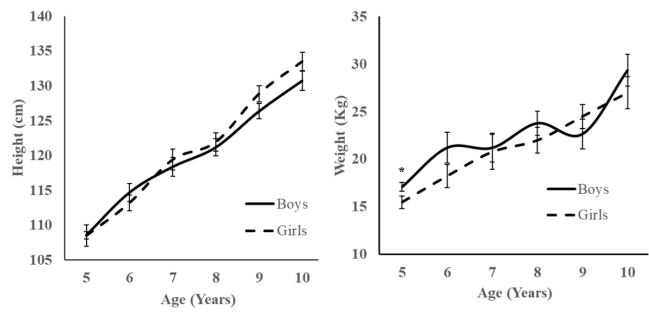


Figure 1: Comparison of age-wise mean height (cm) (a) and weight (kg) (b) between Slum boys and girls. * indicates significant difference ($p < 0.05$) between the mean values

ages (5–6 years). However, with the advancement of age, the mean heights of slum boys drop slightly to just above the 5th percentile value of WHO (Figure. 2a). In girls, mean heights remain around the 15th percentile values of WHO (Figure. 2b). Regarding weight, the mean weight of slum boys (Figure. 3a) and girls (Figure. 3b) remains around the 15th percentile (except for boys at 9 years of age for boys and girls at 5 years of age) of WHO reference data.

The prevalence of mild (Z-score between –1 and –1.99) and moderate stunting (Z-score between –2 and –2.99) was similar for boys (21.96 and 17.42%, respectively) and girls (21.28 and 17.67%, respectively). Severe stunting (Z-score < –3) also showed similar values, with boys at 4.92% and girls at 6.82%. However, for moderate and severe wasting, girls had higher values than boys: moderate wasting (20.98% in girls and 15.53% in boys) was significantly higher in girls ($p < 0.05$). However, severe wasting was 7.41% in girls and 4.16% in boys (Table 2). For underweight, the prevalence of mild underweight was significantly higher in girls than in boys ($p < 0.01$). The percentages of moderate and severe underweight

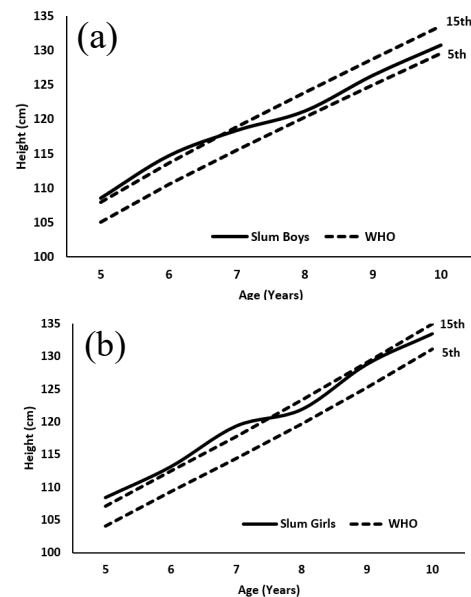


Figure 2: Mean height (cm) of Slum boys (a) and girls (b) with WHO reference

Table 1: Distribution of slum children by socioeconomic class.

Socioeconomic class	Boys (%)	Girls (%)
Upper	-	-
Upper-middle	8.57	2.71
Lower-Middle	25.71	29.72
Upper-lower	34.28	40.55
Lower	31.42	27.02
Total	100	100

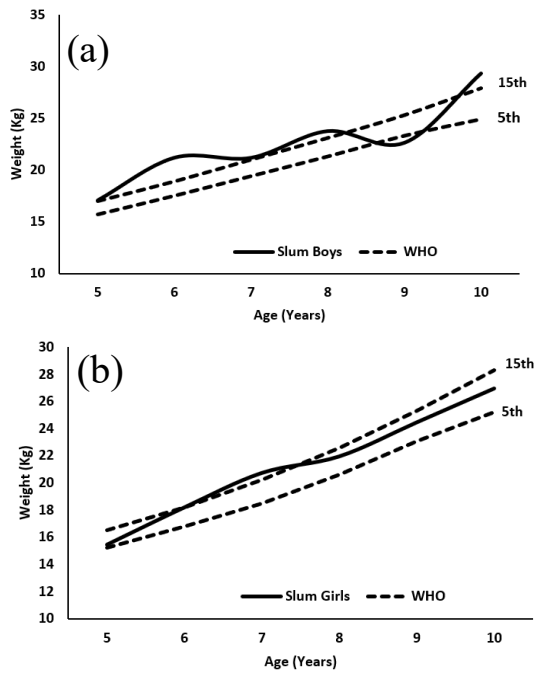


Figure 3: Mean weight (kg) of Slum boys (a) and girls (b) with WHO reference

were higher among girls (25.51 and 5.76%, respectively) than among boys (21.96 and 3.41%, respectively). The percentage of stunting (z-score below 1) was comparable, with slum boys (44.3%) and girls (45.77%). However, the percentage of underweight and wasting (below -1 Z score) was found to be higher in slum girls (62.54 and 53.9%, respectively) than in boys (45.82 and 45.83%, respectively) and overall, based on the WHO criteria (z-score below -2), 23.41% of children from slum areas were found to be stunted, 28.37% were underweight, and 24.4% were wasted. Additionally, severe stunting, underweight, and wasting (below -3 Z-score) were identified in 5.87, 4.58, and 5.28% of children from slum areas, respectively.

Table 3 indicates that the percentages of stunting, underweight, and wasting increased with advancing age. The highest percentage of stunting, underweight, and wasting was found in boys (18.81%, 21.48%, and 21.48%, respectively)

at 9 years of age. The highest percentages of stunting (20.17%), underweight (19.73%), and wasting (23.66%) in girls were observed at ages 9 and 10 years (for underweight and wasting, respectively).

DISCUSSION

The growth and development of children are primarily dependent on environmental factors. Favourable ecological conditions help the child develop to the fullest, whereas unfavourable conditions hinder its development. The socioeconomic status of slum children in the surveyed region of north and central Kolkata, as measured in the present study using the updated Kuppaswamy scale, indicates a lower socioeconomic status. The growth patterns of Slum children, as assessed by height-for-age and weight-for-age curves, indicate that undernutrition is prevalent among these children relative to international standards.

The height and weight of the children are affected by undernutrition. The poor growth patterns of surveyed slum children, as compared with the WHO (2007) standard data on height and weight, may be supported by assessing nutritional status using z-scores. It indicates remarkable undernutrition among slum children. The most commonly used anthropometric indices for assessing child growth are stunting and underweight.⁸ Although there were no significant differences in severe stunting, underweight, and wasting between boys and girls, a notable gender difference was observed in total underweight and wasting values, which were higher in girls in comparison to boys. This suggests that the prevalence of undernutrition is higher among girls living in slums. However, the specific causes of undernutrition in these children cannot be determined from this study. The lower socioeconomic status of these children suggests that factors such as education, occupation, and parental economic status may contribute to undernutrition. The study also showed an increasing trend of all categories of undernutrition (stunting, underweight, and wasting) with age in both boys and girls.

The prevalence of undernutrition among slum children in Kolkata has not been adequately investigated. Recently, Bhattacharya *et al.*⁹ conducted a study on the slum area children aged 6 to 19 years in south Kolkata and showed

Table 2: Distribution of slum children according to z-score

Z-score	Boys			Girls		
	Height-for-age (%)	Weight-for-age (%)	Weight-for-height (%)	Height-for-age (%)	Weight-for-age (%)	Weight-for-height (%)
> 0	44 (16.67)	46 (17.42)	49 (18.56)	48 (19.27)	22 (9.05)	33 (13.58)
0 to -0.99	103 (39.01)	97 (36.74)	84 (31.81)	87 (34.94)	69 (28.39)	79 (32.51)
-1 to -1.99	58 (21.96)	54 (20.45)	69 (26.13)	53 (21.28)	76 (31.27)	62 (25.51)
-2 to -2.99	46 (17.42)	58 (21.96)	41 (15.53)	44 (17.67)	62 (25.51)	51 (20.98)
< -3	13 (4.92)	9 (3.41)	11 (4.16)	17 (6.82)	14 (5.76)	18 (7.41)
Total	264 (100)	264 (100)	264 (100)	249 (100)	249 (100)	249 (100)

Table 3: Age-wise distribution of undernourished Slum children.

Age (Years)	Boys			Girls		
	Height-for-age (%)	Weight-for-age (%)	Weight-for-height (%)	Height-for-age (%)	Weight-for-age (%)	Weight-for-height (%)
5	06 (5.12)	11 (9.09)	18 (14.88)	14 (12.28)	19 (12.5)	14 (10.68)
6	14 (11.96)	16 (13.22)	13 (10.74)	14 (12.28)	24 (15.78)	21 (16.03)
7	18 (15.38)	22 (18.18)	19 (15.71)	20 (17.54)	23 (15.13)	17 (12.97)
8	21 (17.94)	21 (17.35)	22 (18.18)	21 (18.42)	29 (19.07)	24 (18.32)
9	22 (18.81)	26 (21.48)	26 (21.48)	23 (20.17)	27 (17.76)	24 (18.32)
10	16 (13.67)	25 (20.66)	23 (19.01)	22 (19.29)	30 (19.73)	31 (23.66)

that about 10.6 and 23.6% of children are stunted and underweight, respectively. A significant prevalence² of undernutrition has been reported among children (aged 0–14 years) residing in the slum area of Kolkata, with approximately 45% affected. Additionally, a study by Srivastava *et al.*¹⁰ indicated that in the 5 to 15 years age group of Uttar Pradesh, 38.4% were underweight, 33.3% were wasted, and 19.9% experienced stunting. Panigrahi and Das¹¹ reported concerning figures for the 3 to 9 years age group in Bhubaneswar, with 23.3% wasted, 57.4% stunting, and 45.4% underweight. In the present study, the severity of undernutrition among Slum children in central and north Kolkata was found to be greater than in previous reports by Bhattacharya *et al.*⁹ and Mondal *et al.*², as well as in studies from Uttar Pradesh¹⁰ and Bhubaneswar.¹¹

Most of the surveyed Slum populations are daily labourers, including maids, baby-care attendants, shop workers, drivers, masons, electricians, and factory workers. Families in these areas receive water supply from the Kolkata Municipal Corporation. The majority of families have pucca sanitary facilities, although cleanliness falls short of standards. Most students from lower socioeconomic backgrounds have an income range of approximately Rs. 7000 to 9000 per month. Most parents have completed basic education by 8th to 12th grade, although some have no formal education. The slum population of the study area faces many health and nutritional problems due to their illiteracy and ignorance. Poor growth pattern and nutritional status of surveyed children clearly indicate that this community is nutritionally vulnerable.

The factors underlying the undernutrition in the present study have not been investigated. The poor socioeconomic status of this community might be related to their unfortunate nutritional status. To prevent undernutrition among this large number of children, an additional intervention programme is required, in addition to the mid-day meal programme. Non-formal education on food nutrition may benefit the community. An appropriate nutritional program should be designated through the child welfare scheme. Therefore, there is a need to develop comprehensive programs for the overall development of this Slum population, with particular reference to child growth and nutrition. A

nutritional awareness programme can also be effective in combating such undernutrition. Policy-makers may consider the modified mid-day meal programme in schools in the surveyed regions.

The present study revealed a high prevalence of undernutrition among slum children in central and north Kolkata, as reflected in their age-related growth patterns for height and weight. The magnitude of overall undernutrition was higher among girls than among boys. The study also showed an age-related increase in undernutrition among both boys and girls.

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PEER-REVIEWED CERTIFICATION

During the review of this manuscript, a double-blind peer-review policy has been followed. The author(s) of this manuscript received review comments from a minimum of two peer-reviewers. Author(s) submitted revised manuscript as per the comments of the assigned reviewers. On the basis of revision(s) done by the author(s) and compliance to the Reviewers' comments on the manuscript, Editor(s) has approved the revised manuscript for final publication.