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A Sociodemographic Assessment of Infant Malnutrition in Rural Area, Bangladesh: Logistic Regression Approach

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ABSTRACT: This study investigates the association between socio-demographic factors and infant child (0-1 year) malnutrition defined by underweight, stunting and wasting, in rural areas, Bangladesh. Survey data, Multiple Indicator Cluster Survey (MICS) 2019 executed by UNICEF and Bangladesh Bureau of Statistics (BBS), is used in the study. The percentage of undernutrition is 17.08% for underweight out of 3571 sample, 18% for stunted out of 3504 sample, 9.8% for wasted out of 3470 sample with omitting missing value. Statistical methods, ANOVA, chi-square test and sampling weighted logistic regression model, are used to figure out impact of individual socio-demographic factors on child malnutrition. The variables gender, receiving prenatal care, delivery place, parents education, wealth index, child weight at birth, geographical division, and women age group at birth, are significantly associated with malnourished children (P-value: 1%, 5% or 10%). Odds of being malnutrition is lower among female children, educated parents and rich family. Prevalence of child underweight is higher among mother physical disability, childbirth weight. The undernutrition, stunting and wasting, are highly likely among the children of disabled mother. The presence of underweight and wasting is higher in Sylhet Division, lower in Mymenshingh Division respectively, while the prevalence of stunting is higher in Mymenshingh, Rajshahi, Rangpur and Sylhhet Division.

KEYWORDS: Infant malnutrition, logistic regression model, stunting, underweight, wasting.

1. INTRODUCTION

Malnutrition in childhood is prevalent over the world. It incorporates lake of nutrition (wasting , stunting and underweight), is deficient of minerals or vitamins, and resulting of communicable or non-communicable diseases [1], [2]. An individual child is considered as malnourished when the protein, calory, vitamins and mineral are inadequate for overall growth of body, or children's body can not properly utilize necessary health nutrients due to illness known as undernutrition, or they consume excess of calories defined as over-nutrition (UNICEF, WHO, World Bank, 2023). Malnutrition is two categories: undernutrition measured by underweight (low weight for age), stunting (low height for age) and wasting (low weight for height), and over-nutrition is overweight calculated by abnormal weight for height [4], [5]. One objective of the sustainable Development Goal (SDG) 3 defined by United Nations (UN) is to attain child mortality rate age under five years as low as 25 per 1000 by 2030 [6].

Malnutrition during childhood can cause several illness and hamper physical and mental development, and the severe malnutrition can increase the risk of chronic disease and death [5], [7]. The poor malnourishment may have long term affect on economy by reducing the potentiality of youth activity [8]. The poor malnourishment can cause heart problem, affect on immune system, physiological function and also reduce the absorption of micronutrient [9], [10].

The Stunting, one form of malnutrition, is being decreased significantly over the last couple of decades [11], [12]. The percentage of Stunted children under five year were decreased over the years from 33% to 22.3% from 2000 to 2022 throughout the world [3]. Around half of them are malnourished during the infant age. Still now, around 148 million children under 5 years are affected by the Stunting. The prevalence of the Stunting under five years in Bangladesh was 42% in 2013, 28% in 2019, whereas the Stunted during infant age was around 20% in 2013, 2019 [13], [14].

The prevalence of wasting, another form of malnutrition, is not decreased sharply over the last couple of decades [11], [12]. The percentage of Wasted children under five year was decreased from 8.7% to 6.8% from 2000 to 2022 throughout the world [3]. Around half of them are malnourished during the infant age. Still now, around 45 million children under 5 years are affected by the Wasting. Last two decades in Bangladesh, the number of Wasted children under 5 years was almost same, but infant wasted children were decreased slightly. The malnourished Wasted children under five years in Bangladesh was 9.6% in 2013, 9.8% in 2019, whereas the Wasted children during infant age were around 10.05% , 8.7% in 2013, 2019 respectively [15], [16].

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Underweight children age 0 - 5 years, combining of Wasting and Stunting, are decreased sharply over the last few decades . The percentage of Underweight children was decreased from 37% to 12.6% from 1990 to 2020 throughout the world [17], [18]. Around half of them are underweight under the infant age. In perspective of Bangladesh, the number of Underweight children under 5 years was reduced in the last two decades. The malnourished children in Bangladesh were 32% in 2013, 22.6% in 2019, whereas the Underweight children during infant age were around 21.9% , 16.6% in 2013, 2019 respectively [15], [16].

Some key sociodemographic factors are considered for child's malnutrition. The most crucial factors cause for the malnutrition are household economic condition, parent education status, mother working status, mother ANC visit, mother BMI, mother age at birth, child breastfeeding and delivery place [5], [19]. Household economic inequality and mother education are the significant factors for Stunting and Underweight under age 0-5 years [20]. The most dominant causes of Stunting are age of children, mother education, and living area, followed by socioeconomic condition, family skills and knowledge [21], [22]. Wealth index, residential area, gender, and age of child are the significant factors of the Wasting [23].

Malnutrition is the most concerning issue to the governments of under developing and developing countries. A proper assessment in the public health sector is needed to improve the malnutrition status. The objective of the study is to figure out the sociodemographic factors responsible for malnutrition under infant age and analyze the major factors of Stunting, Wasting and Underweight in Bangladesh.

2. METHODOLOGY

2.1 Data Collection Methodology

The Multiple Indicator Cluster Survey (MICS) 2019, UNICEF corporation with Bangladesh Bauru of Statistics (BBS) conducted the survey, is used in this study. The survey covered eight divisions, 64 districts, 3220 primary sampling units (PSU) with 64000 households. A two-stage stratified sampling technique is used in the survey. The district is selected for the primary sampling strata, where PSU is defined within the stratum with past census enumeration areas. Probability proportional to size and systematic sampling techniques are used to select PSU and 20 households for each PSU respectively.

2.2 Outcome Variables

The response variable is malnutrition defined with based on three anthropometric indicators such as Stunting (height for age), Wasting (weight for height) and Underweight (weight for age).

2.3 Independent Variables

Socio-demographic variables are selected as independent variables in the study. The variables are gender of child (male, female), area (urban, rural), division (Dhaka, Khulna, Barishal, Chattogram, Rajshahi, Mymensingh, Rangpur, and Sylhet), wealth index (poor, middle, rich), size of child at birth (very large, larger than average, smaller than average, very small), mother education status (no education, primary, secondary, higher), father education status (no education, primary, secondary, graduate, higher).

2.4 Statistical analysis

In the study, primary statistical techniques are conducted to measure the association between child nutritional status and socio-demographic factors. The techniques are bivariate analysis with cross-tables, ANOVA, chi-square test. Significant variables using chi-square test (p-value <0.1) are selected for the logistic regression model with weighted sample. The binary regression model figures out the relationship between the target and independent variables. R programing tool is used in the work.

Table 1. Cross-table of malnutrition by socio-demographic factor

Characteristics		Underweight	Stunted	Wasted
Received prenatal care	Yes	456 (15.8%)	490 (17.2%)	253 (9%)
	No	152 (22.8%)	144 (22.2%)	88 (13.8%)
		$\chi2$=18.98 df=1 P-value=0.00	$\chi2$=8.71 df=1 P-value=0.00	$\chi2$=13.81 df=1 P-value=0.00

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Place of delivery	Home	347 (19.6%)	352 (20.3%)	204 (11.9%)
	Health facility	263 (14.6%)	285 (16%)	138 (7.8%)
		$\chi2$=15.76 df=1 P-value=0.00	$\chi2$=10.83 df=1 P-value=0.00	$\chi2$= 16.50 df=1 P-value=0.00
Weight of child at birth	More than average	29 (7.9%)	42 (10.5%)	23 (5.9%)
	average	368 (14.7%)	390 (15.8%)	245 (10.0%)
	Less than average	44 (51.2%)	197 (32.9%)	71 (12.0%)
		$\chi2$=103.6 df=2 P-value=0.00	$\chi2$=112.51 df=2 P-value=0.00	$\chi2$=10.6 df=2 P-value=0.00
Mother physical functionality	Yes	10 (30.3%)	5 (15.2%)	4 (12.1%)
	No	573 (16.7%)	604 (17.9%)	328 (9.8%)
		$\chi2$= 4.31 df=1 P-value=0.03	$\chi2$= 0.17 df=1 P-value=0.67	$\chi2$=0.19 df=1 P-value=0.66
Wealth index	Poor	371 (20.6%)	387 (21.9%)	211 (12.1%)
	Middle	112 (15.2%)	113 (15.5%)	52 (7.3%)
	Rich	127 (12.3%)	137 (13.5%)	79 (7.9%)
		$\chi2$= 34.11 df=2 P-value=0.00	$\chi2$= 35.42 df=2 P-value=0.00	$\chi2$=19.51 df=2 P-value=0.00
Mother Education	Pre-primary or none	92 (29.2%)	76 (24.5%)	50 (16.4%)
	Primary	154 (17.7%)	174 (20.4%)	98 (11.7%)
	Secondary	293 (16%)	299 (16.9%)	168 (9.4%)
	Higher	71 (12.7%)	88 (16.1%)	26 (4.8%)
		$\chi2$= 41.88 df=3 P-value=0.00	$\chi2$=15.82 df=3 P-value=0.00	$\chi2$= 33.67 df=3 P-value=0.00
Father Education	Pre-primary or none	247 (20.5%)	248 (21.1%)	139 (12.0%)
	Primary	196 (18%)	213 (19.8%)	108 (10.2%)
	Secondary	132 (14.1%)	138 (15.0%)	78 (8.6%)
	Higher	34 (9.9%)	38 (11.4%)	16 (4.8%)
		$\chi2$= 33.81 df=3 P-value=0.00	$\chi2$= 25.42 df=3 P-value=0.00	$\chi2$= 17.41 df=3 P-value=0.00
	Barishal	54 (17.10%)	41 (13.1%)	31 (10.2%)

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Geographical Division	Chattogram	103 (14.8%)	102 (15.0%)	84 (12.5%)
	Dhaka	97 (15.5%)	95 (15.4%)	63 (10.3%)
	Khulna	61 (12.6%)	61 (12.6%)	46 (9.6%)
	Mymensingh	43 (17.1%)	67 (26.3%)	18 (7.2%)
	Rajshahi	74 (19.7%)	73 (19.7%)	24 (6.5%)
	Rangpur	90 (18.8%)	117 (25.8%)	34 (7.6%)
	Sylhet	88 (25.6%)	81 (23.9%)	42 (12.7%)
		$\chi2$= 30.99 df=7 P-value=0.00	$\chi2$= 60.37 df=7 P-value=0.00	$\chi2$= 17.77 df=7 P-value=0.01
Gender	Male	335 (18.2%)	358 (19.9%)	200 (11.2%)
	Female	275 (15.9%)	279 (16.3%)	142 (8.4%)
		$\chi2$= 3.50 df=1 P-value=0.06	$\chi2$= 7.66 df=1 P-value=0.00	$\chi2$= 7.77 df=1 P-value=0.00
Women age at birth	<20	146 (17.0%)	151 (17.8%)	71 (8.4%)
	20-34	393 (16.4%)	428 (18.2%)	226 (9.7%)
	35+	71 (22.8%)	57 (18.8%)	45 (15.1%)
		$\chi2$= 7.87 df=2 P-value=0.01	$\chi2$= 0.15 df=2 P-value=0.92	$\chi2$= 11.04 df=2 P-value=0.00

Table 2. Logistic regression for child malnutrition age 0-1 year

Characteristics		Underweight OR (95% CI)	Stunting OR (95% CI)	Wasting OR (95% CI)
Gender	Female	0.72*** (0.59 -0.87)	0.74** (0.62- 0.89)	0.69** (0.55- 0.88)
	Male (ref)	1	1	1
Received Prenatal Care (ANC)	Yes	0.94 (0.73-1.21)	0.97 (0.76- 1.25)	0.86 (0.64- 1.16)
	No (ref)	1	1	1
Place of delivery	Home	1.07(0.86 -1.33)	1.10 (0.89- 1.35)	1.18 (0.90- 1.55)
	Health facility (ref)	1	1	1
Weight of child at birth	Average	1.43*** (1.13-3.86)	1.49* (1.06- 2.14)	1.51* (0.98- 2.44)
	Smaller than average	3.49*** (4.17-10.50)	3.86*** (2.67-5.69)	1.81** (1.11- 3.05)
	Larger than average (ref)	1	1	1
Mother physical disability	yes	2.75* (1.12- 6.42)	0.78 (0.25- 2.00%)	1.02 (0.29- 2.732)
	No (ref)	1	1	1
Mother education status	Primary	0.62** (0.44- 0.86)	0.88 (0.63- 1.24)	0.86 (0.58- 1.29)
	Secondary	0.73* (0.51- 1.03)	0.85* (0.60- 1.21)	0.83 (0.55- 1.28)
	Higher	0.63* (0.39- 1.00)	1.05 (0.67- 1.64)	0.55* (0.30- 1.00)
	Pre-school or none (ref)	1	1	1

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Father education status	Primary	0.94 (0.74 -1.19)	0.97 (0.77- 1.21)	0.88 (0.66 - 1.18)
	Secondary	0.79* (0.60-1.03)	0.76* (0.58- 0.98)	0.89 (0.64- 1.23)
	Higher	0.68* (0.43-1.05)	0.64* (0.41- 0.96)	0.61* (0.33- 1.06)
	Pre-school or none (ref)	1	1	1
Wealth index	Middle	0.75* (0.57 -0.98)	0.83 (0.64- 1.07)	0.66** (0.46- 0.92)
	Rich	0.71* (0.54 -0.93)	0.72* (0.55 - 0.93)	0.81 (0.58- 1.13)
	Poor (ref)	1	1	1
Geographical division	Chattogram	0.86 (0.54-1.40)	1.32 (0.88 - 2.032)	1.25 (0.79- 2.02)
	Dhaka	1.19 (0.75-1.93)	1.28 (0.84 - 1.97)	1.17 (0.73- 1.93)
	Khulna	0.93 (0.55-1.58)	1.19 (0.76- 1.87)	1.11 (0.66 - 1.87)
	Mymenshingh	0.91 (0.54-1.54)	2.26*** (1.44-3.59)	0.57* (0.29- 1.08)
	Rajshahi	1.32 (0.82-2.19)	1.61* (1.04- 2.54)	0.68 (0.38- 1.23)
	Rangpur	1.21 (0.74 -2.00)	2.58*** (1.72-3.93)	0.73 (0.42- 1.25)
	Sylhet	1.78* (1.09-2.96)	2.25*** (1.45-3.54)	1.13 (0.66- 1.92)
	Barishal (ref)	1	1	1
Woman age at birth	20-34	1.15 (0.88-1.51)	1.21 (0.94- 1.57)	0.98 (0.71- 1.38)
	35+	1.38 (0.86-2.21)	1.18 (0.74- 1.88)	1.11 (0.63- 1.94)
	<19 (ref)	1	1	1

Note: significant level α, *p<1%, **p< 5%, ***p<1%, OR=1.0

3. RESULTS

In the study, sample size of infant malnourished children are in total 3571 for underweight, 3504 for stunted and 3470 for wasted. The corresponding percentage of suffering undernutrition condition are 17.08% for underweight, 18% for stunted, 9.8% for wasted with omitting missing value. Table 1 shows the prevalence of different malnourished status with socio-demographic factors.

From the Table 1, all the socio-demographic factors are significantly associated with the target variable 'malnutrition status' under 10% significant level (P-value<0.1). The percentage of stunted children are the highest in Received prenatal care, Place of delivery and Gender, while the presence of wasted children are lowest in all factors. The presence of malnourished are highest among less than average weight and lowest among more than average weight children. The highest percentage of malnourished children are from poor households and the lowest from rich households. Parents education is playing key role reducing undernutrition among infant children with increasing education level: highest malnutrition from pre-primary education or none and lowest malnutrition from higher education. Prevalence of malnutrition is highest from Sylhet in underweight, Mymensingh in stunted and Sylhet in wasted, while the lowest percentage of undernutrition children are from Khulna in underweight and stunted, and Rajshahi in wasted. The malnutrition is increasing with increasing women age groups.

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Table 2 represents the influence of individual factors on malnutrition status under infant children in Bangladesh through the sampling adjusted logistic regression model. The significance of parameter is measured by Odds Ratio (OR) with 1%, 5%, and 10% significant level (p-value<0.1).

Table 2 shows that the sociodemographic factors Gender, Weight of child at birth, Mother physical disability, Mother education status, Father education status, and Geographical division have significant association with the malnutrition status 'underweight'. In the case of stunting and wasting, the variables Gender, Weight of child at birth, Mother education status, Father education status, and Geographical division are significantly associated with the poor nutrition conditions 'stunted' and 'wasted'.

Odds of being underweight of female children are 28% lower compared to male children. Children who are average weight at birth are 1.43 times higher for underweight compared to the children whose weights are more than average. This scenario is more severe for the children whose weights are smaller than average (3.49 times more likely). Children of physically disabled mother are 2.75 times higher of odds of being underweight compared to children of physically active mother. Odds of being underweight are 38%, 27% and 37% lower for the children of primary, secondary, and higher educated mothers respectively compared to the children of pre-primary or none educated mother. Children of secondary educated father and higher educated father are 21% and 32% lower of odds of being underweight compared to children of pre-primary or none educated father. Odds of being underweight for the children of middle-class family and rich class family are 25% and 29% lower compared to the children of poor class family. Children living in Sylhet division are 1.78 times more likely of odds of being underweight compared to the children living in Barishal division.

Odds of being stunted of female children are 26% lower compared to male children. Children who are average weight at birth are 1.49 times higher for stunting compared to the children whose weights are more than average. This scenario is more severe for the children whose weights are smaller than average (3.86 times more likely. Odds of being stunting is 15% lower for the children of secondary educated mothers compared to the children of pre-primary or none educated mother. Children of secondary and higher educated father are 24% and 36% lower of odds of being stunted compared to children of pre-primary or none educated father. Odds of being stunted for the children of rich class family are 28% lower compared to the children of poor class family. Children living in Mymenshingh, Rajshahi, Rangpur, and Sylhet division are 2.26, 1.61, 2.58, 2.25 times more likely of odds of being stunted compared to the children living in Barishal division.

4. DISCUSSIONS

A great accomplishment done by the government of Bangladesh is consistently reducing the child malnutrition over the last decades. The infant undernutrition is 17% in underweight, 18% in stunted and 9.9% in wasted data collect from MICS-2019, Bangladesh. The socio-demographic factors Receiving prenatal care, Place of delivery, Weighted of child at birth, Mother physical functionality, Wealth index, Parents education, Geographical division, Gender and Women age at birth are significantly associated with malnutrition during infant age at 1%, 5% or 10% significant levels.

Gender is a key factor of child malnutrition in several studies. In this study, male children are more likely to be malnourished compared to female children. Biologically male children have more risk to morbidity [24].

Child weight at birth is a crucial factor for the undernutrition. Study suggested that malnutrition is prevalence among low birth weight children ([25]). The percentage of malnutrition is sharply increased from more than average weight to less than average weight. The consistent result is found in the study. Children whose birth weight is smaller than average are more vulnerable to undernutrition compared to others two groups with significant level.

Mother functional difficulty consists of seeing, walking hearing, remembering, concentration, self-caring, and communication issues. Mothers with physical disability are struggling to take care their children [26]. The study found that children of mothers with functional disability is significantly associated with malnutrition 'underweight' but not statistically associated with stunting and wasting.

Parents education is the most vital factors of child malnutrition. Educated parents can have proper knowledge about child mental and physical development. Previous studies show that increasing parent's education can help decreasing the child undernutrition [27], [28]. This research work also supports the previous result. The prevalence of malnutrition is decreased with increasing parent educational status.

Wealth index is inversely associated with malnutrition. Studies proof that malnutrition is lower in rich family compared to poor family [29], [30]. Prevalence of underweight is decreasing with wealth inequality groups (poor -rich family) with significant level

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(P-value<0.05). Stunting and wasting are statistically associated with rich class and middle-class families respectively (P-value<0.05).

There are eight geographic divisions in Bangladesh. The presence of malnutrition varies from division to division. The prevalence of underweight in Sylhet is more likely compared to Barishal. In the case of stunting, the prevalence is highly associated with Mymenshingh, Rajshahi, Rangpur, and Sylhet but wasting is inversely associated with Mymenshingh Division.

5. CONCLUSION & LIMITATION

Since malnutrition has been reducing over last the decades, a proper policy is needed by the policymakers to continue this reducing trends. Parents' education is playing a vital role in improving child nutritional status. This nutritional condition will be increased through developing child nurturing programs nationally. Economic crisis in households causes raising malnourished children. A food subsidiary plan for the poor class family can balance child nutrition status. Underweight is prevalent in Sylhet Division. In the case of stunting, this malnutrition is high in Mymenshingh, Rajshahi, Rangpur and Sylhet Division but wasting is low in Mymenshingh Division. The government can ensure overall facilities equally in all Divisions.

This study has a few limitations. First, since MICS-2019 is a cross sectional survey in Bangladesh, causal association is not defined. Second, some confounder factors such as daily diet plan, physical activities, nutrient intake in food are not included in the study. Finally, quantitative information from household is not available in the survey.

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