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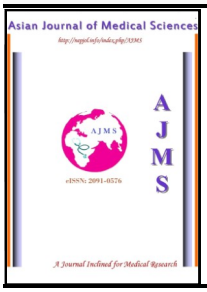

Malnutrition of Under-Five Children: Evidence from Bangladesh

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Abstract

Objective: The objectives of this study are to describe the differentials and associated risk factors of malnutrition among under-five children in Bangladesh.

Material & Methods: The data extracted from Bangladesh Demographic and Health Survey (BDHS)-2007. Basic anthropometric variables were used for finding prevalence of anthropometric indices (stunting, wasting and under weight) to assess child's nutritional statuses. Chi- Square test and Logistic Regression technique were used to find out the significant factors associated with child's nutritional status.

Results: The study results showed the high prevalence of stunting and underweight, for instance 42% and 40% of under -five children were stunted and underweighted respectively. The analyses of the study also revealed that household economic status, mother's education, father's education, mother's antenatal visit (s), mother's age at birth and mother's BMI are the most significant factor /determinant s of child's malnutrition.

Conclusion: The magnitude of the Child's malnutrition still is of great concern in Bangladesh. Significant association between maternal related factors and child's nutritional status has been found in this study. For improving the nutritional status of children or for getting healthy babies the intervention program(s) must connect not only children but also newly mothers and prospective mothers.

Key Words: Anthropometric measurement; Malnutrition; Stunting; Underweight; Wasting

1. Introduction

Malnutrition (measured as poor anthropometric status) of under-five children is an important public health problem which is one of the major killers of children in developing countries.[1] About 35% of under-five deaths in the world are associated with malnutrition.[2] Malnutrition continues to be a significant public health problem throughout the low income countries, particularly in South Asia and Sub-Saharan Africa.[3,4] The alarming prevalence of malnutrition is not only a challenge for South Asia or Sub-Saharan Africa but also a challenge across individual countries, individual societies as well as individual families. Although there is a perception that the situation of malnutrition among children is worst in Africa, the problem of malnutrition is actually much higher in South Asia, for instance, the prevalence of underweight among preschool children is almost double in Bangladesh compared to Somalia or Mozambique and equal to that of Ethiopia.[5,6]

Although the proportion of under-five children with malnutrition declined from 27% in 1990 to 20% in 2005[7] but the progress is not enough in developing countries and continues to be a serious problem. Half of the world's malnourished children are to be found in just three countries, Bangladesh, India and Pakistan.[8] Studies showed that malnutrition of children is the worst in Bangladesh, for instance, the prevalence of child malnutrition in Bangladesh is among the highest in the world.[9] Around two million children of Bangladesh suffer from malnutrition and of these, half a million suffer from severe acute malnutrition which was observed by a survey conducted by World Food Programme (WFP), the

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UN Children's Fund (UNICEF) and the Government's Institute of Public Health and Nutrition (IPHN).[10] Although Bangladesh has recently achieved nearly self-sufficiency in food production, but the poor children have little access in food consumption because of lack of buying capacity on the part of their parents. Micronutrient deficiencies, particularly vitamin A, D, iron, iodine and zinc deficiencies are also high in Bangladesh. Almost three quarters of non-pregnant and half of the pregnant women in rural Bangladesh are anaemic, and 73% under-five children are reported to suffer from iron deficiency anaemia.[3]

Even though Bangladesh has achieved significant progress in reducing the proportion of under-five children suffering from malnutrition, the magnitude of the problem still is of great concern. For instance, more than 40% of under-five Bangladeshi children are stunted and/or underweighted in 2007.[11]

Malnutrition is associated with an increased risk of death from acute respiratory infection, diarrhoea, malaria, measles and other infectious diseases. Malnutrition sometimes results in to serious consequences for the physical growth and mental development of children.[12] Different studies have showed that several factors closely related to infant and child malnutrition including low dietary intake, low birth weight, family size, lack of parental education, breast feeding status, incidence of diarrhoea, previous birth interval, mother's body mass index (BMI), household economic status and delayed weaning.[9,13,14] The main aim of this study is to find the differentials of under-five malnutrition in Bangladesh. Another spotlight of this study is to examine the impact of demographic, health and socio-economic factors on malnutrition. Thus the specific objectives are as follows:

a) To describe the differentials in malnutrition of under-five children

b) To identify the significant determinants of malnutrition among under-five children

2. Material and Methods

The data, utilized in this study, extracted from Bangladesh Demographic and Health Survey (BDHS)-2007. The BDHS-2007 included an anthropometric component in which all under-five children and all ever-married women aged 15-49 years in the household were weighed and measured to determine their nutritional status. All children born in January 2002 or later included in BDHS-2007 were eligible for height and weight measurements. A total of 5,270 children, excluding missing values with respect to independent variables regarding analysis, were selected for analysis. For examining the differentials in malnutrition of under-five children and for finding factors influencing malnutrition of under-five children this study considers the following factors: place of residence, economic status, mother's education, father's education, mother's antenatal visit, preceding birth interval, mother's age at birth, mother's body mass index, breast feed status and birth order of children.

Anthropometric measurements of child are used in this study to assess child's nutritional status. Age, Height and Weight measurements are important tools for assessing child's present and past nutritional status as well as for finding out malnourished children. When two of these variables are used together they are called an index.

The following three indices are commonly used in assessing the nutritional status of children

1. Length-for-age or Height-for-age
2. Weight-for-length or Weight-for-height
3. Weight-for-age

The above three indices are used to identify three nutritional conditions such as (i) Stunting (low height for age), (ii) Wasting (low weight for height) and (iii) Underweight (low weight for age).

Stunting is an indicator of past growth failure. It is associated with a number of long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty. Wasting describes current nutritional status or short-term changes in nutritional status. This index helps to identify children suffering from current or acute malnutrition. Underweight, based on weight-for-age, is a composite measure of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time.[15]

Anthropometric indicators may be developed based on an internal standard within a specific study, from a local growth reference, or from the international growth reference. Irrespective of the reference population used, an anthropometric indicator provides a measure of an individual's growth status in relation to the reference median, expressed either as a percentile, a percentage of the reference median, or as a proportion of the

standard deviation often referred to as a Z score. The use of a reference population makes it possible to compare the growth status of children of different ages and makes it feasible to assess anthropometric status in population studies and in surveillance programs.[16] The nutritional status of children in the survey population is compared with the World Health Organization (WHO) Child Growth Standards, which are based on an international sample (from Brazil, Ghana, India, Norway, Oman, and the United States) of ethnically, culturally, and genetically diverse healthy children living under optimum conditions conducive to achieving a child's full genetic growth potential.[17] The Z-score or Standard deviation (SD) is defined as the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population. This can be written in the equation form as:

$$\text{Z-score (or SD-score)} = \frac{\text{Observed value-median reference value}}{\text{Standard deviation of reference population}}$$

Table-1: Percentage of Children Stunted, Wasted and Underweight in Bangladesh by Four Consecutive Demographic and Health Surveys

Surveys	Reference Period	Children stunted (%)	Children wasted (%)	Children underweight (%)
BDHS-1996-1997	1992-1996	54.6	17.7	56.3
BDHS 1999-2000	1995-1999	44.7	10.3	47.7
BDHS-2004	1993-2003	43	12.9	47.5
BDHS -2007	2002-2006	43.2	17.4	41

Table-2: Demographic and socio-economic differentials of malnutrition among the under-five Children, Bangladesh 2007

Explanatory Variables	Total children	Stunted (Z-score of Height-for-age is less than -2 SD)		Wasted (Z-score of Weight-for-height is less than -2 SD)		Underweight (Z-score of Weight-for-age is less than -2 SD)	
		Number (%)	x^2 value and level of significance	Number (%)	x^2 value and level of significance	Number (%)	x^2 value and level of significance
Place of residence							
Rural	1835	649 (45.0)	46.00***	624 (18.2)	10.787*	1489(43.2)	51.524***
Urban	3435	1547(35.4)		268 (14.6)		609 (33.3)	
Economic status							
Poor	2132	1106(51.9)	184.9***	410 (19.2)		1037(43.6)	159.10***
Middle	993	417 (42)		176 (17.7)	19.30***	419 (42.2)	
Rich	2145	673 (31.4)		306 (14.3)		642 (29.9)	
Mother's education							
No education	1414	726 (51.3)	190.7***	273 (19.3)		681 (48.2)	159.12***
Primary	1649	792 (48)		307 18.6)		757 (45.9)	
Secondary or higher	2207	678 (30.7)		312 (14.1)	21.266***	660 (29.9)	
Father's education							
No education	1781	918 (51.5)	209.7***	343 (19.3)	11.897***	845 (47.4)	157.10***
Primary	1466	682 (46.5)		244 (16.6)		666 (45.4)	
Secondary or higher	2023	598 (29.5)		305 (15.1)		587 (29)	
Mother's antenatal care visit			96.27***				115.8***
No visit	1637	803 (49.1)		321 (19.6)	6.699**	805 (49.2)	
Some visits	2753	938 (34.1)		455 (16.5)		903 (32.8)	
System missing	880	—		—		—	
Preceding birth interval			35.68***				17.299***
First birth							
<24 months	1710	641 (37.5)		268 (15.7)	3.127	625 (36.5)	
24 or 24+ months	521	271 (52)		87 (16.7)		241 (45.3)	
	3039	1284(42.3)		537 (17.7)		1232(40.5)	
Mother's age at birth							
<20	1474	640 (43.4)	2.577*	251 (17)		620 (42.1)	4.332**
20 or 20+	3796	1556 (41)		641 (16.9)	0.015	1478(38.9)	
Mother's BMI							129.9***
<18.5	1667	810 (48.6)	48.044***	381 (22.9)	60.966***	852 (51.1)	
18.5 or higher	3603	1386(38.5)		511(14.2)		1246(34.6)	
Breast feed status of mother							
Never breast feed	33	20 (60.6)		10 (30.3)		17 (51.5)	
<24 months	800	357 (44.6)	40.481***	89 (11.1)	69.868***	284 (35.5)	13.13***
24 or 24+ months	1417	667 (47.1)		177 (12.5)		605 (42.7)	
Currently breast feed	3010	1147(38.1)		616 (20.5)		1189(39.5)	
System Missing	10	—		—		—	
Birth order							
1	1699	637 (37.5)		265 (15.6)		621 (35.6)	32.017***
2-3	2302	1391(39.6)	62.429***	4.3 (17.5)	3.160	888 (38.6)	
4 or 4+	1269	648 (51.1)		224 (17.7)		589 (45.4)	
Total	5270	2196(41.7)		892 (16.9)	16.9	2098(39.8)	

Note: *** Significant at p<0.01, ** Significant at p<0.05, *Significant at p<0.10. Authors' calculation based on BDHS-2007 data

2.1. Classification of Malnutrition

The most commonly used cut-off with Z-scores is -2 standard deviations (SD), irrespective of the indicator used. This means children with a Z-score for stunting, wasting or underweight below -2 SD are considered malnourished. Children whose Z-score is below three standard deviations (-3 SD) from the median of the reference population are considered severely malnourished. In this study, children with Z-score below -2 SD are classified as stunted, wasted or underweight according to height-for-age, weight-for-height and weight-for-age measurement respectively.

2.2. Statistical Analyses

For the analysis of data, bivariate analysis, Chi- square test and logistic regression analysis are used to find out the associated factors for child nutritional status and determinants of malnutrition among young children. The SPSS 16.0 (SPSS Inc. 2007) is used for bivariate, Chi-square test and logistic regression analysis.

3. Results

Data from different demographic and health survey of Bangladesh indicates (table 1) that a slight development in child nutritional status has been achieved, but the prevalence of malnutrition is still high among the under-five children in Bangladesh. Table 2 shows the descriptive statistics of the explanatory variables used to find the differentials of malnutrition among under-five children. The same table also presents the Chi-square test results to examine the association between selected variables and child malnutrition.

3.1. Differentials of Malnutrition among the under-five children

The prevalence of malnutrition, two weeks preceding the survey, among children is assessed by observing the individual z-score on the basis of anthropometric measurement of children. From the table 2, it has been observed that, 42% children were suffering from chronic malnutrition (stunted), 17% children were suffering from acute malnutrition (wasted) and 40% children were underweight among the surveyed children under the age of five in Bangladesh.

It has also observed from table 2 that the malnutrition among children showed wide variation by place of residence, household economic status, mother's education, father's education, antenatal visit of mother, preceding birth interval, age of mother at birth, mother's BMI, breast feed status and children's birth order. The chi-square results, also, showed that these variables are significantly associated with stunting and underweight status of children. The similar results also found in case of wasting. The higher prevalence of stunting, wasting and underweight found among children living in rural areas, in poor economic status household, children of parents with no education, children of mothers who did not receive antenatal care, children with mother's age at birth less than 20 years, children of malnourished mother, children of mothers who never breast feed their children and children with higher birth order.

Table-3: Dependent and explanatory variables used in logistic regression analysis

Dependent variables	Explanatory variables and their categories	
	Variables	**Categories**
1. Is child Stunted? 0=No 1=Yes 2. Is child Wasted? 0=No 1=Yes 3. Is child underweight? 0=No 1=Yes .	X_1 =Place of residence	1= Rural 2=Urban
	X_2 =Economic status	1= Poor 2= Middle 3= Rich
	X_3 =Mother's education	1= No education 2= Primary 3= Secondary or higher
	X_4 =Father's education	1= No education 2= Primary 3= Secondary or higher
	X_5 = Mother's antenatal visit	1= No visit 2= Some visits
	X_6 =Preceding birth interval	1= First birth 2=<24 months 3= 24 or 24+ months
	X_7 =Age at birth	1= <20 Years 2= 20 or 20+ Years
	X_8 =Mother's BMI	1= <18.5 2= 18.5 or higher
	X_9 =Breast feed status of mother	1= Never breast feed 2= <24 months 3= 24 or 24+ months 4= Currently breast feed
	X_{10} =Birth order	1= 1 2= 2-3 3= 4 or 4+

Given the descriptive statistic and x^2 test results of the explanatory variables with child nutritional status which are likely to influence the nutritional status of children, logistic regression analysis has been used (Table 4). The variables which have been used in logistic regression analysis are shown in table 3.

3.2. Determinants of Malnutrition

Table 4 shows that rural children were more likely to be stunted than urban children. Similar results also observed in the case of wasted and underweight children. The study results show that children from household with middle and poor economic status were more likely to be stunted compare to children living in household with high household economic status.

Table-4: Logistic regression estimates for stunting, wasting and underweight of under-five children in Bangladesh

Explanatory variables	Stunted		Wasted		Underweight	
	Coefficient (ß)	Odds ratio	Coefficient (ß)	Odds ratio	Coefficient (ß)	Odds ratio
Place of Residence						
Rural	0.078	1.081	0.104	1.110	0.100	1.106
Urban (RC)	—	1.00	—	1.00	—	1.00
Economic status of household						
Poor	0.337	1.400***	0.083	1.087	0.264	1.302***
Middle	0.128	1.136	0.130	1.139	0.221	1.247**
Rich (RC)	—	1.00	—	1.00	—	1.00
Mother's education						
No education	0.248	1.282**	0.313	1.367**	0.301	1.351***
Primary	0.286	1.331***	0.255	1.290**	0.310	1.363***
Secondary or higher (RC)	—	1.00	—	1.00	—	1.00
Father's education						
No education	0.412	1.509***	0.033	1.033	0.257	1.293***
Primary	0.401	1.493***	-0.138	0.871	0.310	1.363***
Secondary or higher (RC)	—	1.00	—	1.00	—	1.00
Mother's antenatal care visit						
No visit	0.217	1.242***	0.005	1.005	0.318	1.375***
Some visits (RC)	—	1.00	—	1.00	—	1.00
Preceding birth interval						
First birth	0.504	1.656	0.444	1.560	0.543	1.722
<24 months	0.279	1.322**	-0.065	0.937	0.132	1.141
24 or 24+ months (RC)	—	1.00	—	1.00	—	1.00
Mother's age at birth						
<20	0.202	1.224***	0.122	1.130	0.256	1.292***
20 or 20+(RC)	—	1.00	—	1.00	—	1.00
Mother's BMI						
<18.5	0.272	1.312***	0.438	1.549***	0.522	1.685***
18.5 or higher (RC)	—	1.00	—	—	—	1.00
Breast feed status of mother						
Never breast feed (RC)	—	1.00	—	1.00	—	1.00
<24 months	-0.443	0.642	-1.604	0.201***	-0.574	0.563
24 or 24+ months	-0.310	0.733	-1.369	0.254**	-0.310	0.733
Currently breast feed	-0.674	0.510	-0.798	0.450	-0.410	0.664
Birth order						
1(RC)	—	1.00	—	1.00	—	1.00
2-3	0.510	1.665	0.608	1.837	0.650	1.915
4or 4+	0.790	2.203	0.483	1.621	0.742	2.100
Constant	0.017	1.017	-1.443	0.236	-0.121	0.886

Note: *** Significant at p<0.01, ** Significant at p<0.05, *Significant at p<0.10; RC= Reference category; Authors' estimation based on BDHS-2007 data.

The study results showed that children of mothers with no education and primary education were 28% and 33% respectively significantly more stunted than Children with secondary or higher level educated mothers. Wasted and Underweight children also show same results. Children whose father had no education and primary educated were 1.51 and 1.49 times more significantly stunted than children whose father had secondary or higher level education. Similar results also found for underweight children but in the case of wasted children, children among no educated fathers had 1.03 times higher odds and children among primary or secondary educated fathers had 0.87 times lower odds of wasting than children among higher educated fathers.

It is seen from the table 4 that the odds of stunting among children whose mothers have had no antenatal visits were 1.24 times significantly more compared with children whose mothers have had antennal care visits. The odds of suffered from wasting and underweight also show similar results, though result is not significant for wasted children. Children with first birth had 1.66 times and children whose preceding birth interval was less than two years were 1.32 times significantly more likely to be stunted as compared with children of a preceding birth interval 24 months or above and the result is significant for preceding birth interval less than 24 months. Same result also observed for underweighted children though results are not significant and children with first birth had 1.56 times higher and children whose preceding birth interval was less than two years were 0.84 times lower wasted as compared with children of a preceding birth interval 24 months or above. Children whose mother's age were less than 20 years at the time of birth were 1.22 times more likely to be stunted compared to children whose mother's age were 20 years or above, the odds of wasting and underweight children shows similar results and the results are significant for stunted and underweight children.

It has been observed from table 4 that, the likelihood of being stunted was also 1.31 times significantly higher among children whose mother's BMI were less than 18.5 compared with children whose mother's BMI were 18.5 or higher. Wasted and underweight children also show similar significant results. Mother who breast feed their children less than <24 months, 24 months and above and

who were currently breast feeding their children had 36%, 27% and 49% respectively lower risk of stunted than children who were never breast feed. Similar results also observed in the case of wasted and underweight children and the result is significant for wasted children. Higher birth order is positively associated with child malnutrition. From the table 4, we observed that, as compared to children with birth order one, children with 2-3 birth order and 4 or 4+ birth order were 1.67 and 2.20 times more likely to be stunted respectively. Similarly, the higher odds of wasting and underweight children also found among 2-3 and 4 or 4+ birth order.

4. Discussion

The findings of this study shows rural residence as a determinant of child malnutrition. Several studies showed that the levels of malnutrition among children were higher among children living in rural areas than among urban areas.[18] Women in urban areas are far more likely to have formal schooling than women in rural areas, Moreover, availability of water and sanitary facilities and better socioeconomic status and child health care facilities in urban areas results into less risk of being malnourished among children living in urban areas than their rural counterparts. As compared with children residing in households with medium or higher economic status, children residing in very poor and poor households was found more malnourished in this study. The economic status of a household is one of the most important determinants of child nutritional status.[19] Many comparative studies on child nutrition showed that the higher the level of economic status of the household, the lower the level of child malnutrition. Greater access to economic resources means that urban households are less likely to be food insecure and possibly more able to provide adequate care for children. In this study, education of mother and father is found to be an important determinant of malnutrition. Children among higher educated mothers have found to be less suffered from malnutrition than lower educated mothers. Maternal education is known to have profound beneficial effects on child feeding, health seeking and care giving practices which is especially important for child nutritional status. Maternal education is a single most important factor in explaining differentials in child health outcomes.[20] Lowest malnourished children were found among mother with antenatal care visits. Results of this study show that there is a significant association between mother's antenatal care visit and child nutritional status. Antenatal care, the care a woman receives throughout her pregnancy, is important in determining child nutritional status. The study indicated previous birth interval as an important risk factors of child malnutrition. The study also highlighted existence of significant association with the prevalence of malnutrition and mother's age at birth and mother's BMI. Mother's age is an important factor for child nutritional status because adult mothers are more conscious about their children health than very young mothers. Body Mass Index (BMI) is an important indicator of maternal nutritional state, a measure of BMI less than 18.5 indicates that the mother is underweight. This study showed that underweight mothers have a greater risk of their children being malnourished. A healthy mother can have healthy children. Children of well-nourished mothers had a lower risk of being stunted, wasted and underweight compared to children of undernourished mother. This study also showed breast feed status of mother and birth order of children as an important determinant of child nutritional status.

5. Conclusion

From the findings of this study, it is concluded that malnutrition is still an important problem among under-five children in Bangladesh and some socio-economic and demographic factors are found to be significantly associated with the high prevalence of malnutrition among children. To reduce the burden of malnutrition among children, a combined effort by the government, non-governmental organizations and the community is essential to improve the nutritional status of children. Effective, efficient and equitable program should be designed to reduce child malnutrition. In addition, nutrition surveillance needs to be done continually and special attention should be given to vulnerable groups such as poorest and most undernourished. A healthy mother can give birth to a healthy children, thus the intervention programs for improving the nutritional status of children must focus not only on children but also on their mothers.

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