Burden of malnutrition among school-going children in a slum area of Kolkata: A matter of concern

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ABSTRACT

Background: Malnutrition is still a great barrier to the growth and development of children, especially in India. Children from the underprivileged sections of the society like slum children are more vulnerable to both undernutrition and overnutrition. This study aimed to estimate the magnitude of malnutrition among school-going children in a slum area of Kolkata and to elicit the association of nutritional status with parental education. Methods: A cross-sectional observational study was conducted from November 2017 to May 2018 among 508 school-going children of 6 years to 19 years of age in slums of Chetla, Kolkata. Out of three coeducation high schools catering to those children, two schools were randomly selected. 254 participants from each school were selected using systematic random sampling. Students, unwilling to participate and/or whose parents denied providing informed written consent were excluded. After the interview by a predesigned, pretested schedule, their anthropometric examination was conducted. Results: Prevalence of stunting and severe stunting was present in 9.4% and 1.2% of subjects whereas the prevalence of thinness was 23.6% among them. The prevalence of overnutrition was 11%. Boys are more stunted (OR = 2.13, P = 0.013) and thin (OR = 1.73, P = 0.011) than girls. Poor parental education was significantly associated with both undernourishment (stunting and thinness) as well as overweight and obesity. Conclusion: Substantial burden of double malnutrition was observed among school-going slum children. Parental education had an important role to prevent malnutrition of their children. Thus, periodic growth monitoring with the strengthening of the Mid-Day Meal program and awareness generation campaigns regarding malnutrition among parents of slum children are highly needed.

Keywords: Overweight, parental education, slum children, stunting, thinness

Introduction

More than half of the under-five children’s deaths are related to undernutrition. However, no such data is available for adolescents at the population level. But childhood and adolescent malnutrition (both undernutrition and overnutrition) can cause many acute and chronic comorbidities and may lead to non-communicable and metabolic diseases like Diabetes Mellitus, Hypertension, Dyslipidemia, etc., in adult life. Thus estimation of prevalence and predictors of malnutrition among children and adolescents in a community is very essential, especially for both policymakers as well as primary health care physicians, to provide holistic care in terms of preventive promotive curative and rehabilitative measures to stop the vicious cycle of malnutrition and disease.

School children are the future citizen of a country. It is an established fact that proper nutrition can foster their appropriate growth and cognitive function in this period of life. The scenario

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of nutritional incongruity in this critical period is very common in both developing and developed countries. This “double burden of malnutrition” in terms of undernutrition as well as overnutrition in childhood and adolescence becomes one of the prevailing public health problems worldwide.\footnote{\cite{1,2,6,7,8,9}}

Urban slum children are very much vulnerable for growth and nutritional failure to various factors like overcrowding, poor sanitation, poor drinking water supply in residential areas, etc., which are related to lower socioeconomic status.\footnote{\cite{5,6,8,9}} Parental education is one of the important proxy indicators of their socioeconomic status. Lack of proper hygiene and faulty food habits are also the other reasons for nutritional failure, which are directly related to parental education.\footnote{\cite{10,11}} Poor eating behavior, lack of dietary diversity, and excessive intake of energy-dense nutrient-poor junk food and sweetened beverages can lead to overnutrition in urban children. Lack of access to a playground and poor physical activity was also observed in slum children which may lead to obesity. Poor parental education can potentiate this risk. National Family Health Survey (NFHS 4 and 5) data showed the prevalence of undernutrition of under-five children in our country, but not of school-aged children.\footnote{\cite{12,13}} Only a handful of studies in India reported the prevalence of the dual burden of malnutrition especially in school-age children in urban slums. In this context, the present study was conducted to find out the prevalence of malnutrition and its predictors among school-age children in a slum area of Kolkata.

**Methodology**

**Study design**

A cross-sectional observational study was conducted from November 2017 to May 2018 among the school-going children of 6 years to 19 years in the slums of Chetla. These slums were situated predominantly in Kolkata Municipal Corporation ward no. 74 and 82 over 3.9 sq. km under service area of All India Institute of Hygiene and Public Health (AIIH&PH). Out of three coeducation high schools catering to children from this area, two schools were randomly selected. All students present during the days of the survey were included. Students who were unwilling to participate or whose parents denied to provide informed written consents were excluded.

**Sample size and sampling technique**

In a study in 2010-11 Srivastava A \textit{et al.} showed that the prevalence of undernutrition among school-age children of urban slums in Bareilly, Uttar Pradesh, was 53.2\%.\footnote{\cite{14}}

Considering the estimated prevalence $P = 0.532$, standard normal deviate of 95\% confidence interval ($Z = 1.96$), 10\% relative error of prevalence ($L$) and Design effect ($D$) of 1.5, minimum sample size required for this study was $507$ using the following formula:

$$\text{Sample size (n)} = D \times Z^2 \times P \times (1 - P)/L^2.$$  

Number of students list was obtained from the school authorities and total 508 students were selected from those two schools (254 from each school) using systematic random sampling technique.

**Data collection**

After obtaining ethical clearance from Institutional Ethics Committee of AIIH&PH (Ref no: PSM/IEC/2017/31, Date: November 15, 2017) and permission from school authorities’ multiple sessions were conducted during school time over a period of 2 months. Prior to the data collection, informed written consent from parents, and written assent from participants were obtained with help of authorities. Interviews of participants using a predesigned pretested questionnaire were conducted and anthropometric examinations were done as per standard operating procedures.\footnote{\cite{15}}

**Statistical analyses**

Data were checked for consistency and completeness and analyzed using MS Excel 2013 and Statistical Package for the Social Sciences (SPSS version 16.0, USA). Gender and Age-specific Z score of Height for age (HAZ), weight for height, and BMI for Age (BMIZ) for each participant were calculated using WHO Anthro-Plus Calculator version 1.0.4.\footnote{\cite{16}} Descriptive and inferential statistics including Chi-square and logistic regression were calculated. The level of significance was considered in $P$ value $<0.05$.

**Operational definition**

Stunting was defined as low HAZ. Children with $z$-scores $<−2.00$ were coined as stunted and those $<−3.00$ as severely stunted.\footnote{\cite{17}} Thinness was defined as low BMIZ. Children with $z$-scores $<−2.00$ were said to have thinness.\footnote{\cite{18}}

Over-nutrition was defined as high BMI. Children with $z$-scores $>+1.00$ were termed as overweight and $>+2.00$ as obesity.\footnote{\cite{19}}

**Result**

**Background characteristics**

Most of them (44.1\%) belonged to 10 to 14 years of age. Almost half (49.6\%) of them were female. Majority of the parents of these children received at least primary level of education (60.1\% and 58.1\% for mothers and fathers, respectively) [Table 1].

**Stunting: Prevalence and associated factors**

Stunting and severe stunting was present in 9.4\% and 1.2\% (total 10.6\%) of subjects. Difference in prevalence of stunting and severe stunting was present in male (12.5\% and 1.6\%) and female students (6.8\% and 0.3\%) [Figure 1]. This differential pattern of prevalence of stunting (HAZ $<−2$ SD) between genders was statistically significant. Male had 2.13 times higher odds of stunting in comparison to female. ($P = 0.013$). Similarly, significant association of stunting and age was observed. Children from mothers with educational attainment below primary level had 2.93 times higher...
odds of stunting than children from mothers with minimum secondary education which was statistically significant (P = 0.043). Children from mothers with minimum primary level had 1.73 times higher odds of stunting than children from mothers with secondary education. However, this finding was not statistically significant (P = 0.272). No significant association was observed between schooling of father and stunting of their children [Table 2].

**Thinness and overweight: Prevalence and associated factors**

Both thinness (23.6%) and overweight (11%) was present among them [Figure 2]. Differential prevalence of thinness was present in

| Table 1: Distribution of Study Subjects According to Socio-demographic Attributes |
|-----------------------------------------------|
| Socio-demographic Attributes          | Number (%) |
|-----------------------------------------------|
| Age in years                              |
| 6-9                                        | 170 (33.5) |
| 10-14                                      | 228 (44.9) |
| 15-19                                      | 110 (21.6) |
| Gender                                    |
| Male                                       | 256 (50.4) |
| Female                                     | 252 (49.6) |
| Mothers education                         |
| Below Primary                              | 113 (22.2) |
| Primary                                    | 307 (60.4) |
| Secondary and above                       | 88 (17.4)  |
| Fathers’ education                        |
| Below primary                              | 93 (18.3)  |
| Primary                                    | 295 (58.1) |
| Secondary and above                       | 120 (23.6) |

**Figure 1:** Distribution of Study Subjects According to Height for Age (N = 508)

**Figure 2:** Distribution of Study Subjects According to BMI for Age (N = 508)

A high prevalence of both ends of malnourishment was observed among school-going children in the study area. Both stunting and thinness were higher in male students. However, no significant difference in the prevalence of overweight was observed across gender. Lower educational attainment among parents was found to be significantly associated with a higher risk of malnutrition.

**Undernutrition: Prevalence and associated factors**

The present study observed that one-tenth (10.6%) of school children were stunted whereas thinness was present...
in one-fourth (23.6%) of them. A slightly higher prevalence of stunting (18.5%) and thinness (33.3%) were observed by Srivastava et al. among school-going slum children in Bерейли in 2012.[13] Another study in Assam by Dey et al. showed nearly one-fourth (24.5%) of school children had stunting among which 6.5% severely stunted whereas and almost two-third (63.3%) were underweight.[24] Mondal et al. also found a higher prevalence of underweight (44.4%) and stunting (37.2%) among 6-16 years aged Bengali school children in Chapra block in 2012.[14] Shivaprakash et al. noticed prevalence of underweight and stunting were 30.3% and 27.9%, respectively, among 6-12 years aged students from a public school at Mandya district, Karnataka.[22] Verma M et al. conducted a study in 2018 in Punjab and found 37.5% thinness and 87.7% stunting among school-going children.[23] Present study showed a lesser prevalence of overall undernourishment compared to those studies. This is maybe due to regular school health program, home visit, and health education program in the slums of Chetla by the urban health unit of All India Institute of Hygiene and Public Health, Kolkata. However, prevalence of undernourishment was comparable with findings of Daga S et al. who observed 20.2% thinness among school-going children in Pune.[25] Several other studies in low- and middle-income countries (LMIC) like Bangladesh, Ecuador, Tanzania, etc., observed a high burden of undernutrition in this age group.[26-27] Present study noticed significant association of stunting with male gender, low maternal education, and higher age. However, paternal education was not associated significantly with stunting. The probability of thinness was also higher in subjects who were of male gender, higher age, and poor parental education. Contrary to the normal belief of gender abuse and malnutrition in girls, the current study noticed slum boys were more susceptible to both chronic and acute undernutrition, which might be attributable to the higher risk of worm infestation and recurrent episodes of acute illness in slum boys, who spend a significant amount of time outdoors playing in dirty environments and may have a poor hygienic practice. Deb S et al. conducted a study among children of a school in the same area in 2010, and found significantly higher personal hygiene score and lower undernutrition in girls compared to boys. They also noticed comparatively higher prevalence of worm infestation in males (39.8%) than females (29.6%), however no test of significance was carried out. Findings of Deb S et al. supported our hypothesis behind poor nutritional outcome in male school-going children.[28] Shivaprakash et al. also noticed higher susceptibility of both acute and chronic undernutrition in male children in Karnataka, concordant to our finding.[25] However Srivastava et al. found significantly higher prevalence of malnutrition in female school-going children in slums of Uttar Pradesh, contrary to our finding which can explained by possibility of gender abuse and/or higher prevalence of morbidity among female students observed by those researchers. They also showed significant relationship of parental education with malnutrition.[14] Darling et al. also found lesser likelihood of underweight in female children in rural part

| Table 2: Predictors of Stunting (HAZ < -2SD): Binary Logistic Regression Model |
|----------------------------------|----------|-------|-----|-----|
| **Age group**                     | **Number (%)** | **OR** | **CI** | **P** |
| 6-9 years                         | 4 (2.4)    | 1     | -   | -   |
| 10-14 years                      | 22 (9.6)   | 1.43  | 1.49, 13.11 | 0.007 |
| 15-19 years                      | 28 (25.4)  | 1.17  | 4.81, 41.75 | <0.001 |
| **Gender**                       |            |       |     |     |
| Male                             | 36 (14.1)  | 2.13  | 1.17, 3.86 | 0.013 |
| Female                           | 18 (7.1)   | 1     | -   | -   |
| **Mothers Education**            |            |       |     |     |
| Below Primary                    | 18 (15.9)  | 2.92  | 1.04, 8.22 | 0.043 |
| Primary                          | 31 (10.1)  | 1.73  | 0.65, 4.60 | 0.272 |
| Secondary and above              | 5 (5.7)    | 1     | -   | -   |
| **Fathers Education**            |            |       |     |     |
| Below Primary                    | 15 (16.1)  | 1.58  | 0.71, 3.52 | 0.259 |
| Primary                          | 26 (8.8)   | 0.79  | 0.39, 1.61 | 0.523 |
| Secondary and above              | 13 (10.8)  | 1     | -   | -   |

| Table 3: Predictors of Thinness and Overweight: Multinomial Logistic Regression Model |
|----------------------------------|----------|-------|-----|-----|----------|-------|-----|-----|
| **Thinness ¥**                   | **Number (%)** | **OR** | **CI** | **P** | **Overweight ¥** | **Number (%)** | **OR** | **CI** | **P** |
| **Age group**                     |            |       |     |     |            |       |     |     |     |
| 6-9 years                         | 28 (16.5)  | 1     | -   | -   | 16 (9.4)   | 1     | -   | -   | -   |
| 10-14 years                      | 58 (25.4)  | 2.32  | 1.29, 4.15 | 0.005 | 30 (13.2)  | 1.19  | 0.51, 2.76 | 0.68  |
| 15-19 years                      | 34 (30.9)  | 1.86  | 1.12, 3.11 | 0.017 | 10 (9.1)   | 1.69  | 0.88, 3.24 | 0.12  |
| **Gender**                       |            |       |     |     |            |       |     |     |     |
| Male                             | 72 (28.1)  | 1.73  | 1.13, 2.65 | 0.011 | 30 (11.7)  | 1.33  | 0.76, 2.35 | 0.32  |
| Female                           | 48 (19.0)  | 1     | -   | -   | 26 (10.3)  | 1     | -   | -   | -   |
| **Mothers Education**            |            |       |     |     |            |       |     |     |     |
| Below Primary                    | 27 (23.9)  | 2.51  | 1.07, 5.91 | 0.035 | 4 (3.5)    | 0.16  | 0.05, 0.48 | 0.001 |
| Primary                          | 85 (27.7)  | 3.43  | 1.57, 7.48 | 0.002 | 33 (10.7)  | 0.56  | 0.29, 1.06 | 0.074 |
| Secondary and above              | 8 (9.1)    | 1     | -   | -   | 19 (21.6)  | 1     | -   | -   | -   |
| **Fathers Education**            |            |       |     |     |            |       |     |     |     |
| Below Primary                    | 37 (39.8)  | 2.63  | 1.39, 4.98 | 0.003 | 8 (8.6)    | 0.54  | 0.23, 1.31 | 0.176 |
| Primary                          | 61 (20.7)  | 0.99  | 0.57, 1.73 | 0.986 | 25 (8.5)   | 0.39  | 0.21, 0.73 | 0.003 |
| Secondary and above              | 22 (18.3)  | 1     | -   | -   | 23 (19.2)  | 1     | -   | -   | -   |

¥Referent population=Normal BMI for age.
Present study depicted the pathetic condition of malnutrition among school-going slum children in a slum of Kolkata which was unaddressed in past studies. Moreover, the current study accounted for both ends of malnutrition, which was mostly missed in earlier studies. Despite these strengths, the current study had some major drawbacks. First, micronutrient deficiencies among these children were not addressed in the present study.

Second, living conditions and population dynamics in various slums of Kolkata are not the same. Thus, it is arguable that the result of the current study might not illustrate the actual picture of malnutrition in slum children throughout Kolkata. Moreover, malnutrition among school drop-out children was not assessed by the present study. Therefore, future community-based studies are warranted with a higher sample size and representative samples of slum children from all over Kolkata.

Conclusion

Observed burden of double malnutrition among the slum school children was alarming. Parental education has a key role for prevention and management of childhood malnutrition. Thus, periodic growth monitoring using WHO BMI for age chart with the strengthening of the Mid-Day Meal program and awareness generation campaigns regarding malnutrition among parents of slum children are highly needed. Primary care physicians can provide a pivotal role in this regard by not only providing treatment and support to the malnourished children but also spread the adequate and appropriate information toward the community through their clinics for prevention of malnutrition and other diseases related to it. Moreover, further operational research is warranted to explore the effectiveness of such primary care model especially in underserved areas.

Key Points and Messages

- Huge burden of malnutrition is present among the slum school children.
- Poor parental education is an important risk factor for childhood malnutrition.
- Regular growth monitoring along with supplementary nutrition is warranted to solve the problem.
- Primary care physician as well as policymakers should work hand in hand in this regard.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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