



Risk Factors for Child Malnutrition in Bangladesh: A Multilevel Analysis of a Nationwide Population-Based Survey

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Objective To identify the prevalence and risk factors of child malnutrition in Bangladesh.

Study design Data was extracted from the Bangladesh Demographic Health Survey (2011). The outcome measures were stunting, wasting, and underweight. χ^2 analysis was performed to find the association of outcome variables with selected factors. Multilevel logistic regression models with a random intercept at each of the household and community levels were used to identify the risk factors of stunting, wasting, and underweight.

Results From the 2011 survey, 7568 children less than 5 years of age were included in the current analysis. The overall prevalence of stunting, wasting, and underweight was 41.3% (95% CI 39.0-42.9). The χ^2 test and multilevel logistic regression analysis showed that the variables age, sex, mother's body mass index, mother's educational status, father's educational status, place of residence, socioeconomic status, community status, religion, region of residence, and food security are significant factors of child malnutrition. Children with poor socioeconomic and community status were at higher risk of malnutrition. Children from food insecure families were more likely to be malnourished. Significant community- and household-level variations were found.

Conclusions The prevalence of child malnutrition is still high in Bangladesh, and the risk was assessed at several multilevel factors. Therefore, prevention of malnutrition should be given top priority as a major public health intervention. (*J Pediatr* 2016;172:194-201).

Malnutrition refers to inadequate dietary intake, infectious disease, or a combination of both.¹⁻³ Three common indices of malnutrition for children are stunting (low height-for-age), wasting (low weight-for-height), and underweight (low weight-for-age).⁴⁻⁶ About 165 million or 26% of the world's children less than 5 years of age are stunted, which slows down cognitive and physical development.⁷ Over 52 million children or around 8% of the world's children less than 5 years of age suffer from wasting because of acute malnutrition, which noticeably increased the risk of death.⁶ Similarly, an estimated 101 million or 16% of world's children less than 5 years of age are underweight.⁷

Malnutrition can exacerbate the impact of disease and nearly one-half of all child deaths globally are attributable to this cause.² Children suffering malnutrition are more likely to die from common childhood illnesses such as diarrhea, pneumonia, malaria, measles, and AIDS.⁸ The primary causes of malnutrition include a lack of quality food, poor infant and child feeding and care practices such as suboptimal breastfeeding, deficiencies of micronutrients such as vitamin A or zinc, and recurrent attack of infections, often intensified by intestinal parasites.^{9,10} Child malnutrition also draws parallel links with demographic aspects,^{2,11-13} environmental aspects,^{2,14} socioeconomic aspects,^{6,12,15,16} parental characteristics,^{2,11} household possession,¹⁷ and geographical location.¹¹

Bangladesh has made significant progress in the health and human development sectors since its independence in 1971.^{18,19} In Bangladesh, the child mortality per 1000 live births declined from 144 in 1990 to 41 in 2012, with an annual rate of reduction of 5.5%. Bangladesh has already achieved the Millennium Development Goal 4 and proven its achievement to be more impressive than other South Asian countries, particularly, India, Pakistan, and Afghanistan.²⁰ Unfortunately, Bangladesh was not very successful in addressing the problems of child malnutrition. Severe malnutrition increased from 16% in 2011 to 18% in 2013 which may be due to increasing rate of malnutrition among mothers, poor socioeconomic status of parents, relatively low rate of fully breastfeeding babies, and food insecurity.²¹ The prevalence malnutrition in children

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BDHS	Bangladesh Demographic Health Survey
BMI	Body mass index
WHO	World Health Organization

less than 5 years of age in Bangladesh is nearly 40%, which is one of the highest in the world, and causes nearly 60% of deaths in children less than 5 years of age.⁴

In Bangladesh, as well as in other developing countries, prevalence of malnutrition is one of the major indicators of child health in children less than 5 years of age. The factors related to malnutrition may help in policy formulation for the governments in these countries. Hence, a comprehensive study to determine the relationship between health-related factors and various malnutrition statuses is in demand. Several studies used fixed-effect models such as binary logistic regression, generalized Poisson regression, and ordinal logistic regression models to identify the determinants of malnutrition in Bangladesh.^{4,22,23} In another study, a 2-level binary logistic regression model with a random intercept was used to identify the factors related to the malnutrition status in Bangladesh, including any community-level variations in the data.²⁴ However, no previous studies addressed the possibility of both community- and household-level effects on malnutrition. In this study, therefore, multilevel binary logistic regression with a random intercept was used to identify individual-, household-, and community-level factors related to child malnutrition status of children less than 5 years of age in Bangladesh, including any community and household variations on malnutrition.

Methods

Data was extracted from the Bangladesh Demographic Health Survey (BDHS) 2011, a nationally representative cross-sectional study. In BDHS, data collection was implemented in 5 phases, starting on July 8 and ending on December 27, 2011. The BDHS 2011 was conducted by the National Institute of Population Research and Training under the Ministry of Health and Family Welfare, implemented by a Bangladeshi research organization “Mitra and Associate.” Technical support was provided by Inner City Fund International of Calverton, Maryland, and financial support was given by US Agency for International Development. ORC Macro Institutional Review Board approved the data collection procedure. The 2011 BDHS was also reviewed and approved by the National Research Ethics Committee of the Bangladesh Medical Research Council (Dhaka, Bangladesh). Informed consent was obtained from each participant prior to subject’s enrollment. The BDHS sample was drawn from Bangladeshi adults residing in noninstitutional dwellings. The survey was operated in 7 administrative regions (divisions): Southern region (Barisal), Southeastern region (Chittagong), Central region (Dhaka), Western region (Khulna), Midwestern region (Rajshahi), Northwestern region (Rangpur), and Eastern region (Sylhet). Enumeration areas from the 2011 census were used as the primary sampling units for the survey. The survey was based on multistage stratified sampling techniques of households. The detail sampling design and all other issues related to the BDHS were discussed elsewhere.²¹

All children listed in the survey were born in January 2006 or later. These children were eligible for height and weight measurements. Logistic support was given by United Nations Children’s Fund. The implausibility was defined based on World Health Organization (WHO) 2006 standards flag limits of z-score: stunting: <-6 or >6 ; wasting: <-5 or >5 ; and underweight: <-6 or >5 . A total of 8761 children less than 5 years of age in the BDHS sample households were eligible for anthropometric measurements. However, of these figures, only anthropometric and age data available for 7647 children were considered complete and credible (Figure; available at www.jpeds.com). The mean age of children was recorded as 30.38 months. Other indicators, such as, height, weight, and hemoglobin level had mean of 83.25 cm, 10.47 kg, and 10.74 g/dL, respectively.

Outcome Measures and Operational Definitions

The primary outcomes were stunting, wasting, and underweight. A child was considered stunted, wasted, and underweight, respectively, if the height-for-age, weight-for-height, and weight-for-age indices were less than 2 SDs below the respective median of the WHO reference population.^{21,25,52}

Covariates

Most of the covariates in this study were considered based on previous literature review.^{2,16,22,26} Covariates were classified into 3 level characteristics: individual-level, household-level, and community-level. Individual-level characteristics were age, sex, birth order, mothers’ body mass index (BMI), mothers’ and fathers’ education, religion, and food security. Five household food security indicators were selected using the Household Food Insecurity Access Scale.²⁷ The technical working group of the BDHS 2011²⁵ systematically reviewed and modified the indicators to suit Bangladesh. The questions used were: (1) “In the past 12 months, did you have 3 square (‘full-stomach’) meals a day?”; (2) “In the past 12 months, did you have to skip entire meals because there was not enough food?”; (3) “In the past 12 months, did you have less food in a meal because there was not enough food?”; (4) “In the past 12 months, did you or any of your family members eat wheat or another grain in place of rice?”; and (5) “In the past 12 months, did you ask for food from relatives or neighbors to make a meal?” Each indicator had the following 4 response options: never, rarely (1-6 times in the past 12 months), sometimes (7-12 times in the past 12 months), and often (few times each month), which were coded consecutively ranging from 3-0 for first question and 0-3 other than first question. A household was classified food insecure when the family experienced any of the 5 conditions within the recall period (ie, if the answer to first question was “sometimes,” “often,” or “never” and any of the other 4 questions was “rarely,” “sometimes,” or “often”). A household that did not meet these conditions (ie, “0”) was classified as food secure. Afterward, the individual food frequency scores for all the 5 frequency responses were summed in a single food security score for each ever-married woman of the household. To facilitate analysis, a composite score

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