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Research Article

Prevalence and Determinants of Undernutrition among Under Five Children in Bangladesh: Evidence from the 2019 MICS

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Abstract

Background: Malnutrition manifests as undernutrition and overnutrition, with stunting, underweight, and wasting being critical forms of undernutrition that hinder the physical and cognitive development of children under five in Bangladesh. This study aims to assess the nutritional status of children under five and identify key determinants of undernutrition.

Methods: This study utilized secondary data from the 2019 Multiple Indicator Cluster Survey (MICS), including 22,448 children under five. The analysis focused on socio-demographic factors. Chi-square and t-tests were used for hypothesis testing, and logistic regression identified determinants of undernutrition.

Results: The prevalence of multiple forms of undernutrition was 3.2%, with stunting affecting 27.9% of children, underweight 22.6%, and wasting 9.8%. Among districts, stunting was most prevalent in Sunamganj (45.9%), underweight in Habiganj (37.9%), and wasting in Lakshmipur (15.9%). Children from the poorest households had significantly higher odds of experiencing stunting (aOR: 2.2, 95% CI: 1.92-2.51), underweight (aOR: 2.4, 95% CI: 2.04-2.73), and wasting (aOR: 1.5, 95% CI: 1.24-1.83) compared to those from the richest households. Additionally, children in families with a history of child mortality had increased odds of stunting (aOR: 1.2, 95% CI: 1.05-1.32), underweight (aOR: 1.2, 95% CI: 1.07-1.36), and wasting (aOR: 1.2, 95% CI: 1.06-1.45).

Conclusions: Household wealth and a history of child mortality were key determinants of undernutrition among children under five. Parental education, particularly the lack of primary education in both parents, was strongly associated with stunting and overall undernutrition. These findings highlight the need to improve socio-economic conditions and promote parental education to reduce childhood undernutrition in Bangladesh.

INTRODUCTION

Malnutrition is a critical global public health issue that is alarming for the development of developing countries like Bangladesh. Rates of malnutrition in Bangladesh are among the highest in the world. In Bangladesh, more than half the population suffers from malnutrition. Malnutrition affects people in every country. Nearly half of deaths among children under 5 years of age are linked to undernutrition. These mostly occur in low- and middle-income countries [1]. Globally, 144 million children under 5 suffer from stunting, 47 million children under 5 were wasted of which 14.3 million were severely wasted, and 38.3 million were overweight [2].

Over the past fifteen years, Bangladesh has succeeded in reducing childhood malnutrition, but substantial inequalities exist across geographical regions and economic groups [2]. In all forms of undernutrition, children living in rural areas face greater challenges than those living in urban areas [3]. District-level undernutrition indicators show that districts in north-eastern and south-eastern parts are highly exposed to either form of undernutrition than the districts in south-western and central parts of the country. Study revealed that over two-fifths of the children were stunted, of which 26.3% were moderately stunted and 15.1% were severely stunted in rural areas [4]. In contrast to the national decrease observed in Bangladesh overall, child malnutrition has increased in Sylhet in recent years [5,6]. A study revealed that 43% of the children under age five were suffering from chronic malnutrition, 17%

were acutely malnourished, and 41% had an underweight [7]. Bangladesh's nutrition gains have been amongst the highest in the world. However, still many millions of children in Bangladesh grow up stunted because of poor nutrition [8]. Latest nationwide data (2019) used to evaluate four malnutrition statuses of under 5 children. Households with lower socio-demographic status had more malnourished children [9]. The children are facing stunting in the long run. This scenario is almost the same for urban and rural areas [10].

The primary objective of this study was to assess the current nutritional status of children under five in Bangladesh. The dataset comprises information from 64 districts, incorporating multiple indicators of child nutrition and health.

Although numerous studies [10-14], have explored under-five malnutrition in Bangladesh, comparative analyses between urban and rural settings remain limited. Only a few studies have explored area disparities in childhood malnutrition with some focusing solely on the rural area scenario [15-18]. The existing research primarily focuses on undernutrition prevalence without systematically comparing area wise disparities and their underlying socio-demographic and economic determinants. This study aims to address this gap by providing a comparative analysis of undernutrition indicators across urban and rural populations.

By analyzing the spatial distribution and socio-economic determinants of childhood undernutrition, this research provides a comprehensive understanding of its prevalence in different areas. Identifying high-risk areas and vulnerable groups will enable policymakers to develop targeted interventions aimed at reducing child undernutrition, morbidity, and mortality in Bangladesh. The findings may also inform future policies and programs aimed at achieving sustainable improvements in child nutrition and overall public health.

MATERIALS AND METHODS

Source of data

For this study, we utilized data extracted from the Multiple Indicator Cluster Survey (MICS) 2019, conducted by UNICEF. The MICS 2019 represents the sixth edition of this survey, which was carried out using a two-stage stratified cluster sampling by the Bangladesh Bureau of Statistics (BBS) in collaboration with UNICEF Bangladesh, spanning from January to May 2019.

The survey included 3,220 Primary Sampling Units (PSUs), covering a total of 64,400 households, with 24,686 eligible households that had children under five years old selected for interviews. The final dataset for our analysis consisted of 22,448 completed interviews with mothers after excluding certain socio-demographic factors.

Figure 1 depicts the algorithm used to outline the selection process of the study sample from the MICS datasets

The MICS surveys are designed to be nationally representative, with sample sizes large enough to ensure robust estimates at regional, provincial, and urban-rural levels. The MICS 2019 was specifically structured to provide data on a wide array of indicators concerning the situation of children and women at the national level, as well as across different geographic regions, including regions, governorates, and districts. The survey utilized a multi-stage, stratified cluster sampling technique for sample selection, and the data is not self-weighting. Therefore, sample weights were applied to ensure accurate national-level estimates.

Variables included in the study

In this study, undernutrition was considered as the outcome variable, which was assessed using three indicators: stunting (height-for-age z-score), underweight (weight-for-age z-score), and wasting (weight-for-height z-score). Undernutrition was defined according to the World Health Organization (WHO) standards, with a z-score of <-2 standard deviations (SD) from the median.

The covariates used in the analysis were derived from the socio-demographic section of the dataset and were categorized into three groups: household characteristics, maternal characteristics, and child characteristics

Statistical Analysis

All statistical analyses were conducted using STATA **(**Stata Statistical Software: Release 15, StataCorp LLC, College Station, Texas, USA). For data visualization, bar charts waere used. Descriptive analysis was performed

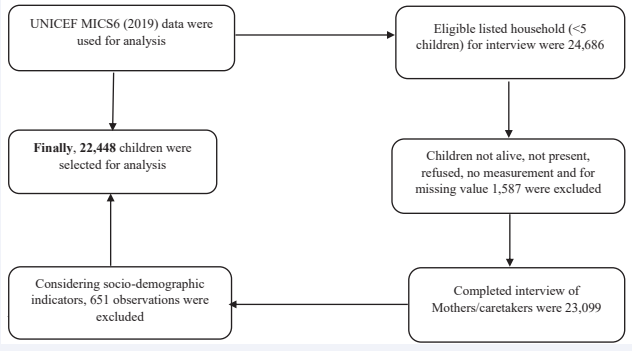

Figure 1 Study sample selection algorithm

to examine the characteristics of the study participants, with results presented as frequencies and percentages. Descriptive statistics, including proportions, means, and standard deviations, were used to summarize the data. Bivariate analyses, specifically the Chi-square test, was utilized to assess significant differences between two categorical variables. For inferential statistics, a 95% confidence interval (CI) was applied, and statistical significance was determined with a p-value threshold of <0.05. To examine the strength of the association between undernutrition and the independent variables, a multiple logistic regression model was employed. Additionally, to identify the adjusted factors associated with child undernutrition, the data were weighted for analysis.

RESULTS

Table 1 presents the socio-demographic characteristics of children from urban and rural settings of Bangladesh. In this study, nearly two out of ten children were from urban areas.

For household characteristics, the mean age of fathers and the standard deviation (SD) were similar across both urban and rural areas. When comparing the two settings, a higher percentage of fathers in rural areas had completed education beyond primary school 22.61% compared to urban fathers. In terms of family size, 55.23% of urban families had more than three members, while 61.24% of rural families fell into this category. Regarding the number of children under five years old, 23.71% of urban households had more than one, compared to 27.34% in rural areas. The presence of a cooking area inside the main house was more common in urban areas 55.06% than rural areas 30.82%. According to the wealth quintile, 45.68% of the richest individuals lived in urban areas, whereas the poorest 28.44% resided in rural areas.

Table 1: Socio-demographic and economic characteristics of under five children by residence

Basic characteristics	Urban (18.70%)	Rural (81.30%)	Overall	*p*-values
Household				
Father age in years (Mean ± SD)	34.92±6.97	34.66±7.38	34.71±7.30	0.112
Father had no formal education	3328(86.44)	12487(77.39)	15815(79.13)	<0.001
Muslim religion	3841(91.52)	16363(89.66)	20204(90.00)	<0.001
Bengali ethnicity	4135(98.52)	17827(97.68)	21962(97.83)	<0.01
Number of family members (≤3)	701(16.70)	2279(12.49)	2980(13.28)	<0.001
Had only one (1) under five children	3202(76.29)	13261(72.66)	16463(73.34)	<0.001
Had (5-17) years old children	2584(61.57)	12190(66.79)	14774(65.81)	<0.001
Had one (1) sleeping room	1354(32.26)	5747(31.49)	7101(31.63)	0.332
Cooking place was in main house	2311(55.06)	5625(30.82)	7936(35.35)	<0.001
Wealth quintile				<0.001
Poorest	362(8.63)	5190(28.44)	5552(24.73)	
poorest	362(8.63)	4311(23.62)	4673(20.82)	
Middle	551(13.13)	3688(20.21)	4239(18.88)	
Richer	1005(23.95)	3207(17.57)	4212(18.76)	
Richest	1917(45.68)	1855(10.16)	3772(16.80)	
Mother				
Age at 1st marriage in years (Mean ± SD)	17.67±3.57	17.08±3.08	17.19±3.18	0.214
Age interval was 20-34 at first birth	3155(75.17)	13048(71.49)	16203(72.18)	<0.001
Had no formal education	324(7.72)	1978(10.84)	2302(10.25)	<0.001
Had knowledge sharing scope (≥1)	4014(95.64)	15787(86.50)	19801(88.21)	<0.001
Ever had child who later died	282(6.72)	1602(8.78)	1884(8.39)	<0.001
Faced any kind of domestic violence	1037(24.71)	5015(27.48)	6052(26.96)	<0.001
Child				
Age in years (Mean ± SD)	2.00±1.42	2.00±1.41	2.00±1.41	0.142
Height-for-age z-score	-1.13±1.44	-1.33±1.33	-1.29±1.35	
Weight-for-age z-score	-0.99±1.21	-1.26±1.11	-1.21±1.14	
Weight -for- Height z-score	-0.49±1.27	-0.70±1.17	-0.66±1.18	
Male sex	2179(51.92)	9438(51.71)	11617(51.75)	0.810
Birth interval				<0.001
First birth	1647(39.24)	6446(35.32)	8093(36.05)	
≤2 years	503(11.98)	2733(14.97)	3236(14.42)	
>3 years	2047(48.77)	9072(49.71)	11119(49.53)	
No twins	4141(98.67)	17968(98.45)	22109(98.49)	0.300
Had Diarrhea	294(7.01)	1257(6.89)	1551(6.91)	0.789
Had Cough	944(22.49)	3867(21.20)	4811(21.44)	0.065
Had picture/reading books	1366(32.55)	4758(26.07)	6124(27.28)	<0.001

For maternal characteristics, the mean age at first marriage was nearly 17 years for mothers in both urban and rural areas. In terms of education, a higher proportion of mothers in both urban 92.28% and rural 89.16% areas had completed education beyond primary school compared to fathers. Moreover, 95.64% of urban mothers had access to at least one source of knowledge, compared to 86.50% of rural mothers. Concerning maternal health, child mortality rates and exposure to domestic violence were higher in rural areas 8.78% compared to urban areas 6.72% and for domestic violence 27.48% in rural vs. 24.71% in urban.

In the children's characteristics section, the overall mean age of children was 2 years, with a slightly higher proportion of males 51.75% than females 48.25%. Regarding morbidity, diarrhea and cough rates were higher in urban areas 7.01% vs. 6.91% for diarrhea and 22.49% vs. 21.20% for cough compared to rural areas. However, a notable difference was observed in the availability of reading materials or picture books for children, with rural households having significantly higher access 73.93% compared to urban households 67.45%.

Figure 2 shows that 3.16% of children experienced multiple forms of undernutrition, with stunting, underweight, and wasting occurring simultaneously in the same child. Additionally, the overall prevalence of at least one form of undernutrition, stunting, underweight, or wasting, was 36.46%.

In the selected sample, the prevalence rates for stunting, underweight, and wasting were 27.90%, 22.57%, and 9.82%, respectively. When comparing rural and urban areas, the prevalence of stunting, underweight, and wasting was higher in rural areas than in urban areas.

In Figure 3, among the 64 districts, stunting and underweight rates remained highest in the north-eastern districts of Sunamganj 45.93% and Habiganj 37.99%,

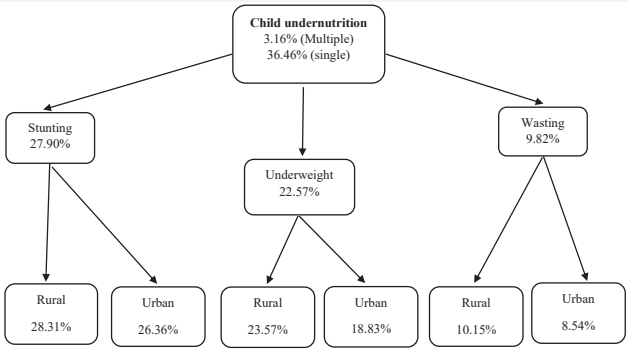

Figure 2 Area-wise child undernutrition

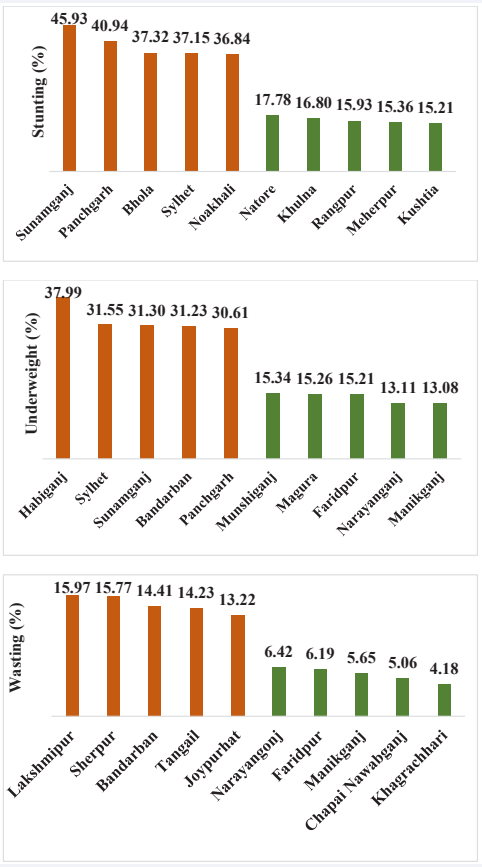

Figure 3 Five (5) districts of stunting, underweight and wasting in highest and lowest position

respectively. In contrast, the south-eastern district of Lakshmipur had the highest rate of wasting at 14.97%. On the other hand, Kushtia 15.21%, Manikganj 13.08%, and Khagrachhari 4.18% recorded the lowest rates for stunting, underweight, and wasting, respectively. However, no district was completely free from undernutrition.

Table 2 outlines the factors significantly associated with stunting, underweight and wasting in children under five years old, after adjusting for various variables. These include the father's age and education, as well as the child's religion, ethnicity, and the number of children under five and those aged 5-17 years in the household. Additional factors include the number of sleeping rooms, total family members, cooking location, residential area, wealth quintile, mother's age at first marriage and first birth, maternal education, access to at least one source of knowledge, exposure to domestic violence, history of child mortality, the child's age, birth interval, twins, and the availability of picture books or reading materials for the child.

The adjusted associations between various factors and underweight status in children under five years old.

Table 2. Associated determinants of childhood stunting, underweight, and wasting

Indicators	Stunted		Underweighted		Wasted	
	COR (95%CI)	AOR (95%CI)	COR (95%CI)	AOR (95%CI)	COR (95%CI)	AOR (95%CI)
Father age	1.00(0.99, 1.00)	0.99(0.98, 0.99)[c]	1.00(0.99-1.00)	0.99(0.99-1.00)[b]	1.01(1.00-1.01)[a]	1.00(0.99-1.01)
Father education (Ref.: Primary and above)						
Pre-primary or none	1.67(1.55, 1.80)[c]	1.18(1.08, 1.29)[c]	1.59(1.47-1.72)[c]	1.15(1.05-1.25)[b]	1.25(1.12-1.40)[c]	1.02(0.89-1.16)
Religion (Ref.: Muslim)						
Non-Muslim	1.08(0.97, 1.20)	1.14(1.01, 1.28)[a]	0.99(0.88-1.11)	1.02(0.90-1.16)	1.04(0.89-1.22)	0.99(0.83-1.19)
Ethnicity (Ref.: Other)						
Bengali	0.85(0.64, 1.13)	1.64(1.20, 2.25)[b]	1.29(0.93-1.81)	2.22(1.54-3.20)	0.93(0.61-1.43)	1.12(0.70-1.79)
Number of family members (Ref.: >3)						
≤3	1.04(0.96, 1.14)	1.15(1.01, 1.31)[a]	1.01(0.92-1.11)	1.12(0.97-1.28)	0.93(0.81-1.06)	1.03(0.85-1.25)
Number of under five children (Ref.: 1)						
>1	1.21(1.13, 1.29)[c]	1.19(1.10, 1.30)[c]	1.16(1.08-1.24)[c]	1.10(1.01-1.21)[a]	1.08(0.97-1.19)	1.07(0.95-1.22)
Had (5-17) years old children (Ref.: No)						
Yes	1.08(1.02, 1.15)[a]	1.19(1.07, 1.31)[b]	1.12(1.05-1.20)[b]	1.14(1.02-1.27)[c]	1.13(1.03-1.25)[a]	1.04(0.89-1.21)
Number of sleeping room (Ref.: >1)						
1	1.33(1.25, 1.42)[c]	1.10(1.02, 1.19)[b]	1.23(1.15- 1.32)[c]	1.01(0.93-1.09)	1.15(1.05-1.27)[c]	1.06(0.95-1.19)
Cooking place (Ref.: Outside of main house)						
In main house	0.93(0.87, 0.99)[a]	1.10(1.02, 1.19)[a]	0.88(0.82-0.94)[c]	1.14(1.05-1.23)[b]	0.89(0.81-0.98)[a]	1.03(0.92-1.16)
Residential area (Ref.: Rural)						
Urban	0.91(0.84, 0.98)[b]	1.28(1.16, 1.40)[c]	0.75(0.69-0.82)[c]	1.06(0.96-1.17)	0 .83(0.74-0.93)[b]	0.96(0.84-1.11)
Wealth quintile (Ref.: Richest)						
Richer	1.24(1.12, 1.37)[c]	1.29(1.14, 1.46)[c]	1.48(1.32-1.65)[c]	1.57(1.37-1.79)[c]	1.07(0.92-1.25)	1.07(0.89-1.29)
Middle	1.41(1.27, 1.56)[c]	1.47(1.29, 1.67)[c]	1.69(1.51-1.89)[c]	1.76(1.53-2.02)[c]	1.20(1.03-1.39)[a]	1.22(1.01-1.47)[a]
Poorer	1.84(1.67, 2.03)[a]	1.79(1.57, 2.04)[c]	2.23(2.01-2.49)[c]	2.17(1.88-2.50)[c]	1.50(1.30-1.73)[c]	1.47(1.21-1.78)[c]
Poorest	2.48(2.25, 2.72)[c]	2.20(1.92, 2.51)[c]	2.62(2.36-2.91)[c]	2.36(2.04-2.73)[c]	1.57(1.36-1.81)[c]	1.51(1.24-1.83)[c]
Mother						
Age at first marriage	0.99(0.98, 1.00)[a]	1.01(1.00, 1.03)[a]	0.99(0.98-1.00)[b]	1.01(1.00-1.02)	0.98(0.97-1.00)[a]	0.99(0.98-1.01)
Age category at first birth (Ref.: 20-34 years)						
<20 & 35+ years	1.16(1.08, 1.24)[c]	1.22(1.13, 1.33)[c]	1.11(1.03-1.19)[c]	1.10(1.01-1.20)[a]	0.99(0.90-1.10)	1.04(0.92-1.17)
Education (Ref.: Primary and above)						
Pre-primary or none	1.95(1.78, 2.13)[c]	1.34(1.20, 1.49)[c]	1.85(1.68-2.03)[c]	1.31(1.17-1.47)[c]	1.41(1.23-1.61)[c]	1.16(0.99-1.36)
Knowledge sharing source (≥1) (Ref.: Yes)						
No	1.64(1.50, 1.80)[c]	1.13(1.02, 1.25)[c]	1.62(1.48-1.79)[c]	1.17(1.05-1.30)[c]	1.18(1.03-1.36)[a]	0.97(0.83-1.13)
Ever had child who later died (Ref.: No)						
Yes	1.47(1.33, 1.62)[c]	1.18(1.05, 1.32)[b]	1.42(1.28-1.58)[c]	1.20(1.07-1.36)[b]	1.40(1.21-1.62)[c]	1.24(1.06-1.45)[b]
Faced any kind of domestic violence (Ref.: No)						
Yes	1.28(1.19, 1.36)[c]	1.09(1.01, 1.17)[a]	1.15(1.07-1.23)[c]	0.97(0.90-1.05)	0.99(0.90-1.10)	0.92(0.83-1.03)
Child						
Age (in years)	1.07(1.05, 1.10)[c]	1.56(1.12, 1.18)[c]	1.11(1.09-1.14)[c]	1.17(1.14-1.21)[c]	0.99(0.96-1.03)	0.99(0.96-1.04)
Sex (Ref.: Female)						
Male	1.01(0.95, 1.08)	1.01(0.94, 1.07)	0.98(0.92-1.05)	0.99(0.92-1.06)	1.15(1.05-1.26)[b]	1.17(1.06-1.29)[b]
Birth interval (Ref.: 2≤ years)						
≥ 3 years	0.66(0.61, 0.72)[c]	0.77(0.70, 0.86)[c]	0.74(0.67-0.80)[c]	0.85(0.77-0.95)[b]	0.89(0.79-1.02)	0.98(0.85-1.14)
First birth	0.66(0.60, 0.72)[c]	0.80(0.71, 0.91)[c]	0.70(0.64-0.77)[c]	0.91(0.80-1.04)	0.76(0.66-0.87)[c]	0.92(0.77-1.12)
Twins (Ref.: No)						
Yes	1.55(1.23, 1.95)[c]	1.44(1.10, 1.89)[b]	1.76(1.39-2.22)[c]	1.65(1.26-2.17)[c]	1.39(1.00-1.94)[a]	1.36(0.94-1.96)
Diarrhea (Ref.: No)						
Yes	1.11(0.99, 1.24)	1.08(0.96, 1.23)	1.34(1.19-1.51)[c]	1.34(1.18-1.52)[c]	1.21(1.02-1.42)[a]	1.18(0.99-1.41)
Cough (Ref.: No)						
Yes	0.99(0.92, 1.07)	1.04(0.96, 1.13)	1.01(0.94-1.09)	1.06(0.97-1.15)	1.06(0.95-1.18)	1.03(0.92-1.15)
Picture/reading books (Ref.: Yes)						
No	1.46(1.36, 1.56)[c]	1.53(1.40, 1.68)[c]	1.27(1.18-1.37)[c]	1.40(1.28-1.54)[c]	1.18(1.06-1.31)[b]	1.03(0.91-1.18)

Note: a<0.05, b<0.01, and c<0.001

Significant predictors include paternal age and education, maternal age at first birth and education, ethnicity, household composition (number of children under five and those aged 5-17 years), cooking location, wealth quintile, access to health-related knowledge, history of child mortality, and child-specific factors such as age, birth interval, presence of twins, diarrhea incidence, and availability of picture books or reading materials. Children with fathers who had no formal education were more frequently underweight compared to those with educated fathers (aOR: 1.15, 95% CI: 1.05-1.25; $p < 0.01$), and a similar association was observed for maternal education (aOR: 1.31, 95% CI: 1.17-1.47; $p < 0.001$). Cooking inside the main house was associated with higher underweight rates than cooking outdoors (aOR: 1.14, 95% CI: 1.05-1.23; $p < 0.01$). Children from the poorest households had higher odds of being underweight compared to those from the richest families (aOR: 2.36, 95% CI: 2.04-2.73; $p < 0.001$). Maternal age at first birth also played a role, with children born to mothers younger than 20 or older than 35 years showing higher underweight rates compared to those born to mothers aged 20-34 years (aOR: 1.10, 95% CI: 1.01-1.20; $p < 0.05$). Twins had higher underweight rates than singletons (aOR: 1.65, 95% CI: 1.26-2.17; $p < 0.001$). Children who had experienced diarrhea were more frequently underweight (aOR: 1.34, 95% CI: 1.18-1.52; $p < 0.001$). Furthermore, children from households without picture books or reading materials had higher odds of being underweight than those with access to such materials (aOR: 1.40, 95% CI: 1.28-1.54; $p < 0.001$).

After adjusting for various factors, the significantly associated variables with childhood wasting were household wealth quintile, history of child mortality, and child sex. In terms of wealth quintile, children from middle-class families had 1.22 times higher odds of being wasted compared to those from the richest families (aOR: 1.22, 95% CI: 1.01-1.47; $p < 0.05$). In poorer families, the odds of wasting were 1.47 times higher than in the richest families (aOR: 1.47, 95% CI: 1.21-1.78; $p < 0.001$), and in the poorest families, the odds of wasting were 1.51 times higher (aOR: 1.51, 95% CI: 1.24-1.83; $p < 0.001$). No significant association was observed with wasting in the richer wealth class. A history of child mortality was associated with 1.24 times higher odds of childhood wasting (aOR: 1.24, 95% CI: 1.06-1.45; $p < 0.01$). Regarding sex, male children were more likely to experience wasting, with 1.17 times higher odds compared to female children (aOR: 1.17, 95% CI: 1.06-1.29; $p < 0.01$).

DISCUSSION

Bangladesh, like many developing countries, faces a significant burden of child undernutrition, with both single and multiple forms prevalent. In this study, 3.2% of children had multiple forms, and 36.5% had at least one form of undernutrition. These findings align with results reported in other settings [19]. MICS6 reported stunting at 27.9%, underweight at 22.6%, and wasting at 9.8%, while BDHS 2022 showed similar trends with 24% stunting, 22% underweight, and 11% wasting [20]. In South Asia, the prevalence of stunting, underweight, and wasting has been reported at 30.7%, 27.4%, and 14.1%, respectively, where in Nepal, the national average prevalence of underweight is 37% [21].

Our study highlighted area-wise disparities in undernutrition among under-five children, revealing higher rates in rural areas compared to urban areas. This finding aligns with evidence from other low- and middle-income countries, which also report greater burdens of severe acute malnutrition in rural populations [22]. Despite higher overall malnutrition rates in rural areas, the analysis showed that children in urban settings were more likely to be stunted aOR: 1.28 (1.16-1.40), indicating that residential area served as an effect modifier in the association with stunting [23].

Parental formal education was more prevalent and showed a stronger association in urban areas compared to rural areas. Among stunted children, the odds of having a formally educated father were aOR: 1.18 (1.08-1.29), while for underweight children, the odds were aOR: 1.15 (1.05-1.25) [24]. Research on child undernutrition had shown that higher levels of parental education were linked to reduced rates of stunting and underweight among children. This relationship was found to be stronger in urban areas, indicating that parental education has a more substantial influence on child health outcomes in urban areas compared to rural ones [4-25]. The prevalence of nuclear families (families with ≤3 members) was higher in urban areas (17%) compared to rural areas (12%). Additionally, living in a nuclear family was identified as an independent predictor of stunting in children [26]. The prevalence of families with more than one child under five was higher in rural areas, and this factor was associated with childhood stunting and underweight [27]. In urban settings, 55% of households reported cooking inside the main house. Indoor cooking emerged as an independent predictor of childhood stunting and underweight, aligning with findings from Bangladesh [28], and India [29]. In all aspects of nutritional status (stunting, underweight, and wasting), household socio-economic status, particularly wealth quintile, was a significant independent predictor of undernutrition. In rural areas, there was a decreasing trend in percentage from the poorest to the richest

quintile, whereas in urban areas, the trend showed an increase [30,31]. The scope of knowledge sharing (with at least one source) was higher among mothers in urban areas compared to those in rural areas. This higher knowledge-sharing scope was found to be associated with determinants of stunting and underweight in children [32]. The death of a child later in life was reported in 9% of rural areas and 7% of urban areas. This factor was independently associated with multiple forms of undernutrition [33]. Domestic violence was more prevalent in rural areas and was found to be associated with childhood stunting [34]. In the Sylhet Division, particularly in the northeastern area [35], two districts, Sunamganj (46%) and Habiganj

(38%), showed a high prevalence of stunting and underweight [36]. In this study, the prevalence of infections, including cough and diarrhea, was higher in urban areas, with diarrhea being associated with undernutrition in children aOR: 1.34 (1.18-1.52), highlighting the need to focus on infectious diseases in the context of undernutrition. Additionally, the study found that diarrhea is linked to childhood undernutrition in rural settings of Bangladesh [37]. In this study, a consistent finding was observed for wasted children, with male wasting being associated with specific determinants aOR: 1.17 (1.06-1.29) [16].

In comparison to other studies, this research observed a notable decrease in the rates of underweight and wasting; however, the prevalence of stunting remains a significant concer [38]. We identified several key factors associated with child undernutrition, which were found to be different from those in other studies [39-41]. Several contextual factors, including the father's age, religion, ethnicity, number of under-five and school-aged children in the household, number of sleeping rooms, total family size, indoor cooking practices, access to information, exposure to domestic violence, history of maternal child loss, and the presence of children's pictures or reading materials, may influence child undernutrition. These multidimensional determinants underscore the complex interplay of household, social, and environmental factors, warranting further investigation in future studies.

STRENGTHS AND LIMITATIONS

The strength of this study was the use of a nationally representative sample, with data collected from all 64 districts through a partnership between the Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh. This large sample size allowed for a robust estimation of the effects of undernutrition. Additionally, the study has several limitations. The dataset lacks information on several important variables, such as the measurement of mid-upper arm circumference for both children and mothers, children's mobility patterns, household income and expenditure, and parental occupations. Furthermore, certain relevant variables, including birth size, pre- and postnatal visits, duration of breastfeeding, and place of delivery, were excluded from the analysis due to significant missing data. However, since the study utilized secondary data, it was not possible to examine certain factors that were not included in the dataset.

CONCLUSIONS

Despite numerous advancements in public health, malnutrition basically undernutrition continues to pose a significant barrier to the achievement of the 2030 Sustainable Development Goals (SDGs). The challenges have been compounded by the COVID-19 pandemic, which disrupted food systems, health services, and economic stability worldwide. Furthermore, the ongoing impacts of climate change, such as erratic weather patterns, droughts, and floods, have worsened food insecurity and undernutrition, particularly in vulnerable populations. Achieving the SDGs related to nutrition, health, and poverty reduction has become even more urgent and complex in the wake of these crises. However, there is still hope. To overcome the public health challenges posed by maternal and child undernutrition, a united approach is essential. The concerted efforts of governments, non-governmental organizations, and international agencies are crucial to addressing the root causes of undernutrition. Through collaborative action, investments in healthcare infrastructure, enhanced food security initiatives, and sustainable development practices, these organizations can play a key role in alleviating the burden of undernutrition and working toward the realization of the SDGs. The consequences of undernutrition should be a significant concern for policymakers in Bangladesh.

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ETHICS

The MICS study adheres to UNICEF's ethical standards for research, evaluation, data collection, and analysis and includes a record of an ethics review. It is designed to protect and respect human and child rights in all research, evaluation, and data collection processes conducted or commissioned by UNICEF.

AVAILABILITY OF DATA

The data are available in a public, open-access repository.

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