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The Impact of Maternal Education on Childhood Stunting in Bangladesh

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Table of Contents

ABSTRACT	4
BACKGROUND	5
AIM AND RESEARCH QUESTION	6
LITERATURE REVIEW	6
METHODOLOGY	8
THEORETICAL CONCEPT.....	8
THE DATA.....	11
VARIABLE SPECIFICATION.....	11
<i>Dependent variable</i>	11
<i>Independent variables</i>	12
DATA ANALYSIS.....	13
ETHICAL CONSIDERATION.....	13
RESULT	13
DISCUSSION	19
POLICY IMPLICATIONS	21
REFERENCE	21

Abstract

Childhood stunting is a type of undernutrition which is prevalent in Bangladesh. Childhood stunting is associated with increased morbidity and mortality in childhood and low productivity in adulthood which, in turns affect the development of a nation. The aim of the paper is to identify whether maternal education have an effect on stunning of children aged 0 to 59 months independently and controlling for other socioeconomic factors in Bangladesh. Bangladesh Demographic and Health Survey 2011 data has been used in this study.

Unadjusted and adjusted logistic regression analyses has been performed. The sample size for this study was 7,861 children aged 0 to 59 months. The prevalence of stunting was found 41% among the under five children in Bangladesh. Maternal education found to be one of the main factors that affects childhood stunting. Unadjusted model showed that children from illiterate mothers had 4.33 times higher odds of being stunted (odds ratio=4.33, 95% CI: 3.5-5.4; $p=0.00$) compared to higher educated mother. Controlling other socioeconomic factors also revealed that maternal education was still a significant factor where illiterate mothers had odds (odds ratio=1.36, 95% CI: 1.0-1.80; $p=0.04$) of having stunted children compared to higher educated mother. Besides maternal education wealth index, age of child, father's education, size of the child at birth, food security and mother's health status were significantly associated with stunting. More initiatives are to reduce childhood stunting and ensuring higher educations to the girls who will be a future mother might be helpful.

Keywords

Bangladesh, demography and health survey, stunting, maternal education, food insecurity

Background

Childhood stunting is an indicator of children's health and a precise reflection of social inequalities. Childhood stunting or stunted growth is the most predominant form of child malnutrition falling below -2 standard deviation (SD) from the length-for-age/height-for-age World Health Organization (WHO) Child Growth Standards median. Despite global accord on how to circumscribe and measure it, stunting often goes unrecognized in societies where short physique is the norm as linear growth is not habitually assessed in primary health care settings and it is challenging to visually identify it. Childhood stunting is associated with morbidity and mortality at childhood, lower educational achievement, shorter height in adulthood, reduced productivity and earnings in adulthood. Child growth patterns are one of the main predictors of future human capital, health and social development of a nation [1, 2]. Optimum child growth requires sufficient food and nutrient intake, proper care and absence of disease. Growth faltering often starts in utero and endures for at least the first two years of post-natal life. Increased awareness of stunting's destructive consequences has resulted in its being identified as a major global health priority [3].

Childhood stunting is a global phenomenon. Around 165 million children aged 0-59 months old are stunted worldwide, 27% of these stunted children are in Asia and 36% in Africa [4]. However, the prevalence of stunted growth is 39% in South Asia which makes it an alarming health issue to reckon with and must be addressed proficiently [5]. In Bangladesh 36% of under five children were stunted which equals to 5.5 million children. The prevalence of stunting has decreased by only 1.5 percentage points per year from 2004 [6] and at these rate 4.0 million children will be stunted in 2025 and Bangladesh will fail to reach the World Health Assembly goal which is to reduce the stunting percentage by 40% in 2025 [7].

Previous studies have shown that different risk factors were associated with stunting in Bangladesh [8-13]. Factors such as maternal health status, education, paternal education, place of residence, socio-economic status, religion, region of residence and food security are significantly associated with childhood malnutrition in Bangladesh. The mother is the principal caregiver in Bangladesh in general, while the father is the bread earner [14]. Therefore, a more educated mother might provide better protection of her child against childhood undernutrition including stunting. Semba et al. [8] found that parents with higher education have low level of childhood stunting. A recent study [10] found a significant association between childhood undernutrition and maternal education. However, the study did not control for household food security which is a prominent factor associated with childhood stunting. In a recent study Sarma et al. showed that maternal education was associated with

childhood stunting [12]. They also found that children from the richest, food secure and improved toilet facilities households had significantly lower odds of being stunted in Bangladesh. However, the study did not consider the health status of the mother [12].

Aim and research question

The preliminary research question is ‘does education level of mother have an impact on childhood stunting among 0- to 59- months old children in Bangladesh?’ This can be regarded as a hypothesis driven research question. The null hypothesis (H_0) is mother’s education level does not have an impact on childhood stunting. The alternative hypothesis (H_1) is mother’s education level does have an impact on childhood stunting. The sub-objectives are, 1) to identify percentage of stunted children in Bangladesh. 2) To find out if there is any difference in childhood stunting with respect to mother’s education level and 3) to find out mother educational status have an effect on childhood stunting independently and controlling for other socioeconomic factors.

Literature review

There are several studies from Bangladesh which specifically addresses childhood stunting and various factors associated with it. The methodology of analysis is same as most of the studies have used regression analysis on secondary data to examine the impact of various factors associated with stunted growth. The studies are described below:

Rabbani et al. have showed long term trends and determinants of socioeconomic inequalities in childhood malnutrition measured as childhood stunting in Bangladesh among children under 5 years old. This study has used six rounds of Bangladesh Demographic and Health Survey data. Concentration curve and regression is used to analyse stunting trends and factors. The study has found that socio-economic inequalities have worsened and relative inequality in under-five stunting has increased [15].

Islam & Biswas have showed that mother’s education and child health has been one of the significant aspects of development studies and human development respectively. This study has used 3 rounds of Bangladesh and Demographic Survey data. Improvement in both women education and child health has been a formidable challenge for Bangladesh. Bangladesh is one of the poorest and densely populated country in the world. Its performance in improving the survival of infants and children under five years of age has received wide recognition from World Health Organization (WHO). However chronic malnutrition and stunted growth still

remain key concerns in the field of human development. Bangladesh demographic and health surveys in the recent decade has suggested a correlation between mother’s level of education and children’s well-being. These previous surveys also show a trend of varied prevalence rates of stunting in children whose mothers have the secondary or higher education [16].

Semba et al has showed that comparative analysis of childhood stunting is vital for policy implications in female education and child health in Bangladesh. This study has used 3 rounds of Bangladesh and Demographic Survey data. This study emphasizes that greater levels of formal education achieved by mothers can be a strong predictor of child stunting. This study also suggests that further research and insights is needed into the relation between mother’s education and risk factors of stunted growth [8].

Ahmed et al has showed that Bangladesh has been more successful in the fight against stunting compared to its neighbouring south Asian countries. However, the level of stunting is still high and unacceptable. Bangladesh need to increase stunting reducing rate to achieve the World Health Assembly target of reducing stunting level. Education can play a significant role in achieving or even surpassing this target. Low maternal education and low literacy are key determinants of impaired growth in child health [17].

Akram et al has showed that stunting among children has been a significant issue of human development and public health since forever. This study has used data from Bangladesh Demographic and Health Survey 2014. This study suggests that nutritional stunting also known as stunted growth is an anthropometric indicator of chronic undernutrition. This research has proven that inadequate feeding practices, poor maternal nutrition and limited access to sanitation facilities are critically major determinants of stunting. Although Bangladesh have done a notable progress in reducing stunting in the last three decades, recent stat shows that still one in three children remain stunted in Bangladesh [18].

Table 1: Characteristics of studies from Bangladesh on childhood stunting

Characteristics	Rabbani et. al.	Islam & Biswas	Semba et. al.	Ahmed et. al.	Akram et. al.
Data source	BDHS’ 1996-2014	BDHS’ 2004, 2007 & 2011	BDHS’ 1999-2000, 2004	BDHS’ 2004, 2007 & 2011	BDHS’ 2014

Publication year	2017	2015	2008	2016	2018
Sample size	Not known	Not known	395,122 families	Not known	Not known
Methods	Concentration curve and regression	Regression analysis	Cross-sectional study	Qualitative analysis	Multivariate regression analysis
Variables having significant affect					
Education of Mothers	√	√	√	√	√
Education of Fathers	√	√	√	√	√
Household food security	√	√			√
Wealth index	√		√	√	
Sex of child	√	√		√	√
Size of child at birth		√		√	√
Age of child in months	√	√	√		√
Household members		√			√
Religion		√			√
Region				√	√
Residence				√	√
Mother's BMI	√			√	√
		√	√		
Economic status	√		√	√	
Antenatal care received			√		
Delivery assistance			√		
Father's occupation		√			

Abbreviation: BDHS, Bangladesh Demographic and Health Survey

Methodology

Theoretical concept

The concept of households' decisions on the quantity and health quality of children was developed by Becker and later surveyed by Grossman [19]. Becker's model of family and child health is based on allocation of household time to market and non-market activities. Grossman tested the impact of education on nonmarket outcomes. This empirical analysis on

education and nonmarket outcomes shows a causal relation. Grossman predicts that an increase in parents' education will improve child health.

Various empirical studies of the impact of mothers' education on child health show different results. Many scholars argue that maternal education has significant impact on child health while others deny a causal relationship. For example, Breierova and Duflo [20] perform an analysis in Indonesia to identify the impact of parent's education on child health. This analysis revealed that parents' education has a significant impact on child mortality and evidently exists a causal relationship. On the other hand, Frongillo, de Onis and Hanson [21] perform a regression analysis of child height-for-age (stunting) and weight-for-height (wasting) on education and various socioeconomic variables. This study discovers a negative impact of education on stunting. Therefore, various studies have shown different inconsistent findings. However, there is a wide agreement among most economists that there is a causal relationship between maternal education and child health.

Association between maternal education and children's health status may help shed some light on the factors involved in a child's well-being. Schultz [22] described that mothers' education may affect child health in various ways: (1) education may play a vital role to ensure a better utilization of health inputs in the production of a healthier child; (2) mothers who are more educated may possess better knowledge to allocate resources for the betterment of children's health; (3) educated mothers may improve family wealth and health status even though many times they are not necessarily an earning member of the family but engage themselves in household decisions; (4) education may make parents understand that fewer but healthier children are important; and (5) better literacy rate among mother's may ascribe a higher value to their time. "Paradoxically, education could be a negative factor in child health by reducing both the duration of the breastfeeding and the time allocated to healthcare" [23].

The causes of childhood stunting and associated factors has been described in a World Health Organization framework (figure 1). The concepts is built on the UNICEF framework on cause of malnutrition [24].

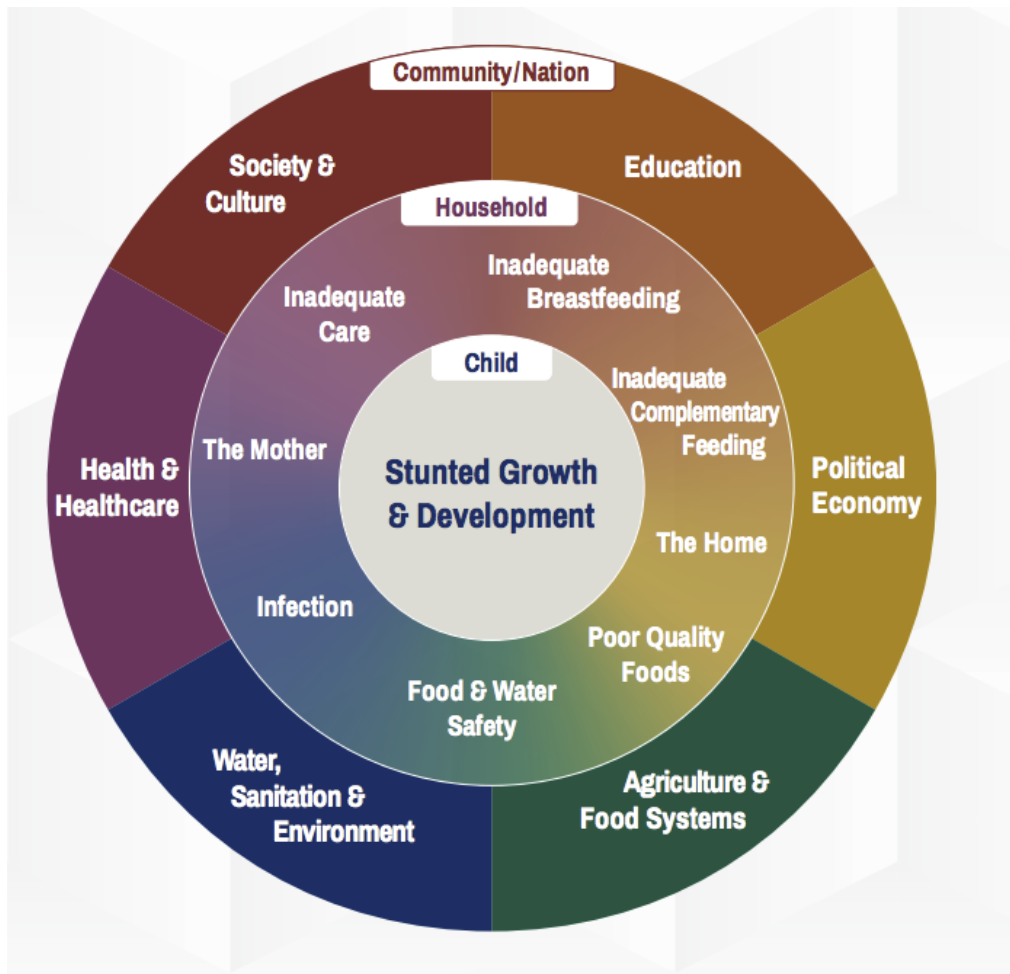


Fig. 1: WHO Framework

The household and family elements mentioned in the causes category include maternal factors during pregnancy or prior to pregnancy. Factors described within the home environment factor is based on care as depicted in one adaptation of the UNICEF framework [25]. The home environment comprises a clean, safe and stimulating environment for the mother and child which is vital for the proper nourishment. The UNICEF framework considers other factors such as community and societal factors as significant for the underlying and basic causes of malnutrition. The prominence of various underlying causes of stunting is influenced by various contextual elements.

Caregiver education is an essential predictor of child health and nutritional outcomes. Research shows that improved female education have managed to reduce 43% of undernutrition between 1971 and 1995 [26]. Parental education plays a vital role in child health. Parents with higher education are more likely to have the ability to understand child's need and respond to nutrition behaviour change messages, to be more receptive to alternative food preparation methods or recipes, and to read and interpret food labels correctly. A number

of trials have emphasized on improving caregiver knowledge regarding raising of the children as a means to improve child growth and nutrition.

Household and family factors, inadequate complementary feeding, inadequate breastfeeding practices, and infection are the critically major factors of stunted growth according to the conceptual framework. These factors may emerge separately in the framework; however, they overlap and interact to compromise growth and development. These factors can also be modified in the framework. Genetic factors haven't been mentioned in this study despite their contribution to growth and development [27].

Each of these components may have context-specific impediments and may not be easy to apply as a 'one package fits all' model. Therefore, the various factors of childhood stunting outlined in the conceptual framework may differ from country to country and can also be different for Bangladesh.

The data

This study is a cross sectional analysis of Bangladesh Demographic Health Survey' (BDHS) 2011 dataset, conducted by the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare of Bangladesh from 8 July to 27 December 2011. The survey was funded by U.S. Agency for International Development (USAID) (9). This was a nationally representative survey with stratified, multistage cluster sample of 600 enumeration areas (EAs), 207 from the urban area and 393 from the rural area. A systematic sample of 30 households on average was selected from each EA, which led to 18,964 household. Interview was conducted in 17,141 (98% of households), which comprised 18,222 eligible ever married women aged 15–49 years. From these, 17,842 were interviewed with a response rate of 98%. Details of the questionnaire, data collection procedure and management procedures are described elsewhere (9). Among the women the survey identified a total of 7,861 children aged 0 to 59 months which is the sample size for this study. The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Questionnaires were administered verbally through a well-trained interviewer.

Variable specification

Dependent variable

Being stunted or not has been used as dependent variable. Stunting of the children aged 0 to 59 months has been assessed by height for age z score (HAZ). According to the definition of

WHO, HAZ explains the height of a child in terms of the number of standard deviations (SD) above or below the median height of healthy children in the same age group [28]. A child is classified as stunted if he/she had a z score below -2 SD.

Independent variables

Education levels of mothers and their husbands are categorized into no education, primary education, secondary education, and higher education. Primary education completion is defined as completing grade 5 and secondary school completion is defined as grade 10. For the first time in Bangladesh, information regarding food security was included in BDHS'2011. Food security is measured by four questions regarding availability of food and then converted to Household Food Insecurity Access Scale as suggested by Coates et. al [29]. The details of questionnaire and scale can be found elsewhere [30]. For the purpose of this study, food security is defined as women who did not experienced any food insecurity (access) conditions or had to worry about food in last 12 months. If this condition is not fulfilled, the household is deemed to be food insecure.

A relative index of household wealth is calculated based on interviewer-observed assets, which included ownership of consumer items and dwelling characteristics. The household characteristics include having electricity, availability of cooking fuel, type of source of drinking water, access to a sanitation facility, main roof material, floor material, and main wall material. The asset variable includes durable goods (wardrobe, table, chair or bench, bicycle, motorcycle, sewing machine, watch or clock, radio, television, and telephone) and land ownership. The variable is categorized into five quintiles by BDHS: poorest, poorer, middle, richer, and richest and is kept as same for this report.

It is found that birthweight of a child is important factor for stunting [31]. However, BDHS'2011 does not have this information. Instead the size of the child at birth is used as proxy of birthweight. Women were asked whether the size of the child at birth was small, normal or large. Age of the children is categorized in 5 groups 12 months' intervals for the following groups. Household members is categorized into three categories; 2-4, 5-9 and 10 or higher. Religion is dichotomized into Muslim and Hindu and others. Majority of Bangladeshi people are Muslims. Bangladesh has seven administrative divisions or regions; Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet where residence is rural and urban. Mother's body mass index (BMI) is used as a proxy for the health status of mother. BMI is measured as weight in kilograms divided by height in meters squared (kg/m^2). A BMI less than 18.5 is categorized as underweight and higher than 25 is overweight; whereas in between is normal weight.

Data analysis

The dependent variable being dichotomous, logistic regression model is used to assess the effect of each variable independently on the dependent variable and then controlling for the variables with 95% confidence Interval (CI). Before that, chi square test is performed to check the differences between dependent and independent variables. Data analysis is carried out using SPSS, version 21.

Ethical consideration

Data collection procedure of BDHS'2011 is approved by the ethics committee of the ORC Macro at Calverton in the United States. All study participants gave informed consent before participation after a document emphasizing the voluntary participation was read.

Result

The prevalence of stunting in child 0-59 month in Bangladesh is 41% according to BDHS'2011 survey data (figure 2). The percentage of stunting in accordance with level of mother education are – illiterate (53%), primary education (46%), secondary education (35%) and higher education (20%) (table 1). The numbers of stunting are quite similar when it comes to the level of father's education. This data evidently signifies that children are more likely to be stunted if their parents are less educated. This study has found that about 36% of the children are stunted when the household food is secured while this number is high (50%) when the household food is not secured. The number of stunting in the poorest family is about 55%, poorer family (47%), middle family (40%), richer family (35%) and richest family (24%). Wealth index clearly indicates that the richer the family, lessen the chances of being stunted.

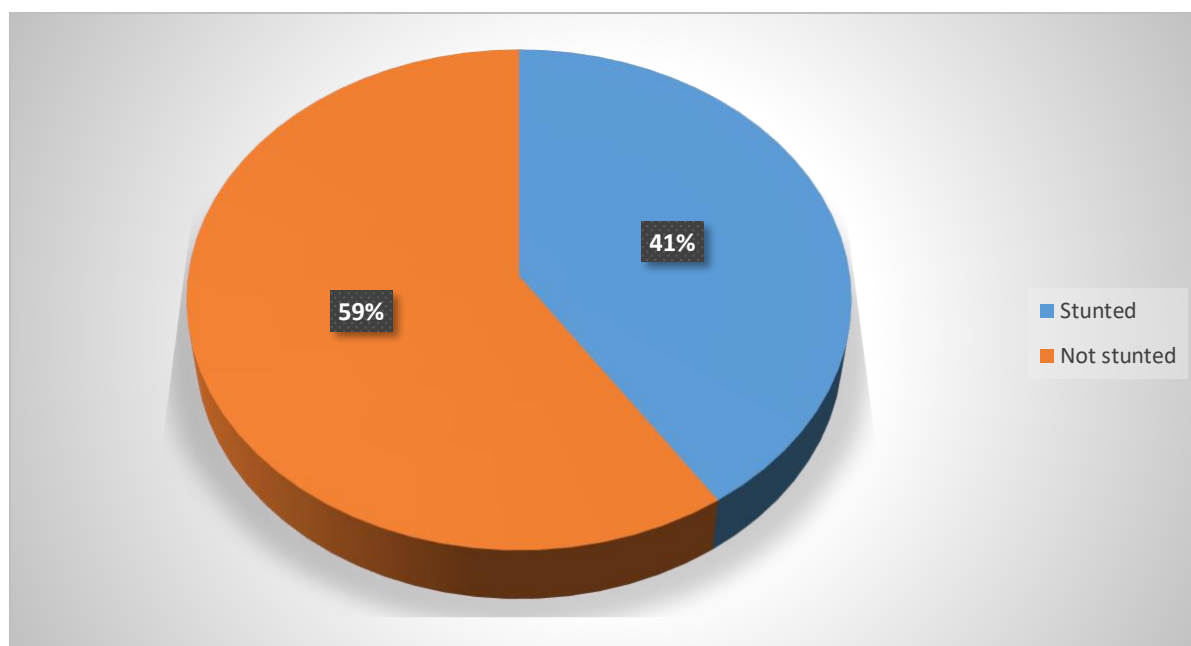


Figure 2: Prevalence of childhood stunting in Bangladesh

The prevalence of stunting in below five years old children is higher in the rural regions (43%) compared to the urban regions (35%). Administrative division wise distribution shows that Sylhet is a high-risk area for stunting, where the prevalence is about 47% while Rajshahi is a low risk area (32%). The prevalence of stunting is about 51% when mother is underweight while it drops down to 39% and 25% when mother is normal and overweight respectively. That means childhood stunting be contingent even with maternal BMI.

Table 2: Childhood stunting according to background characteristics (n=7861)

	Stunting	Not Stunting	p value
	Number (percentage)	Number (percentage)	
Mother's education			
Illiterate	762 (53%)	687 (47%)	0.000
Primary	1080 (46%)	1246 (54%)	
Secondary	1140 (35%)	2120 (65%)	
Higher	124 (20%)	484 (80%)	
Father's education			
Illiterate	1087 (51%)	1054 (49%)	0.000
Primary	1018 (46%)	1206 (54%)	
Secondary	771 (35%)	1458 (65%)	

Higher	233 (22%)	814 (78%)	
Household Food Security			
Food secure	1771 (36%)	3200 (64%)	0.000
Food insecure	1333 (50%)	1326 (50%)	
Wealth index			
Poorest	927 (55%)	755 (45%)	0.000
Poorer	699 (47%)	790 (53%)	
Middle	590 (40%)	866 (60%)	
Richer	524 (35%)	969 (65%)	
Richest	370 (24%)	1157 (76%)	
Gender of children			
Male	1576 (40%)	2333 (60%)	0.521
Female	1534 (41%)	2204 (59%)	
Size of child at birth			
Small	663 (51%)	633 (49%)	0.000
Normal	2088 (40%)	3174 (60%)	
Large	358 (33%)	728 (67%)	
Age of child in months			
1-12	359 (23%)	1213 (77%)	0.000
13-24	703 (49%)	721 (51%)	
25-36	682 (46%)	786 (54%)	
37-48	765 (45%)	916 (55%)	
49-60	594 (41%)	858 (59%)	
Household members			
2-4	912 (41%)	1328 (59%)	0.920
5-9	1841 (40%)	2701 (60%)	
10+	357 (41%)	508 (59%)	
Religion			
Muslim	2836 (41%)	4050 (59%)	0.006
Hindu and others	274 (36%)	487 (64%)	
Region			
Barisal	351 (42%)	486 (58%)	0.000
Chittagong	623 (41%)	893 (59%)	

Dhaka	546 (43%)	726 (57%)	
Khulna	298 (33%)	596 (67%)	
Rajshahi	296 (32%)	620 (68%)	
Rangpur	420 (42%)	573 (58%)	
Sylhet	576 (47%)	643 (53%)	
Residence			
Urban	825 (35%)	1517 (65%)	0.000
Rural	2285 (43%)	3020 (57%)	
Mother's BMI			
Underweight	1073 (51%)	1043 (49%)	0.000
Normal	1781 (39%)	2748 (61%)	
Overweight	239 (25%)	715 (75%)	

Table 3 shows the odd ratios (ORs) derived from unadjusted and adjusted logistic regression analyses for measuring the connotation between stunting of children aged 0 to 59 months and sociodemographic characteristics of the households.

In case of unadjusted odd ratio, mother's education is crucial in determining the percentage of stunting. Mother's without any formal education are 4.33 times more likely to have children with impaired growth (OR. 4.33, 95%CI: 3.5-5.4; p= 0.00) compared to the mothers who have higher education. The level of education of father has also similar impact on stunting (OR. 3.60, 95% CI: 3.0-4.3; p= 0.00). The data implies that the more educated the parents, lessen the chances of children being stunted. Moreover, data also signifies that rich parents is less likely to have children with stunted growth. Children from poorest family are 3.84 times more likely to be stunted (OR. 3.84, 95%CI: 3.3-4.5; p= 0.00) compared to the children who are from richest families. Child's age in months is statistically associated with stunting; children aged 13 to 24 months are more likely to be stunted (OR. 1.41, 95% CI: 1.2-1.6; p= 0.00) than those aged 0 to 12 months.

Adjusting for other variables also reveals that the level of mother education plays an important role in the stunting status of children as children of mothers with no education are 1.36 times more likely to be stunted (OR. 1.36, 95% CI: 1.0-1.8; p= 0.00) compared to the mothers who have higher education (Table 2). The level of education of father has also similar impact on stunting (OR. 1.55, 95% CI: 1.2-1.9; p= 0.00). Child's age in months is also

statistically related with stunting; children aged 13 to 24 months are more likely to be stunted (OR. 1.44, 95% CI: 1.2-1.7; p= 0.00) than those aged 0 to 12 months. Children who are perceived by their mothers to be small in size at the time of delivery are notably more likely to be stunted (OR. 1.51, 95% CI: 1.7; p= 0.00) than children who are perceived to be normal or large at the time of delivery. This study also reveals that children from poorest family are 2.65 times more likely to be stunted (OR. 2.65, 95% CI: 2.1-3.3; p= 0.00) compared to the children who are from richest families (Table 2).

Table 3: Categorical logistic regression of stunting among 0- to 59- months old children of different socioeconomic variables

	Unadjusted			Adjusted		
	OR	95% CI	p value	OR	95% CI	p value
Mother's education						
Illiterate	4.33	3.5-5.4	0.00	1.36	1.0-1.8	0.04
Primary	3.40	2.7-4.2	0.00	1.31	1.0-1.7	0.04
Secondary	2.10	1.7-2.6	0.00	1.23	1.0-1.6	0.09
Higher	1.00	Ref.		1.00	Ref.	
Father's education						
Illiterate	3.60	3.0-4.3	0.00	1.55	1.2-1.9	0.00
Primary	2.95	2.5-3.5	0.00	1.58	1.3-1.9	0.00
Secondary	1.85	1.6-2.2	0.00	1.32	1.1-1.6	0.01
Higher	1.00	Ref.		1.00	Ref.	
Household Food Security						
Food secure	1.00	Ref.		1.00	Ref.	
Food insecure	1.82	1.6-2.0	0.00	1.22	1.1-1.4	0.00
Wealth index						
Poorest	3.84	3.3-4.5	0.00	2.65	2.1-3.3	0.00
Poorer	2.77	2.4-3.2		2.10	1.7-2.6	
Middle	2.13	1.8-2.5		1.81	1.5-2.2	
Richer	1.69	1.4-2.0		1.48	1.2-1.8	
Richest	1.00	Ref.		1.00	Ref.	
Gender of children						

Male	0.97	0.9-1.0	0.52	1.02	1.0-1.1	0.67
Female	1.00	Ref.		1.00		
Size of child at birth						
Small	1.59	1.4-1.8	0.00	1.51	1.3-1.7	0.00
Normal	1.00	Ref.		1.00	Ref.	
Large	0.75	0.6-0.8	0.00	0.74	0.6-0.8	0.00
Age of child in months						
1-12	0.43	0.4-0.5	0.00	0.39	0.3-0.5	0.00
13-24	1.41	1.2-1.6	0.00	1.44	1.2-1.7	0.00
25-36	1.25	1.1-1.4	0.03	1.27	1.1-1.5	0.00
37-48	1.21	1.0-1.4	0.01	1.23	1.1-1.4	0.01
49-60	1.00	Ref.		1.00	Ref.	
Household members						
2-4	1.00	Ref.		1.00	Ref.	
5-9	0.99	0.9-1.1	0.89	1.06	1.0-1.2	0.27
10+	1.02	0.9-1.2	0.78	1.35	1.1-1.6	0.00
Religion						
Muslim	1.25	1.1-1.4	0.01	1.21	1.0-1.4	0.02
Hindu and others	1.00	Ref.		1.00	Ref.	
Region						
Barisal	1.00	Ref.		1.00	Ref.	
Chittagong	0.97	0.8-1.1	0.69	1.05	0.9-1.3	0.63
Dhaka	1.04	0.9-1.2	0.65	1.15	0.9-1.4	0.15
Khulna	0.69	0.6-0.8	0.00	0.83	0.7-1.0	0.08
Rajshahi	0.66	0.5-0.8	0.00	0.66	0.5-0.8	0.00
Rangpur	1.02	0.8-1.2	0.88	0.99	0.8-1.2	0.94
Sylhet	1.24	1.0-1.5	0.02	1.25	1.0-1.5	0.29
Residence						
Urban	0.72	0.6-0.8	0.00	1.15	1.0-1.3	0.02
Rural	1.00	Ref.		1.00	Ref.	
Mother's BMI						
Underweight	1.59	1.4-1.8	0.00	1.29	1.1-1.4	0.00
Normal	1.00	Ref.		1.00		

Overweight	0.65	0.4-0.6	0.00	0.71	0.6-0.8	0.00
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Discussion

In this study, the determinants of stunting for under five children in Bangladesh is estimated with a special emphasis of maternal education. It is observed that maternal education is one of the strongest determinants of childhood stunting besides other socioeconomic factors.

Several studies from other countries [32-34] and also from Bangladesh [8, 12] have found that mother's education is one of the best predictors for childhood stunting, which is in line with the findings of this study. One reason could be that education provides greater knowledge regarding food intake, proper care of the child and use of healthcare services and also better hygiene practice [8, 12]. Father education also have a role as it is found that children with illiterate father have the higher risk of being stunted. Therefore, education of both parents are important determinants of childhood stunting. This is also observed in studies from Bangladesh [8, 12]. Educated parents might have better income, better living condition, access to food and allocation of resources to child welfare [8, 12]. Therefore, parenteral education is one of the main factors for preventing childhood stunting.

Wealth index or the household economic status is also one of the strongest determinants. This is in line with several studies in Bangladesh [8, 12, 35]. The reason might be that women from richest households' women can afford food not in quantity but also in quality. Moreover, they can afford healthcare services if the children are sick. Stunting is also found in the richer household. One explanation is that richer household might have inadequate knowledge on food, poor hygiene practice and inappropriate food allocation as suggested by the World Bank [36].

It is interesting to note that children who were small in size at the time of birth has a higher risk of stunting than normal size children. On the other hand, children who were large in size at the time of birth has significantly low risk of being stunted. The size of children at birth may represent whether pregnant women had adequate nutrition and care at the time of pregnancy. Studies from other countries have showed that low birth weight is one of the main predictors for childhood stunting [37, 38] and also in Bangladesh [39]. Lack of proper food and care may be a reason for small size at birth and this might have continued even after the child has been born. Therefore, proper nutrition even when the child was on mothers' womb can have an influence on childhood stunting. In line with the thought, it is also found that

mother's health status also has a significant influence on childhood stunting. This is in line with studies from India [40] and Ghana [41]. Underweight mothers have higher risk of having a stunted child than mothers who are overweight. It is likely that underweight mother did not get proper food, proper treatment and care when they were sick and thus their children were stunted. On the other hand, overweight is generally a sign of abundance of food and higher wealth [42]. Therefore, the children belonging to these women group have lower chance of being stunted.

It is not surprising that household food security is associated with childhood stunting as food insecure household have the higher risk of stunted children. Having food is one of the predictors for malnutrition. Not having food can lead to any type of childhood undernutrition including stunting. This is in line with many studies in the world [43-45] as well as in Bangladesh [46, 47]. This is same as household member, too many household members can lead to shortage of food in one hand and living in unhealthy or unhygienic condition in another hand. Ahsan et al. showed that higher number of household members are a predictor of malnutrition in the slum of Bangladesh [48]. Unhealthy or unhygienic living condition can lead to frequent diseases to the children and the risk of stunting is higher. It is found that the risk of stunting is higher for the household which has more than 10 members in this study. It is noteworthy that children with age 1-12 months have the lowest risk of stunting while children with 13-24 months aged have highest risk of stunting even controlling for all other factors. One reason could be that small children were exclusively breastfeed. Traditionally Bangladeshi women breastfeed longer duration than other south Asian countries [49]. At the age 13-24 months their need is higher which was not being able to fulfill by mother breast milk alone. Thus, the stunting rate is higher at this age group. This is in line with other studies in Bangladesh [49, 50].

One of the strengths of this study is that it is based on a representative national survey with large sample size. This study may face some limitations. Stunting or stunted growth can be a cycle of intergenerational cycle of malnutrition. This study does not address intergenerational nature of stunted growth that is passed onto the next generations. This research is based on a cross sectional survey. This sort of surveys provides a sample of whole situation and may differ from real life scenario. Moreover, interviewer biases and recall biases are critically major limitations of national household survey. Cross-sectional research lacks internal validity that creates an ambiguity about the direction of causal influence.

Policy implications

Maternal education as well as education of the father was one of the main factors that affect childhood stunting besides other socioeconomic factors. Several strategies and policy changes are needed by both from the governmental and nongovernmental organizations in Bangladesh to educate girls who will be the future mother. This can help to reduce child stunting and, in the long term, can ensure the development of a country.

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