PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
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Pakistan Journal of Nutrition 5 (6): 558-562, 2006
ISSN 1680-5194

Factors Causing Malnutrition among under Five Children in Bangladesh

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Abstract: The nutritional status of under five children is a sensitive indicator of a country's health status as well as economic condition. This study investigated differential impact of some demographic, socio-economic, environmental and health related factors on nutritional status among under five children in Bangladesh. The study used Bangladesh Demographic and Health Survey 1999-2000 (BDHS 1999-2000) data. Bivariate analysis and multivariate analysis (Cox's linear logistic regression model) were used to identify the determinants of under-five malnutrition. The analyses revealed that 45 percent of the children under age five were suffering from chronic malnutrition, 10.5 percent were acutely malnourished and 48 percent had under-weight problem. The main contributing factors for under five malnutrition were found to be previous birth interval, size at birth, mother's body mass index at birth and parent's education.

Key words: Malnutrition, Z-score, stunting, Wasting, logistic regression model

Introduction

Possessing a land area of 1,47,570 square kilometers and over 131 million people, Bangladesh is the ninth most populous country and one of the most densely populated countries in the world (834 persons per sq. km). Over-population and poverty are pervasive in Bangladesh and causing population hazards like malnutrition. Specially, under five children who are naturally innocent, vulnerable, dependent often suffering from malnutrition. The nutritional status of these children is a sensitive indicator of the country's health and nutritional status.

Malnutrition impedes body's metabolism and retards utilization of immunity. Malnourished children are more likely to develop severe infections because of deficiencies in immunocompetence. It affects vital functions like blood circulation, respiration and maintenance of body temperature (basal metabolic needs) are affected. Jahan and Hossain (1998) showed that 77 percent of children aged 6-71 months were physically retarded in Bangladesh. Bairagi and Chowdhury (1994) found that the family income, mother's education, sex and birth order of children are the important determinant of malnutrition. Fauveau *et al.* (1990) in their study in Matlab Thana area of Bangladesh during 1986-1987 showed that about one-third of overall mortality among 6-36 months old children was related to severe malnutrition. Ahmed and Islam (1984) in their study showed a significant relationship between the mother's level of education and the nutritional status of children. Ricci and Becker (1996) conducted a study where one of the most frequently suggested causes for child malnutrition is short birth interval (<24 months). Malnutrition among under five children is a common problem in the underdeveloped world. Study in the Philippines (UNICEF, 1998) revealed that nearly two third of under five children was malnourished and one of major causes was low birth-weight.

The aim of this study is to examine the current nutritional status and to identify the determinant of malnutrition among under five children (0-59 months children) in Bangladesh.

Materials and Methods

This study utilized the data extracted from a nationally representative survey, Bangladesh Demographic and Health survey 1999-2000 (BDHS 1999-2000; Mitra *et al.*, 2000). The survey was implemented from November 10, 1999 to March 15, 2000. This survey employed two-stage sample that was selected from the master sample maintained by the Bangladesh Bureau of Statistics (1997). The primary sampling units (500 PSUs) in the master sample were selected with probability proportional to size. The PSUs for the BDHS survey were subselected from the master sample with equal probability. A total of 341 primary sampling units were used for the BDHS survey (99 in urban areas and 242 in rural areas). In the rural areas, the primary sampling unit was the mauza, while in urban areas, it was the mahalla. Information was available for 6939 children under age five, of them 6430 were alive and 84 percent of the alive children (5419) were weighted and measured. The present study focuses on the nutritional condition based on the above sample of 5419 children. Since the sample was not self-weighted, weighting factors were used for the estimation.

This study considered the U.S. National Center for Health Statistics (NCHS) standard, for the classification of malnutrition, because of its widely acceptance and recommendation of the World Health Organization (WHO, 1986). For reporting of Height-for-age, Weight-for-age and Weight-for-height relative to the NCHS

Table 1: Percentage of under five children according to stunting, wasting and underweight status (by NCHS standard)

Stunting Status	Percentage	Wasting Status	Percentage	Underweight Status	Percentage
Moderately Stunted	26.4	Moderately Wasted	9.5	Moderately Underweight	34.8
Severely Stunted	18.5	Severely Wasted	1.0	Severely Underweight	13.2
Total Stunted	44.9	Total Wasted	10.5	Total Underweight	48.0
Not Stunted	55.1	Not Wasted	89.5	Not Underweight	52.0

Note: Total number of under five children is 5419.

reference, Z-scores (standard deviation i.e. SD scores) are commonly used. Children are classified as moderately and severely stunted (chronic malnourished), wasted (acutely malnourished) and under weighted (stunted, wasted, or both) if the height-for-age Z-score (HAZ), weight-for-height Z-score (WHZ), weight-for-age Z-score (WAZ) are respectively below minus two and minus three standard deviations (-2 SD and –3 SD) from the median of the reference population. Based on the available information, this study examined the influences of the following risk factors for causing under five malnutrition. Demographic factors: Sex of child, Mother's age at birth, Number of living children, Birth order, Previous birth interval, Size at birth, Age of child, Mother's body mass index; Socio-economic factors: Place of residence, Division, Mother's education, Mother's occupation, Father's education, Father's occupation, Type of housing, Religion, Household possessions, Mass-media exposure; *Dietary factor:* Breast feeding status; *Environmental factors:* Household drinking water source, Type of toilet facility; and Health care and Immunization factors: Place of delivery, Complication during delivery, Antenatal care, TT injection, Vaccination coverage, Vitamin A supplementation.

Bivariate analysis was performed to determine the differentials of under five malnutrition by explanatory variables. Pearson's chi-square test of independence was performed to test the existence of significant association between categories of malnutrition and selected risk factors. The significant variables (p-value < 0.05) observed in bivariate analysis were subsequently included in multivariate analysis. Considering the fact that among multivariate techniques the Cox's linear logistic regression model is algebraically simple, computationally straightforward and efficient with acceptable degree of precision for a binary dependent variable, this study applied Cox's linear logistic regression model (Cox, 1970) for multivariate analysis.

The model is:

$$P_i = \frac{\exp\left(\beta_0 + \sum_{i=1}^{p} \beta_j X_{ij}\right)}{1 + \exp\left(\beta_0 + \sum_{i=1}^{p} \beta_j X_{ij}\right)}$$

Where I =1,2,……,n; j = 1,2,……,p.

Here, P_i is the probability of success of binary dependent variable on i^{th} risk factor. β_0 and β_j s are regression coefficients which are to be estimated. $X_{i\,j}$ indicates j^{th} category of i^{th} risk factor. Since it is easier to interpret of odds, the logistic equation can be written in terms of odds as,

$$\text{Odds} = [P_i / 1\text{-}P_i]$$

$$= \exp\left[\beta_0 + \sum_{J=1}^{p} \beta_j X_{ij}\right]$$

The exponential to the power β_j is the factor by which the odds change when the j^{th} independent variables increased by one unit. If β_j is positive the factor will be greater than 1, which means that the odds are increased; if β_j is negative the factors will be less than 1, which leaves the odds unchanged.

Three different models had been considered in this study. Model 1 considered height-for-age (<-2 SD) or stunting as dependent variable and it was coded as '1' if children were classified as stunted, otherwise it was '0'. Model 2 considered weight–for-height (<-2SD) or wasting as dependent variable and it was coded as '1', if children are classified as wasted, otherwise it was '0'. Model 3 considered weight–for–age (<-2SD) or underweight as dependent variable and it was coded as '1', if children were classified as underweight, otherwise it was '0'. Data analyses were done by the 'SPSS 10' statistical software.

The study considered 27 independent variables in bivariate analysis, which were categorized as they were in the original data file. In multivariate analysis some variables were recoded for more specification on categories. Previous birth interval was obtained excluding the first child of parents. Since most babies in Bangladesh were not weighted at the time of birth, mothers were asked whether babies born during the five years preceding the interview were large, average, small, or very small at birth. Mother's body mass index was classified as acute malnourished mother who had less than 18.5 kg/m^2 body mass index (BMI), and nourished mother who had greater than or equal to 18.5 kg/m^2 BMI. Parents education were classified as no education (illiterate), primary and secondary or higher level.

Results

Classification of malnutrition: The results of Table 1 reveals that 45 percent of the children under age five were stunted (a condition reflecting chronic malnutrition), 10.5% percent were wasted (a condition indicating acute

Table 2: Percentage of under five children in different categories of malnutrition according to significant risk factors

Risk factors	Stunted	Wasted	Under weighted	Total number of cases
Previous birth interval				
0-23 months	52.8	9.4	55.0	616
24-47 months	48.3	11.5	49.7	1886
48+ months	37.6	10.9	42.8	1387
Size at birth				
Very small	59.7	17.0	69.2	253
Smaller than average	53.8	15.0	59.9	756
Average / Larger	42.5	9.4	44.8	4403
Mother's body mass index				
Acutely malnourished mother	49.7	14.2	58.6	2347
Nourished mother	41.0	7.7	39.9	3056
Mother's education				
No education	52.6	12.2	55.7	2525
Primary level attended	46.2	10.1	48.5	1570
Secondary or Higher level	28.6	7.8	32.7	1323
Father's education				
No education	51.8	12.6	55.7	2310
Primary level attended	48.2	9.8	50.7	1331
Secondary or Higher level	32.0	8.6	34.6	1692
Total	44.9	10.5	48.0	5419

Significance level: p-value< 0.05.

or short-term food deficits) and 48 percent were under-weighted (which may reflect stunting, wasting or both).

Classification of malnutrition by selected risk factors: Differentials of malnutrition among under five children were investigated by some selected demographic, socio-economic, dietary, environmental and health related factors. This study considered 27 probable risk factors. Table 2 shows differentials of under five malnutrition according to significant variables (p value < 0.05) found from bivariate analysis.

Table 2 shows that malnutrition status was diminished with increasing of the length of previous birth interval. Babies who were larger in size at birth had lower risk of malnutrition than those who were very small in size at birth. Children who had malnourished mothers were suffering from malnutrition in greater percentage than those of nourished mothers. Children of illiterate mothers were 52.6 percent stunted, 12.2 percent wasted and 55.7 percent under-weighted, these proportions dropped drastically among children whose mothers attended secondary or higher level of education. The rates of under five malnutrition were decreased as the educational level of father increased.

Determinants of stunting: To identify the determinants of stunting multivariate analysis (Cox's linear logistic regression model) was performed. Table 3 shows that previous birth interval was highly significant and had an inverse relationship with prevalence of stunting. Children with previous birth interval 0–23 months and 24-47 months had respectively 1.55 and 1.36 times higher risk of being stunted as compared to children with birth interval 48 and above months. Babies who were very small in size and smaller than average had respectively 2.08 and 1.79 times higher risk of being stunted than those children who were average or larger in size at birth. Risk of stunting were 11 percent and 37 percent lower according to the children whose mothers had primary education and secondary education, compared to the children of illiterate mothers.

Determinants of wasting: Multivariate analysis shows that children born with very small size and smaller then average size had respectively 1.89 and 1.69 times higher risk of being wasted compared to those with larger size at birth in Table 4. Children of nourished mother had 40 percent lower risk of being wasted as compared to children of acute malnourished one.

Determinants of under-weight status: The result of logistic regression analysis shown in the Table 5 describes that children with previous birth interval 0-23 months and 24-47 months had respectively 1.4 times and 1.2 times higher risk of being under weighted as compared to children with previous birth interval 48 and above months. Babies were very small in size and smaller than average had respectively 3.93 times and 2.23 times higher risk of being under-weighted than those children who were average or larger in size at birth. Children of nourished mother were 38 percent less likely to be under-weighted compared to children of acutely malnourished mother. Father's education and prevalence of under-weight were inversely related. Risks of under-weight were 0.98 and 0.70 times lower for children of fathers attended primary and secondary level respectively, comparing to the children of illiterate fathers.

Discussion

The impact of malnutrition is multifarious. It has an all-pervasive impact on the physical well-being and socio-economic condition of a nation. Both bivariate and multivariate analyses indicated size of baby at birth as

Table 3: Significant factors causing stunting according to multivariate analysis

Factors	Estimated β coefficient	S.E. of estimate	p-value	Odds ratio
Previous birth Interval				
0-23 months	0.435	0.115	0.000	1.545
24-47 months	0.303	0.085	0.000	1.355
48+ months (r)	----	----	----	1.000
Size at birth				
Very small	0.734	0.190	0.000	2.083
Smaller than average	0.582	0.112	0.000	1.790
Average/ Larger(r)	----	----	----	1.000
Mother's education				
No education(r)	----	----	----	1.000
Primary level attended	-0.112	0.091	0.218	0.894
Secondary or Higher level	-0.464	0.138	0.001	0.629

Note: Children are classified as stunted if their height-for-age Z-scores are below minus two standard deviations (-2 SD) from the median of the reference population where 'r' represents reference category. Significance level: p-value < 0.05.

Table 4: Significant factors causing wasting according to multivariate analysis

Factors	Estimated β coefficient	S.E. of estimate	p-value	Odds ratio
Size at birth				
Very small	0.634	0.187	0.000	1.885
Smaller than average	0.525	0.124	0.000	1.690
Average/ Larger(r)	----	----	----	1.000
Mother's body mass index				
Acute malnourished mother (r)	----	---	---	1.000
Nourished mother	-0.520	-0.099	0.000	0.594

Note: Children are classified as wasted if their weight-for-height Z-scores are below minus two standard deviations (-2 SD) from the median of the reference population where 'r' represents reference category. Significance level: p-value < 0.05.

Table 5: Significant factors causing under-weight status according to multivariate analysis

Factors	Estimated β coefficient	S.E. of estimate	p-value	Odds ratio
Previous birthInterval				
0-23 months	0.343	0.118	0.004	1.409
24-47 months	0.185	0.087	0.033	1.204
48+ months (r)	----	----	----	1.000
Size at birth				
Very small	1.369	0.221	0.000	3.933
Smaller than average	0.800	0.118	0.000	2.226
Average/ Larger(r)	----	----	----	1.000
Mother's body mass index				
Acute malnourished mother (r)	----	---	----	1.000
Nourished mother	-0.478	-0.078	0.000	0.620
Father's education				
No education (r)	----	----	----	1.000
Primary level attended	-0.012	0.095	0.902	0.988
Secondary or Higher level	-0.354	0.114	0.002	0.702

Note: Children are classified as under-weighted if their weight-for-age Z-scores are below minus two standard deviations (-2 SD) from the median of the reference population where 'r' represents reference category. Significance level: p-value < 0.05.

an important risk factor for all the three categories of malnutrition (stunting, wasting and underweight). Babies who were very small in size at birth had two times higher risk of being stunted than those who were larger in size at birth. Prevalence of wasting and underweight were also remarkably high among low birth weight children. Sanghvi *et al.* (2001) investigated the risk factors for underweight status in children under 3 years of age in Kerala, India. Their statistical analysis showed that infant birth weight (p = 0.01) and maternal body mass index (p = 0.03) were significant risk factors for current child underweight status. Wasting and underweight status of under five children showed significant relationship with mother's body mass index. Children of well-nourished mothers had a lower risk of being under-weight compared to children of acutely malnourished mothers. The reason may be that thin or malnourished mother cannot provide sufficient breast-milk because of their nutritional deficiency. Acute malnutrition of mother could be an impediment for her child's growth.

Previous birth interval showed highly significant and inverse relationship with the prevalence of stunting and underweight. Children with longer previous birth interval had lower risk of being stunted and under-weighted. Mozumder *et al.* (2000) study also indicated the potential

importance of longer birth intervals in reducing malnutrition in children. Their study was undertaken to investigate the malnutrition of 1887 infants from a post-flood survey in Bangladesh. Cross-tabulations and logistic regression showed that the proportion of children who were under-weight-for-age decreased with the increase in the length of the subsequent birth interval. Longer duration of birth reduces sharing problems among living siblings and parents can take better care of their children. The educational level of mothers was positively related to the better nutritional status of children. Educated mothers are more conscious about their children's health; they tend to look after their children in a better way. Islam *et al*. (1994) found from a case-control study on 250 children, aged <36 months, in Bangladesh that maternal education was significantly associated with severe malnutrition. This study finding also suggests that mother's education played a significant role in reducing prevalence of stunting. Chronic malnutrition was highest among children of illiterate mothers. Smith and Haddad (2000) drawn on the experience of 63 developing countries over the 25-years period to identify the determinants of child malnutrition for each developing region. Six factors were explored; one of the important factors was women's education. They depicted that improvements in female secondary school enrollment rates were estimated to be responsible for 43 percent of the total 15.5 percent reduction in the child underweight rate of developing countries during the period 1970-95. Father's education emerged as an important factor that was significantly associated with underweight status among under five children. Analysis showed that children whose fathers had higher level of education, were lower in proportion of weight deficiency than those with illiterate fathers. Usually father is the main earner and decision maker of a family and so their higher level of education plays an important role to ensure better nutritional status of children.

The above findings are expected to update knowledge of health scientists about possible causes of malnutrition among under five children and help policy planners to develop strategic plans. Well thought health care programs need to be designed to ensure easy access to services and facilities, health information and health education. Government should take necessary steps to aware women of reproductive age about hazardous effect of short birth interval and risk of giving birth of low-weight babies. Education enhances knowledge and equips with decision-making power. This study depicted strong negative relationship between parent's education and prevalence of malnutrition, there is no alternative but to create scope and opportunities for education. Involvement of the community, NGOs and use of media of mass communication with coverage of necessary health care information may prove to be useful in improving nutritional status.

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