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Gender differences in child nutrition status of Bangladesh: a multinomial modeling approach

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Abstract

Purpose – Malnutrition is one of the serious public health problems especially for children and pregnant women in developing countries such as Bangladesh. This study aims to identify the risk factors associated with child nutrition for both male and female children in Bangladesh.

Design/methodology/approach – This study was conducted among 23,099 mothers or caretakers of children under five years of age from a nationally representative survey named Bangladesh Multiple Indicator Cluster Survey, 2019. This study used chi-square test statistic for bivariate analysis and multinomial logistic regression was used to evaluate the adjusted effects of those covariates on child nutritional status.

Findings – The prevalence of severely malnourished, nourishment was higher for males than females (5.3% vs 5.1%, 77.4% vs 76.8%) while moderately malnourished were higher for females (18.1% vs 17.4%). The findings from the multinomial model insinuated that the mother's education level, wealth index, region, early child development, mother's functional difficulties, child disability, reading children's books and diarrhea had a highly significant effect on moderate and severe malnutrition for male children. For the female children model, factors such as mother's education level, wealth index, fever, child disability, rural, diarrhea, early child development and reading less than three books were significant for moderate and severe malnutrition.

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Originality/value – There is a solution to any kind of problem and malnutrition is not an exceptional health problem. So, to overcome this problem, policymakers should take effective measures to improve maternal education level, wealth status, child health.

Keywords Malnutrition, Nutrition, Nourished, Weight-for-age

Paper type Research paper

1. Introduction

Nutrition status can be the most powerful predictor of prosperity for children (Poda *et al.*, 2017). A healthy child can become a worthy human resource of a country. That is why it is very important to ensure the adequate nutrition of children. Yet, unfortunately, very few of them get adequate nutrition in developing countries.

Children with extreme acute malnutrition have a higher chance of dying from childhood diseases such as diarrhea, pneumonia and malaria. Around 45% of deaths among children under five years of age are due to malnutrition, which typically occurs in low- and middle-income countries (World Health Organization, 2018). Not entirely exact, but close to 3.1 million children die from malnutrition each year. In particular, undernutrition leads to more than half the deaths of children worldwide (International Food Policy Research Institute, 2015; UNICEF, 2018). Malnutrition refers to a human body nutritional imbalance disorder that can be of both forms, under-nutrition and over-nutrition, as well as associated diseases (Toma *et al.*, 2018). Wasting, stunting, underweight and vitamin and mineral deficiencies are some typical sub-forms of undernutrition (World Health Organization, 2020).

Developing countries are the most dominant place of child malnutrition, although it remains worldwide (Mahgoub *et al.*, 2006). According to Bangladesh Demographic and Health Survey (BDHS) 2007, in Bangladesh, 43% and 41% of children were stunted and underweight, respectively (National Institute of Population Research and Training (NIPORT), Mitra and Associates and Macro International, 2009). Despite the government's target to reach Millennium Development Goals (MDGs) goal related to child nutrition, the proportion of underweight children is still above the target which is 33% by 2015 in the Sylhet, Barisal, Chittagong and Rangpur divisions (Das *et al.*, 2018). According to a recent study of child malnutrition in Bangladesh based on small area estimation, the stunting level ranged between 34% and 48% at the district level and 28% to 51% at the sub-district level (Haslett *et al.*, 2015). Moreover, the BDHS-2014 data reveals that the frequency of stunted and underweight children is one per every three children; on the other hand, one in every seven children is wasted. While male children and children of age 12–59 months are at high risk to be stunted (Rahman and Sultana, 2019).

The sex of the child, age, type of birth, health, age of the mother, education and body mass index (BMI), household wealth index, number of children under five years, place of child delivery, place of residence can have a major effect on a child's nutritional status (Poda *et al.*, 2017). There is a strong association between the BMI of the mother and her child's nutritional status (Negash *et al.*, 2015; Felisbino-Mendes *et al.*, 2014). A joint report by United Nations Children's Fund (UNICEF) and WHO states that worldwide 101 million children are underweight and about 34 million children in Asia are wasted (Shrestha *et al.*, 2020; de Onis *et al.*, 2011).

In Southeast Asia, Bangladesh is one of the top ten countries with the largest number of under-five child deaths (in thousands) (World Health Organization, 2020). The recent findings of the Bangladesh Bureau of Statistics (BBS) and UNICEF (2019) indicate a favorable outcome for chronic malnutrition (Bangladesh Bureau of Statistics (BBS) and UNICEF, 2019). In recent years, the percentage of stunting children has decreased from 42%

to 28%, whereas the percentage of moderate and severe underweight prevalence rate has declined to 22.6% (UNICEF, 2020).

In the past, most researchers had used different strategies and different statistical models to determine the risk factors for child malnutrition. Most of the studies used the binary logistic regression model (Khadse and Chaurasia, 2020; S and K, 2016). In this study, as we classified child nutritional status as severely malnourished, moderately malnourished and nourished, so we can apply the ordinal logistic regression model to determine the causes of child malnutrition (Das and Rahman, 2011). Alternatively, multinomial logistic regression can be applied if the order information is ignored to compare with ordinal logistic regression for selecting the best model.

Therefore, it is clear from the above discussion that Bangladesh's new task is to maintain the consistency of progress and look forward to achieving the sustainable development goals (SDGs) by 2030. To address this situation, we must identify the factors which are responsible for child malnutrition, especially considering male children and female children separately. The current study aimed to examine the influence of sociodemographic and economic factors on child nutritional status both in male and female children of Bangladesh and identify important factors with their adjusted effects using data from the Bangladesh 2019 Multiple Indicator Cluster Surveys (MICS) and moving toward to SDGs Target 2. In this paper, we applied both Ordinal and Multinomial logistic regression models and considered Akaike information criteria (AIC) and Bayesian information criteria (BIC) techniques to identify the best model.

2. Conceptual framework

Several studies have found that socio-demographic characteristics such as wealth index, mother's education, place of residence, region were associated with child nutritional status (Das and Rahman, 2011; Saha *et al.*, 2019; Rahman, 2016a, 2016b; Megabiaw and Rahman, 2013). Earlier several studies identified potential risk factors associated with children's nutritional status were children's disability, recent diarrhea and fever (Kuper *et al.*, 2015; Hume-Nixon and Kuper, 2018; Das and Rahman, 2011; Ferdous *et al.*, 2013). Alongside, Mother's functional disability, early childhood developments (ECD), early childhood education, the reading book to children were also considered as the possible risk factors for children's nutrition status in this analysis. Figure 1 portrays the pathway through which socio-demographic factors and proximate determinants were likely to operate to influence child nutrition status. Socio-demographic characteristics that affect child nutrition were not only influence directly but also indirectly through proximate determinants. Among them, proximate determinants of children's nutrition status, child health, maternal health and child development were considered in this analysis and also indicate that it was directly influenced children's nutrition status in Bangladesh (Figure 1).

3. Methodology

3.1 Study design and sample selection

For our analysis purpose, we extracted relevant information from the 2019 Bangladesh MICS on children's nutritional status, which was conduct through a joint effort between the Bangladesh Bureau of Statistics (BBS) and UNICEF (Bangladesh Bureau of Statistics (BBS) and UNICEF, 2019). Bangladesh MICS-2019 has used a two-stage stratified cluster sampling approach, which is similar to Bangladesh Census of Population and Housing, 2011 (Bangladesh Bureau of Statistics (BBS) and UNICEF, 2019). At the first stage, 3,220 enumeration areas (EAs) were defined for the census enumeration which was the primary sampling units. A systematic sample of 20 households was drawn from each sampled EAs and 64,400 households were selected in the second stage while 24,686 mothers/caretakers were qualified from these sampled households. We applied sample weight to the MICS data

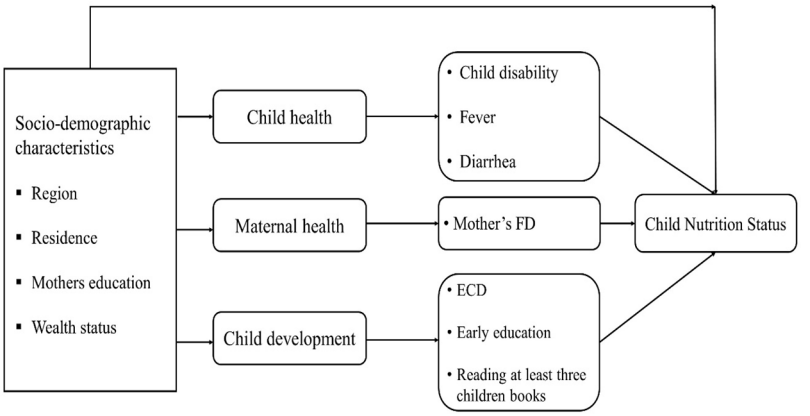

Figure 1.
Conceptual framework for child nutrition status

for a true representation of the research findings. After being weighed, the sample size of this study was approximately 23,099 mothers/caretakers who had children under five years of age. Among the mothers/caretakers who were interviewed in the whole of Bangladesh, 11,950 had male and 11,149 had female children below five years of the inquiry fields (Bangladesh Bureau of Statistics (BBS) and UNICEF, 2019). The flowchart of the selection of children is given as follows (Figure 2).

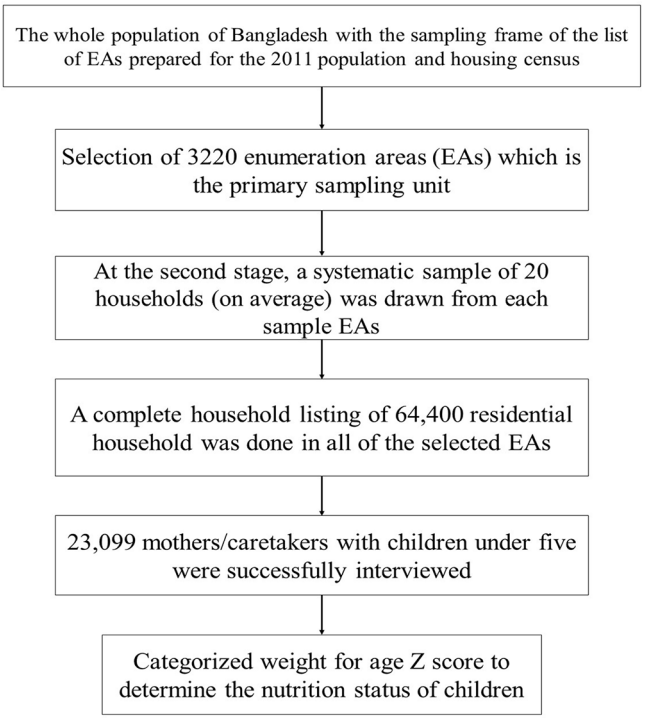

Figure 2.
Flowchart of target sample selection in this study

3.2 Variables

Outcome variable. In 2019, MICS Bangladesh used anthropometric measurement technique for assessing nutritional status by measuring weight and height of under-five children and common indicators were height for age Z score, weight for age Z score and weight for height Z score to determine the nutritional health of children. Among these three indicators, we used weight for age Z score as a dependent variable named child nutritional status which was categorized as, severely malnourished (WAZ < -3.0); moderately malnourished ($-3.0 <$ WAZ < -2.01); nourished (WAZ > -2.01)

Explanatory variables. In the established multivariate model, a set of socioeconomic and demographic factors related to child nutritional status were considered as covariates. As for our study, region (Central, East and West), residence (Urban and Rural), mother's education level (no education, primary education, secondary and above education), wealth status (poor, middle, rich), attendance to early childhood education (attending, not attending), early childhood development (Yes, No), reading children's books ($\geq$3 books, $<$3 books), functional difficulties for mothers and children (Yes, No), fever (Yes, No) and diarrhea (Yes, No) were selected as independent variables.

The ECD characterized the development index of children aged from 36 to 59 months and was measured using four domains, namely, literacy-numeracy, physical, social-emotional and learning. Analyzed ECD compliance for each child i, aged 36 to 59 months, in Bangladesh, that assures at least 3 out of 4 domains. That is,

$$ECD_i = \begin{cases} 1; & if \sum_{r=1}^{4} d_{i,r} \geq 3 \\ 0; & otherwise \end{cases}$$

The ECD index defined the percentage of children aged 36 to 59 months old and was calculated using four areas/domains, including literacy-numeracy, physical, social-emotional and learning. Among four domains, The ECDI is the proportion of children who were developmentally on track in at least three domains.

3.3 Data analysis

For our study, we divided the whole analysis part into two sections, one is for male children and the other is for only female children. The chi-square test was used to examine the association between selected covariates and child nutritional status. In this study, we framed two types of the logistic regression model in multivariate cases such as the ordinal logistic regression model and multinomial logistic regression model, and finally, the odds ratio was calculated with a 95% confidence interval (Kleinbaum and Klein, 2010).

Additionally, two different ordinal regression models and two different multinomial regression models were generated, one for males and the other for the female who was under-five children, and finds the best model using AIC and BIC techniques in this case. A good model is the one with the least value of AIC and BIC among all other models (Mohammed *et al.*, 2015). BIC's goal is to find the best model for prediction with the highest posterior likelihood, while AIC's goal is to find the model that most plausibly produced the results. Finally, we compare the differences to assess the impact of sociodemographic factors between the two genders.

The Statistical Package for Social Science 25 version and R-programming version 4.0.0 were applied for data management, analysis and geographical mapping. For geographical mapping, we use "sf" and "ggplot2" package.

3.3.1 Ethical consideration. In this study, we used MICS-2019 data downloaded from the MICS. A special thank goes to the UNICEF for enabling us to use Bangladesh MICS for our study from http://mics.unicef.org/. During the data collection, MICS maintained the privacy and confidentiality of respondents and at the beginning of individual interviews, respondents were given an informed consent form. Therefore, as this study was focused on public use, no further ethical approval was required for our data analysis.

4. Results

4.1 Geographical illustration of child nutrition status

This study found that, among male children, 5.3% were severely malnourished, 17.4% moderately nourished and 77.4% were nourished. However, among the female children, 5.1% were severely malnourished, 18.1% were moderately malnourished and 76.8% were nourished.

Figures 3 and 4 demonstrate that the divisional variation of under-five children in Bangladesh. Here we represent different maps for different nutritional statuses.

4.2 Result of bivariate analysis

Table 1 represents the results of bivariate analysis and the covariates region, residence, maternal education level, wealth index, early childhood development, early education, read children books and child disability were significantly associated with child nutritional status for both male and female. Although the covariates, namely, fever (for male), functional

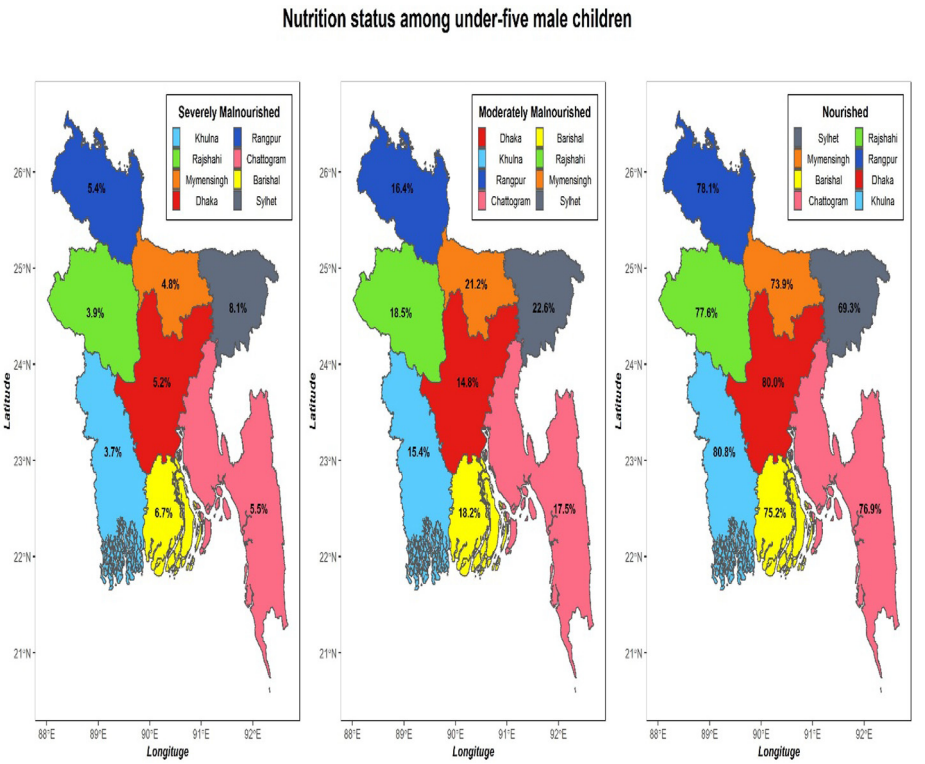

Figure 3.
Spatial presentation of nutritional status among under-five male children in Bangladesh

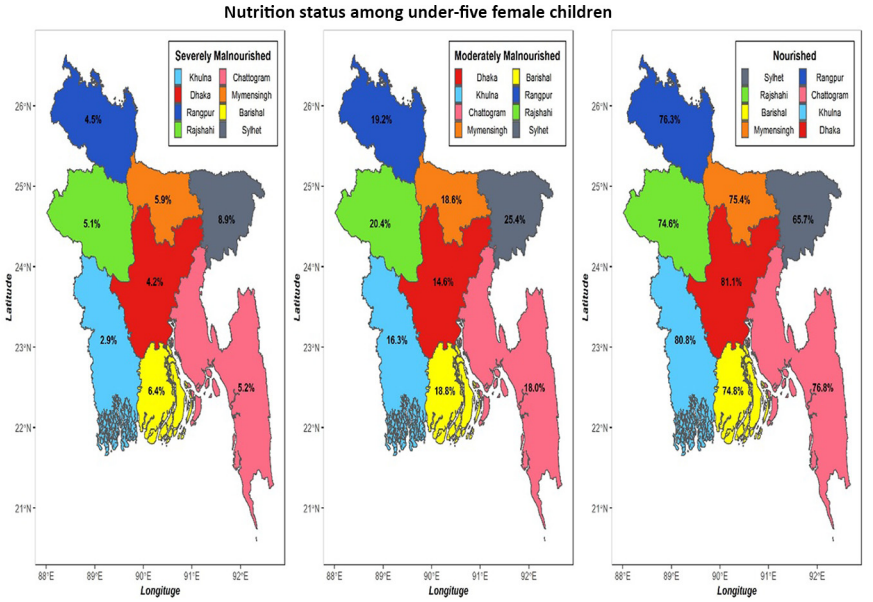

Figure 4.
Spatial presentation of nutritional status among under-five female children in Bangladesh

difficulties of mother and child disabilities (for female) were not significant in bivariate analysis, we included multivariate analysis.

The percentages of severely and moderately malnourished children were found higher in the east region (6.1% and 18%, respectively for male and 6.0% and 18.8%, respectively for female). A greater percentage of severely and moderately malnourished children lived in rural areas (5.3% and 16.9%, respectively for male and 5.4% and 18.3%, respectively for female).

We also found higher percentages of severely and moderately malnourished children for uneducated mother (8.7% and 22.3%, respectively for male and 7.1% and 24.7%, respectively for female), poor household (6.8% and 20.2%, respectively for male and 6.7% and 21.7%, respectively for female), no early child development (5.4% and 19.9%, respectively for male and 6.5% and 21.9%, respectively for female), not early child education (4.5% and 19%, respectively for male and 5.5% and 21.5%, respectively for female), not reading three or more children books (5.4% and 16.9%, respectively for male and 5.2% and 17.3%, respectively for female), having child disability (5.9% and 24.5%, respectively for male and 5.1% and 23.7%, respectively for female), having mother's functional disability (8.6% and 15.2%, respectively for male and 5.7% and 17.8%, respectively for female), children having fever (5.6% and 17.4%, respectively for male and 6.6% and 18.7%, respectively for female) and diarrhea (7.8% and 19.7%, respectively for male and 7.5% and 19.0%, respectively for female).

4.3 Best model selection

Table 2 represent different logistic regression model for children nutritional status in terms of their sex. The selections of the best model were performed according to the principle of AIC and BIC. From Table 2 we can see that multinomial logistic regression was the best, in this case, as the AIC and BIC values were lower compared to ordinal logistic regression.

Background factors	Male			Female		
	Severely malnourished (%)	Moderately malnourished (%)	Nourished (%)	Severely malnourished (%)	Moderately malnourished (%)	Nourished (%)
Region						
Central	5.3	15.9	78.9	5.0	15.4	79.7
East	6.1	18.0	75.9	6.0	18.8	75.2
West	4.3	16.0	79.6	4.2	17.7	78.1
p-value	<0.001			<0.001		
Residence						
Urban	4.6	15.2	80.2	3.5	12.8	83.7
Rural	5.3	16.9	77.7	5.4	18.3	76.2
p-value	0.03			<0.001		
Mothers education						
No education	8.7	22.3	69.0	7.1	24.7	68.2
Primary	6.3	19.1	74.6	7.1	20.7	72.1
Secondary+	4.2	14.6	81.2	3.9	14.6	81.5
p-value	<0.001			<0.001		
Wealth index						
Poor	6.8	20.2	73.0	6.7	21.7	71.5
Middle	4.0	16.6	79.4	4.4	17.6	78.0
Rich	4.0	12.8	83.2	3.6	12.2	84.2
p-value	<0.001			<0.001		
ECD						
Yes	3.5	17.1	79.3	4.6	19.8	75.6
No	5.4	19.9	74.7	6.5	21.9	71.6
p-value	<0.001			0.01		
Early education						
Yes	2.0	13.7	84.3	2.9	15.5	81.5
No	4.5	19.0	76.5	5.5	21.5	73.1
p-value	<0.001			<0.001		
Read child books						
≥3 books	2.4	10.7	86.9	2.2	14.7	83.1
<3 books	5.4	16.9	77.7	5.2	17.3	77.5
p-value	<0.001			<0.001		
Child disability						
Yes	5.9	24.5	69.6	5.1	23.7	71.2
No	4.6	17.8	77.5	5.3	19.9	74.8
p-value	0.01			0.495		
Mother's FD						
Yes	8.6	15.2	76.2	5.7	17.8	76.5
No	5.1	16.6	78.3	5.0	17.1	77.9
p-value	0.004			0.776		
Fever						
Yes	5.6	17.4	77.0	6.6	18.7	74.7
No	5.1	16.3	78.7	4.6	16.7	78.7
p-value	0.174			<0.001		
Diarrhea						
Yes	7.8	19.7	72.6	7.5	19.0	73.5
No	5.0	16.3	78.7	4.8	17.0	78.1
p-value	<0.001			0.001		

Notes: Statistical significance: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 1.
Cross tabulation between socioeconomic-demographic variables and nutritional status among children under-five

4.4 Result of multivariate analysis

Table 3 evaluates the effectiveness of the covariates by the multivariate multinomial logistic regression model. All the independent variables included in the analysis manifested to have significant interconnection with outcome variables.

The adjusted effects for child nutritional status based on socio-demographic factors among children below five years of age for both males and females in Bangladesh using the multinomial regression model are presented in Table 3.

Our findings from Table 3 at least hint that, for the male under-five children, there were significant ($p < 0.001$, $p < 0.01$, $p < 0.05$) effects of mother's education level, wealth index, east region, ECD and diarrhea on both moderate and severe malnutrition. From the result, it is clear that the effects of mother's functional difficulties (OR = 0.69) and west region (OR = 0.82) were stronger on severely malnourished compared to moderately malnourished for under five male children. Also, we found a significant connection between moderate malnutrition and several factors such as child disability (OR = 1.21), early education (OR = 1.24) and reading children's books (OR = 1.51) for male children.

In addition, we obtained good results with multivariate multinomial logistic regression method for female under-five children which were shown in Table 3. The results indicate that there were significant ($p < 0.001$, $p < 0.01$, $p < 0.05$) effects of wealth index, mother's education in secondary and above level, child disability, rural and early education on both moderate and severe malnutrition. Our result demonstrated that diarrhea, and ECD, reading less than three books to children exhibited a significant effect on severely malnourished female children.

5. Discussion

In this study, we are comparing the child nutritional status of under-five children for both males and females. The bivariate findings revealed highly significant association between nutritional status for both male and female under-five children and several factors such as mother's education, wealth index, region, place of residence and this finding is consistent with the existing study (Toma *et al.*, 2018; Rahman, 2016a, 2016b; Srivastava *et al.*, 2012; Mostafa Kamal *et al.*, 2010).

Child nutritional status for both male and female children were significantly associated with ECD, early education, reading book and recent diarrhea. Mother's functional disability had a significant impact on nutritional level for male under-five children.

A mother's level of education is the key to the nutritional status of the children. Women's education is significantly negatively associated with children's nutrition status in both female and male children in Bangladesh. Multivariate analysis shows that children who had a mother with higher education and a household with a higher wealth index were less likely to be malnourished compared with the reference group for both male and female children. The outcome was comparable or marginally higher in this study than in the previous study (Poda *et al.*, 2017; Rahman, 2016a, 2016b; Rayhan and Khan, 2006; Talukder, 2017). The

	Male		Female	
Model	AIC	BIC	AIC	BIC
Ordinal logistic regression	15,182.2	15,332.5	13,962.4	14,079.4
Multinomial logistic regression	15,158.5	15,308.3	13,956.5	14,073.0

Notes: AIC = Akaike information criterion, BIC = Bayesian information criterion

Table 2. Comparison table of different statistical model

Background factors	Male		Female	
	Severely vs nourished OR [95% CI] (*p*-value)	Moderately vs nourished OR [95% CI] (*p*-value)	Severely vs nourished OR [95% CI] (*p*-value)	Moderately vs nourished OR [95% CI] (*p*-value)
Region				
Central (ref.)	1	1	1	1
East	1.21 [1.01–1.49] (0.04)	1.17 [1.04–1.32] (0.009)	1.26 [1.02–1.54] (0.03)	1.27 [1.12–1.44] (<0.001)
West	0.82 [0.66–1.00] (0.049)	0.95 [0.84–1.07] (0.35)	0.83 [0.66–1.03] (0.09)	1.10 [0.97–1.25] (0.13)
Residence				
Urban (ref.)	1	1	1	1
Rural	0.92 [0.73–1.16] (0.47)	0.89 [0.77–1.01] (0.07)	1.31 [1.01–1.70] (0.04)	1.20 [1.03–1.39] (0.01)
Mothers education				
No education (ref.)	1	1	1	1
Primary	0.72 [0.56–0.93] (0.01)	0.83 [0.70–0.97] (0.022)	1.03 [0.78–1.35] (0.855)	0.86 [0.73–1.01] (0.70)
Secondary+	0.54 [0.42–0.68] (<0.001)	0.70 [0.60–0.82] (<0.001)	0.63 [0.48–0.82] (0.001)	0.64 [0.54–0.75] (<0.001)
Wealth index				
Poor (ref.)	1	1	1	1
Middle	0.61 [0.47–0.78] (<0.001)	0.80 [0.70–0.92] (0.002)	0.69 [0.54–0.88] (0.002)	0.81 [0.71–0.93] (0.003)
Rich	0.59 [0.48–0.73] (<0.001)	0.59 [0.52–0.68] (<0.001)	0.60 [0.48–0.76] (<0.001)	0.59 [0.51–0.67] (<0.001)
ECD				
No (ref.)	1	1	1	1
Yes	0.61 [0.47–0.79] (<0.001)	0.866 [0.75–0.99] (0.043)	0.72 [0.55–0.92] (0.01)	0.92 [0.80–1.07] (0.28)
Early education				
Yes (ref.)	1	1	1	1
No	1.14 [0.90–1.45] (0.284)	1.24 [1.08–1.43] (0.002)	1.29 [1.00–1.65] (0.05)	1.28 [1.11–1.47] (0.001)
Read child books				
≥3 books (ref.)	1	1	1	1
<3 books	1.61 [0.97–2.66] (0.065)	1.51 [1.17–1.94] (0.001)	1.90 [1.12–3.23] (0.02)	1.14 [0.91–1.43] (0.26)
Child disability				
Yes (ref.)	1	1	1	1

(*continued*)

Table 3.
Nutrition status among under five male and female children according to associate factors

Background factors	Male		Female	
	Severely vs nourished OR [95% CI] (*p*-value)	Moderately vs nourished OR [95% CI] (*p*-value)	Severely vs nourished OR [95% CI] (*p*-value)	Moderately vs nourished OR [95% CI] (*p*-value)
No	0.92 [0.76–1.13] (0.44)	1.21 [1.07–1.37] (0.003)	1.43 [1.15–1.78] (0.001)	1.55 [1.36–1.77] (<0.001)
Mother's FD				
Yes (ref.)	1	1	1	1
No	0.69 [0.48–0.98] (0.038)	1.22 [0.93–1.61] (0.148)	0.99 [0.64–1.56] (0.996)	1.08 [0.82–1.42] (0.60)
Fever				
Yes (ref.)	1	1	1	1
No	0.95 [0.78–1.14] (0.561)	0.91 [0.81–1.02] (0.113)	0.67 [0.55–0.81] (<0.001)	0.82 [0.73–0.92] (0.001)
Diarrhea				
Yes (ref.)	1	1	1	1
No	0.68 [0.52–0.89] (0.006)	0.78 [0.65—0.93] (0.007)	0.69 [0.51–0.93] (0.02)	0.85 [0.70–1.04] (0.12)

Notes: (ref.) = Reference category; statistical significance: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.

education level of the mother had an inverse association with the wasting status of children and implies that the higher the mother's education level, the less likely a child is to be wasted (Talukder, 2019). The study of India (Srivastava *et al.*, 2012) found that maternal education was a potential risk factor for child nutritional status. This study provides evidence that there was a significant association between women's wealth status and child nutritional status in both male and female children in Bangladesh. This evidence is supported by an earlier study conducted in Bangladesh and observed that children from the wealthiest families were less likely than those from the poorest families to be stunted (Rahman and Sultana, 2019). Children from middle- and upper-income families were less likely to be wasted than children from low-income families (Talukder, 2019).

Rural female children were more likely to be malnourished compared to urban children, however, it is converse for male children. In a study conducted by Pradhan in 2010, where she found that female children were more likely to be stunted compared to male children, similar findings were found (Pradhan, 2010). Rural children were less likely than urban children to be stunted (Rahman and Sultana, 2019). Another research conducted in Indonesia in 1999 indicates a similar form of outcome, with 32% of rural children malnourished vs 27% of urban children (Saadah *et al.*, 1999). Sickness is one of the biggest threats to the prevalence of malnutrition, diarrhea and fever (Poda *et al.*, 2017). This research indicates that both male and female children who had no diarrhea and no fever were less likely to be malnourished than children who had diarrhea and fever. However, for both male and female children, diarrhea was considered statistically important, but the fever was found significant only for female children. The diarrheal disease was a significant predictor of wasting and underweight in the study of Ethiopia (Fekadu *et al.*, 2015).

Surprisingly, except for male children with severe malnutrition, children without disabilities were more likely to be severely and moderately malnourished, and children's disability had a higher significant effect on both severe and moderate malnourished for female children. Several underlying risk factors for malnutrition among disabled children have been reported in various countries (Groce *et al.*, 2014). In Bangladesh, disabled children were vulnerable to malnutrition also do not attend regular school (Jahan *et al.*, 2019).

There were several limitations were arisen in the present study. This cross-sectional study design was not suitable for determining the cause-and-effect relationship between malnutrition and its associated factors. This study is based on the AIC and BIC model selection criteria and we found that the multinomial logistic regression model is better than ordinal logistic regression due to the smallest value of AIC and BIC in this analysis. However, we did not reduce gender variation by applying a multilevel logistic model rather we separately applied multinomial logistic regression to identify potential risk factors for child nutritional status in both male and female children.

6. Conclusion

The prevalence of child malnutrition in Bangladesh is still high, especially for female under-five children. This study revealed that mothers with higher education levels, wealthy families and child disability have a significant negative impact on moderate and severe malnutrition for both male and female below five years of age children. Additionally, mother's functional disabilities affect male children. Additionally, poverty rates are still high in Bangladesh, and poverty must be reduced to attain SDG 1, corresponding to improve child malnutrition in these areas, since economic status and child nutrition are inversely related. Policymakers should not only take necessary steps to increase children's nutrition level in the division level of Bangladesh but we should also consider regulating childhood development through the expansion of maternal education, especially secondary and higher education.

On this basis, we conclude that increasing maternal education level, wealth status, child health and development is necessary to overcome the malnutrition problem among children under five in Bangladesh.

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