RESEARCH BRIEF

Determinants of Undernutrition in Children Under 2 years of Age From Rural Bangladesh

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This study aimed to assess the determinants of under nutrition among under-two year old children of rural Bangladesh. The data of the National Nutrition Program baseline survey conducted in 2004 was analyzed, which included 8,885 under-two children and their mothers. Among the children studied, 41%, 35% and 18% were stunted, underweight, and wasted; and 16%, 11.5% and 3% were severely-stunted, -underweight, and –wasted, respectively. Multivariate analysis revealed that undernourished children were less likely to be female and having received measles vaccination, more likely to have suffered from diarrhea in the previous two weeks, and more likely to have older- (>30 years), shorter- (<145 cm), undernourished- (BMI ≤18.5 kg/m^2) and illiterate/less educated mother. Children with moderate stunting and underweight were more likely to reside in households with un-hygienic toilet. Children with all forms of under nutrition were more often from families with lowest quintile of asset index. The identified associated/risk factors can be used for designing and targeting preventive programs for undernutrition.

Key words: *Bangladesh, Children, Risk factors, Undernutrition*.

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One fifth of all under-five year old children in the developing world are malnourished and it is associated with more than one-third of all under-five deaths globally [1]. From the latest national survey (BDHS 2007), 43% of children under-five were found stunted (16% severely stunted), 17% were considered wasted (3% severely wasted), and 41% were underweight (12% severely underweight). Stunting, wasting and underweight were associated with place of residence (rural or urban), maternal education, age and nutritional status [2]. Previous studies have shown that multiple family and household characteristics were associated with malnutrition in under-five children [3-5]. Poor fetal growth and/or stunting in the first two years of life leads to irreversible damage, including shorter adult height, lower attained schooling, reduced adult income, and decreased off spring birth weight. On the other hand, children who are undernourished in the first two years of life and who put on weight rapidly later in childhood and in adolescence are at high risk of chronic diseases related to nutrition [6]. Before/within this period, nutrition interventions are most needed and have the greatest impact on child survival, health and development [7]. Investigators had identified several associated/risk factors for under-five malnutrition in Bangladesh,but there is a paucity of literature reported the determinants of under nutrition in under-two year age group.

Methods

This study used data of the National Nutrition Programme (NNP) baseline survey conducted in rural Bangladesh in 2004. The details of survey methodology, sample design and principle finding can be found elsewhere [8]. *Z*-scores of all anthropometric data were calculated in relation to the WHO growth standard by using WHO Anthro (version 2.0.2, 2007) software. Children were classified as moderately and severely stunted, wasted and underweight if the height for age *Z*-score (HAZ), weight for height *Z*-score (WHZ) and weight for age *Z*-score (WAZ) were respectively, below minus two and minus three *Z*-score. Based on the available information, this study examined the influences of socioeconomic, demographic, health and community factors determining the nutritional status of less than two years old children.

Bivariate analysis was performed to determine the differentials of under-two malnutrition by explanatory variables. Pearson's chi-square test was performed to test the existence of significant association between categories of malnutrition and selected factors. The significant variables observed in bivariate analysis were subsequently included in multivariate analysis. The multinomial logistic regression model was used to estimate regression parameters in multivariate analysis.

Statistical analysis was done using the statistical software package SPSS 11.5 for windows and STATA 8.

RESULTS

Analysis of total 8,858 under-two children revealed that 40.5% of the children were stunted (15.6% severely stunted), 35.4% were underweight (11.5% severely underweight) and 17.8% were wasted (3% severely wasted). Bivariate analysis of demographic, health and nutrition care characteristics (the data are not shown) revealed that male children were significantly more underweight, stunted and wasted than the female children. Too early or late initiation of complementary feeding practices was found negatively associated with under nutrition in bivariate analysis. Mothers of undernourished children had less exposure to mass media (television, radio and newspapers) and were less educated. Families of undernourished children did not use iodized salt for cooking.

Multinomial logistic regression (***Table* I**) showed that female children had 30% and 21% less odds to become moderately and severely stunted than the male counterparts, respectively. Multivariate analysis showed that female children had 20% to 21% less odds of being underweight (***Web Table* I**). Moderately underweight children had greater number of aged, short-statured and malnourished mother. On the other hand, severely underweight children were associated only with the latter two. Multivariate analysis revealed that severely wasted children were less likely to be female, vaccinated against measles, and consumed iodized salt for cooking. (***Web Table* II**).

DISCUSSION

The present study reports on the level of under nutrition and the impact of some socioeconomic, demographical, health and nutrition care characteristics on the nutritional status of under two years old children of rural Bangladesh. As this survey included a large sample size and had a wide geographical coverage, it may reasonably be considered to reflect all under-two year rural children of Bangladesh.

Mother's nutritional and educational status was found to be an important risk/associated factors for all three

TABLE I FACTORS ASSOCIATED WITH MODERATE AND SEVERE STUNTING AMONG LESS THAN TWO YEARS OLD CHILDREN

Characteristics	*Moderate Stunting (<–2 to –3 SD)*			*Severe Stunting (<-3 SD)*			*Total (n)*
	%	*Odds ratio*	*95% CI*	*%*	*Odds ratio*	*95% CI*	
Sex (female)	24.2	0.70**	0.59 - 0.82	13.7	0.79**	0.69 - 0.89	8,858
Measles vaccination	30.1	0.70**	0.58 - 0.85	21.1	0.80**	0.68 - 0.95	4,451
Diarrhea	29.1	1.26*	1.01 - 1.57	17.8	1.12	0.93 - 1.34	8,858
Suffering from any illness	24.5	1.24*	1.01- 1.52	16.0	0.89	0.75- 1.05	8.858
Maternal age at child birth[a]							
<20 years	26.7	1.09	0.91 - 1.29	14.7	1.11	0.96 - 1.27	8046
>30 years	23.1	1.33**	1.08 - 1.64	20.9	1.02	0.85 - 1.22	
Mother's height < 145 cm	31.3	3.47**	2.91 – 4.12	27.3	2.08**	1.78 - 2.43	8,851
Mother's BMI < 18.5 kg/m^2	28.2	1.47**	1.24 - 1.74	19.4	1.23**	1.09 - 1.39	8.837
Mother's education[b]							
Primary level	52.3	0.77**	0.64 – 0.93	30.9	0.89	0.76 –1.04	8,667
Secondary incomplete	21.9	0.74*	0.59 - 0.93	10.9	0.79*	0.65 - 0.95	
Secondary complete	13	0.50**	0.31 - 0.79	7.4	0.47**	0.34 - 0.65	
Hygienic toilet	18.5	0.74*	0.57 – 0.96	9.5	0.88	0.72 – 1.07	8.858
Asset index[c]							
Second	26.3	0.75**	0.60 – 0.92	18.4	0.77**	0.64 - 0.93	8,858
Middle	26.9	0.71**	0.56 - 0.89	16.1	0.79*	0.66 - 0.96	
Fourth	24.1	0.54**	0.42- 0.69	13.0	0.66**	0.54 - 0.81	
Highest	16.6	0.35**	0.26 - 0.49	7.7	0.49**	0.38 - 0.63	

*According to WHO growth standards; Multivariate analysis done; Comparison group: [a]Maternal age at birth 20 to 30 years; [b]Illiterate mother; [c]Lowest quintile of asset index * P<0.05; ** P<0.01.*

WHAT THIS STUDY ADDS?

- Associated risk factors of undernutrition among under two year old children in Bangladesh included male sex, not receiving measles vaccine, diarrhea in previous two weeks, and older, shorter, undernourished, illiterate/ less educated mother.

types of malnutrition. The highest rates of diarrhea occurred among malnourished children, likely due to the vicious cycle of the malnutrition–infection interaction. Educational level of mother is important because educated mothers are more knowledgeable about their children's health and nutrition. They can make better use of health services, provide better care, have better hygienic practices and also have higher status in the family. It is also known that better economic conditions increase the living standard of the families, which allow them to take essential care of the children. That is why among most of the parameters of malnutrition, asset index was found to be a very important predictor. In agreement to our findings, studies by Radhakrishna, *et al*. [9] and NFHS3 (2005-6) [10] maternal nutritional status, education and wealth index were found positively associated with all types of childhood under nutrition. Similarly, Rayhan, *et al*. [11] also found that mothers with secondary or higher level of education had likelihood of 37% and 30% less number of stunted and under weight under-five children, respectively than illiterate mothers. In a cross-country analysis from 63 countries, Smith and Haddad [12], found that women's education was strongly associated with child malnutrition in developing countries. Wamani, *et al*. [5] also reported maternal education to be associated with stunting among under-two children in Uganda.

Wamani, *et al*. [5] reported that male sex, maternal illiteracy, children without hygienic toilet facilities, and fever in last two weeks were significantly related with under-two stunting. Weaning, complementary feeding were found to be related with under-two underweight status in that study [5]. We found these two variables to be significant only in bivariate analysis.

No recent studies among Bangladeshi children found sex as a predictor of malnutrition, which was found to be significant for both chronic and acute forms of malnutrition in the current survey. In contrast to our finding, Radhakrishna, *et al*. [9] reported that male children were more prone to become undernourished than female children. Apart from wasting, measles vaccinated children had fewer chances to develop all other form of malnutrition. Measles vaccination may be considered as a proxy indicator as it was given at the age of nine months. So, those who were measles vaccinated are most likely to be vaccinated against all other EPI diseases.

Some important factors could not be considered in the current survey *e.g.* birth interval, birth order, size at birth, complementary feeding, father's education and occupation. These were found to be significant in the other studies [3,6,9,11,13], but this data were not captured in this survey.

The causes of undernutrition in under-two children are complex and involve multiple factors. The current study specially suggests giving emphasis on maternal nutrition and education, measles vaccination of children, use of hygienic latrines and improvement of socio-economic status to reduce the burden of childhood under nutrition in this region. These above findings are expected to update knowledge of health scientists about possible determinants of under-two malnutrition. It may help the policy planners to develop strategies to combat different forms of malnutrition by targeting the high-risk groups.

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