Does household food insecurity influence nutritional practice of children age 6 to 23 months in Bangladesh?

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Abstract

To examine the prevalence of household food insecurity (HHFI) among children aged between 6-23 months in Bangladesh. This paper also aims to identify the individual, household and community levels determinants of HHFI and the association between nutritional behavior and HHFI. Bangladesh Demographic Health Survey (BDHS), 2011 was used for this research. A total of 2,344 children were selected for analysis. Statistical analysis and tests were guided by the nature of the variables. Finally, logistic regression analysis was used to find out the association between independent variables and outcome. The overall prevalence of HHFI was 36.3% (95% CI: 33.6-39.0) among the participants (children). The prevalence of HHFI was significantly higher among children who did not receive nutritional items. In contrast, HHFI was more prevalent among children who were breastfed (37.0%) as compared to non-breastfed. Binary logistic regression analysis showed that children of illiterate mothers (adjusted OR: 2.20, 95% CI: 1.17-4.10), illiterate fathers (adjusted OR: 2.27, 95% CI: 1.41-3.66) and socio-economically poor families (adjusted OR: 11.35, 95% CI: 7.20-17.91) were more at risk of experiencing HHFI, whereas, rural children (adjusted OR: 0.72, 95% CI: 0.57-0.93) were more protective. In the adjusted logistic regression model, children who did not receive juice (adjusted OR: 1.54, 95% CI: 1.09-2.16) had experienced HHFI. The prevalence of HHFI among children is still high in Bangladesh. Therefore, to achieve the Millennium Development Goals, the Government of Bangladesh should priorities HHFI as a major public health issue. Strong collaborations among various stakeholders are also crucial to improve the situation.

Keywords: Household food insecurity, Children, Nutrition, MDG, Bangladesh.

Introduction

Household food insecurity (HHFI) refers to the insufficient access of nutritionally safe and adequate foods to meet dietary needs and food preferences for an active and healthy life.[1] Although Bangladesh is on its way of achieving the Millennium Development Goals (MDGs) (the substantial reduction of hunger, poverty and maternal and child mortality by the year 2015), improvements in the child nutritional status have been less impressive.[2] The prevalence of under-five child malnutrition in Bangladesh is nearly 40%, which is one of the world's highest and causes around 60% of under-five deaths.[3] Poor nutritional status of children is associated with a variety of factors, such as, household food unavailability, improper nutritional practice, unavailability of services and social issues.[2,4] Nearly 30% of Bangladeshis have a lack of income and live below the poverty line. This results in them being vulnerable to household food insecurity (HHFI).[5] In Bangladesh, over 60% of all pregnant and lactating women produce underweight children due to insufficient caloric intake.[6]

About 6 to 23 months of age of child development is a 'critical window' for the transition of body and cognitive development[7]. At this stage, children should be fed small quantities of nutritional solid and semisolid foods in addition to breastfeeding.[7] Proper and adequate feeding practices during infancy and early childhood are fundamental for the growth, development, and survival of

Practice Points

- Household food insecurity (HHFI) refers to the insufficient access of nutritionally safe and adequate foods to meet dietary needs and food preferences for an active and healthy life.

- Socioeconomically poor families were more at risk of experiencing household food insecurity.

- Food insecurity was more prevalent among children of illiterate parents and higher prevalence of breastfeed children were found to suffer food insecurity.

- Bangladeshi women in rural areas are responsible to ensure the food requirements of their dependents.

- Strong collaborations among various stakeholders are also crucial to improve the situation.

infants and children, particularly in developing countries.[8,9] Evidence shows that HHFI is associated with a high prevalence of inadequate intake of key nutrients, resulting in a wide variety of adverse health and development outcomes in children.[10,11] In Bangladesh, approximately 50% of all children aged 6-24 months do not receive the minimum meal frequency (eating 3 meals a day or more).[12] More than 60% of

Bangladeshi children did not meet the minimum recommended dietary diversity per day (proportion of children who receive foods from World Health Organization (WHO) recommended four or more food groups).[12]

Over one billion people (which accounts for over 20% of global population), mainly in the developing world, are food insecure. Over 15 million people, mostly children, die from hunger, poverty and malnutrition every year.[13] Children growing up in food insecure families are more susceptible to diseases that adversely affect a country's long term economic, social and political development.[14,15] Household food security (HHFS) is affected by the various social determinants, such as, education, poverty, gender, age and disability, geographical location and cultural practices.[6]

The aim of this study was to identify the association between the nutritional practice of children 6-23 months of age and HHFI together with identifying the multi-level determinants of HHFI. Multiple studies already have highlighted the significance of the relationship between CFP and HHFI, for example, dos Santos & Gigante[16] showed the relationship between food insecurity and the nutritional status of Brazilian children aged under-five years old. Lindsay *et al.*[17] identified the association between HHFS and a mothers' child feeding behavior in a qualitative study. In Argentina, Osei *et al.*[18] examined the relationship between HHFS and dietary diversity of children and Saha *et al.*[19] showed the association between HHFS and change in CFP in different age groups in Bangladesh. To our knowledge, no previous studies in Bangladesh have focused substantially on the relationship between the nutritional behavior of children and HHFI using a nationally representative sample. Considering the limited number of studies and formulations of effective policy decision for the society, it is essential to establish a comprehensive relationship between nutritional practice among children and HHFI.

Materials and methods

Sources of data
The data used in this study was extracted from the Bangladesh Demographic Health Survey (BDHS) 2011, which was a nationally representative cross-sectional survey. The data was collected in five phases, starting on July 8 and ending on December 27, 2011. The BDHS 2011 was conducted by the National Institute of Population Research and Training (NIPORT) under the Ministry of Health and Family Welfare. It was implemented by a Bangladeshi research firm 'Mitra and Associates'. Technical support was provided by ICF International of Calverton, Maryland, USA and financial support was afforded by USAID. The BDHS was based on adult household data. The survey was undertaken in seven administrative regions (divisions): Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet (covering both rural and urban areas). Enumeration areas from the most recent census were used as the Primary Sampling Units (PSUs) for the survey. Multistage stratified sampling technique was used. At the first stage of sampling, 600 PSUs were selected (393 rural PSUs and 207 urban PSUs). The resulting lists of households were used as the sampling frame for the selection of households in the second stage of sampling. The detail sampling design and other

related issues of BDHS are described in another study.[20]

Sample size selection
A total of 8,761 children under 5 years of age were considered for anthropometric measurements, of which anthropometric and age data were complete for 7,647 children (around 88%). From the total of 2,405 children aged 6-23 months in BDHS (2011), 61 children were excluded due to missing information e.g. children of mothers who responded "do not know" for nutritional practice. Therefore, the final sample for analysis was 2,344.

Outcomes
We selected five household food security indicators using the Household Food Insecurity Access Scale (HFIAS) and included these in a questionnaire. This was then given to and answered by mothers of the children included in the BDHS-2011 survey.[20] The technical working group of the BDHS-2011 (11) systematically reviewed and modified the indicators used in the HFIAS to ensure that the included indicators were relevant and specific to Bangladesh. Participants were asked five questions about their food intake in the last 12 months: 1) how often they had three square (full stomach) meals a day; 2) whether they skipped entire meals because there was not enough food; 3) whether they had smaller meals because there was insufficient food; 4) whether the mother or any other family members ate wheat or another grain in place of rice and 5) if they had asked relatives or neighbors for food to make a meal. Each indicator had four response options: never (0 times in the past 12 months), rarely (1-6 times in the past 12 months), sometimes (7-12 times in the past 12 months) and often (a few times each month). A household was classified as food insecure if the respondent answered sometimes, often, or never to question one and answered rarely, sometimes or often to questions two to five. A household that did not meet these conditions, and scored zero, was classified as food secure. Individual food frequency scores for all the five frequency responses were added together to provide a single food security score for each woman in the household who was married. To facilitate the analysis, a composite score ranging from a minimum of zero to a maximum of 15 was calculated and classified as a dichotomous score, with zero representing food secure and a score of more than zero representing food insecure.

Covariates
Three levels of characteristics, such as, individual, household, and community characteristics were included in this study. Individual level characteristics included the age of the child (6-11 months, 12-17 months, 18-23 months); sex of the child (male, female); mother's educational status (no education, primary, secondary, higher); father's educational status (no education, primary, secondary, higher). Household socio-economic status based on wealth index (poorest, poorer, middle, richer, and richest) was considered as the household-level characteristics. The wealth index was constructed using household asset data via principal components analysis.[20] Community-level characteristics included place of residence (urban, or rural).

For nutritional indicators, the authors included 17 frequently asked questions (indicators) for mothers of households (Figure 1). Among them 16 food items were

listed (excluding breastfeeding) which could have been received by the children within 24-hours prior to the interview. For each question, responses were coded binary as 1= given/yes and 0 = not given/no.

Statistical analysis

Descriptive statistics were presented as percentages for HHFI, multilevel characteristics and nutritional behavior. Chi-square test and binary logistic regression were used to evaluate the association between outcome and independent variables (covariates). Stata version 11.2/SE (Stata Corp, College Station, Texas, USA) was used for all statistical analysis. All analyses were statistically significant at 5% level.

Results

The summary of the study findings are presented in Table 1. It is found that among the children, 50.55% were male, 21.07% were from socio-economically poor families and 69.28% were living in rural areas.

Nutritional practice of children

Figure 1 showed that around 94.8% children were breastfed. A higher percentage was recorded for micronutrients/foods like bread, noodles or others made from grains (75.9%); vitamins. On the contrary, a lower percentage was observed for foods, such as, cheese, yogurt, and/or other milk products (1.5%).

Prevalence of HHFI (bivariate analysis based on Chi-square test)

An estimated of 36.3% children aged 6-23 months were food insecure (Table 2). The prevalence of HHFI was found to be significantly higher among children of illiterate mothers (58.5%), illiterate father (52.7%), socio-economically poor families (63.0%) and rural settlement (39.6%).

In Table 3, the prevalence of HHFI was also significantly higher among children who did not receive juice (38.6%); tinned, powdered or fresh milk (38.1%); other liquids (37.7%); eggs (39.4%); meat (beef, pork, lamb, chicken, etc) (38.2%); pumpkin, carrots, squash (yellow or orange inside) (36.9%); mangoes, papayas, other vitamin A fruits (36.9%);

Table 1: Background characteristics of children

| Variables	Frequencies (%)
Children age (months)	
6-11	844 (36%)
12-17	791 (33.75%)
18-23	709 (30.25%)
Sex of child	
Male	1185 (50.55)%
Female	1159 (49.45%)
Mother's educational status	
No education	376 (16.04%)
Primary	695 (26.65%)
Secondary	1081 (46.12%)
Higher	192 (8.19%)
Father's educational status	
No education	601 (25.64%)
Primary	692 (29.52%)
Secondary	727 (31.02%)
Higher	324 (13.82%)
Socio-economic status	
Poorest	494 (21.07%)
Poorer	451 (19.24%)
Middle	446 (19.03%)
Richer	484 (20.65%)
Richest	469 (20.01%)
Place of residence	
Urban	720 (30.72%)
Rural	1624 (69.28%)
Total	**2344**
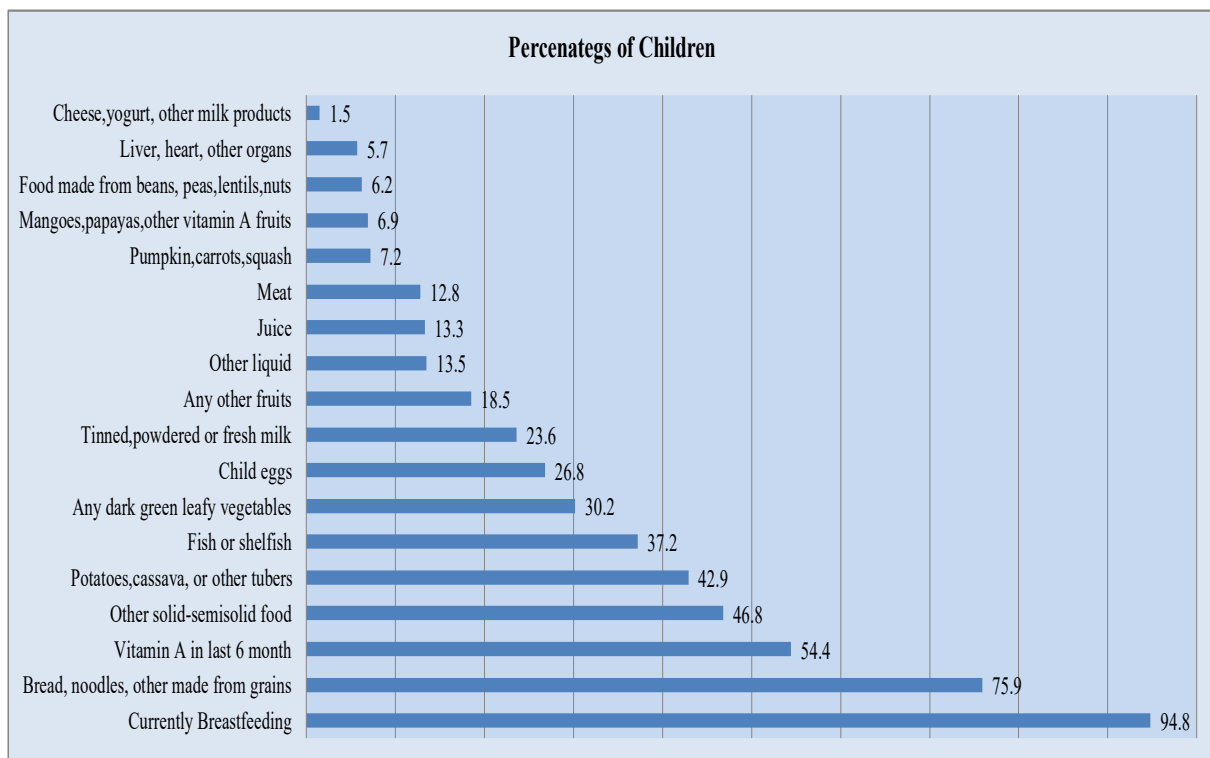
Figure 1: Percentage of children receiving nutritional items chidlren

Table 2: Prevalence of HHFI in terms of individual, household and community levels factors

Variables	Food insecurity		
	Subject	Prevalence (95% CI)	P values
Children age (months)			
6-11	310	39.0 (35.0-43.1)	0.094
12-17	251	33.1 (29.3-37.2)	
18-23	254	36.7 (32.4-41.1)	
Sex of child			
Male	397	35.1 (32.0-38.4)	0.271
Female	418	37.5 (34.0-41.1)	
Mother's educational status			
No education	220	58.5 (52.1-64.7)	<0.001
Primary	308	45.0 (40.3-49.8)	
Secondary	269	26.5 (23.4-29.8)	
Higher	18	9.6 (5.7-15.7)	
Father's educational status			
No education	314	52.7 (47.9-57.5)	<0.001
Primary	293	42.9 (38.7-47.2)	
Secondary	176	25.9 (22.1-30.0)	
Higher	32	10.3 (6.9-15.1)	
Socio-economic status			
Poorest	308	63.0 (58.2-67.7)	<0.001
Poorer	222	49.2 (43.7-54.8)	
Middle	140	32.9 (27.9-38.4)	
Richer	106	19.8 (16.0-24.3)	
Richest	39	9.3 (6.5-13.2)	
Place of residence			
Urban	187	24.7 (20.1-30.0)	<0.001
Rural	628	39.6 (36.5-42.8)	
Total	815	36.3 (33.6-39.0)	

Note: Values in parenthesis indicate Confidence Interval (CI)

liver, heart, other organs (36.8%) and fish or shellfish (38.1%). In contrast, HHFI found significantly more prevalent among breastfed children (37.0%).

Association between HHFI and covariates (outcomes based on binary logistic regression analysis)
Significant variables in bivariate analysis were considered for binary logistic regression analysis (Table 4). As indicated in Table 4, children of illiterate mothers (adjusted OR: 2.20, 95% CI: 1.17-4.10) and/or fathers (adjusted OR: 2.27, 95% CI: 1.41-3.66) were more at risk of experiencing HHFI. Socio-economically poor children (adjusted OR: 11.35, 95% CI: 7.20-17.91) were more vulnerable to HHFI. A lower chance of being HHFI was observed among rural children (adjusted OR: 0.72, 95% CI: 0.57-0.93).

According to crude model (Table 5), children who were not given juice (crude OR: 2.46, 95% CI: 1.79-3.37); tinned, powdered or fresh milk (crude OR: 1.28, 95% CI: 1.03-1.60); other liquid (crude OR: 1.37, 95% CI: 1.02-1.76); eggs (crude OR: 1.45, 95% CI: 1.17-1.80) and meat (beef, pork, lamb, chicken, etc) (crude OR: 1.55, 95% CI: 1.14-2.11) had more chance to experience HHFI. In adjusted model, children who did not receive juice (adjusted OR: 1.54, 95% CI: 1.09-2.16) were more likely to experience HHFI.

Discussion

In this study, we considered 18 nutritional indicators which were strongly recommended for the children 6-23 months of age.[21] We observed that most of the nutritional items were poorly received by the children. Studies previously conducted in Bangladesh found similar results.[22] Similar findings have also been noted in most South Asian countries, such as, India, Pakistan, Sri Lanka and Nepal.[23-26] Global foods prices have increased by more than 10% along with social, political and environmental vulnerabilities adversely affecting food and nutrition security throughout South Asian regions.[27] In this study, approximately 36.3% children age 6-23 months were estimated to be food insecure. The prevalence of under-five year old children HHFI was also significantly higher in some developing countries, such as, Brazil (51.7%), Ghana (69.9%), Ethiopia (66.4%), Vietnam (40.3%) and Nepal (69.0%).[6,16,18,28]

Our study showed that food insecurity was more prevalent among the children of illiterate parents, socio-economically poor families and rural dwelling. The findings were consistent with a study in Nepal that suggested that parent's educational status and socio-economic status were significantly associated with HHFI.[18] Similar results have been observed in Organization for Economic Co-operation and Development (OECD) countries, such as, The Unites States of America; households with illiterate mothers are vulnerable to food insecurity [29]. Illiterate mothers with poor socio-economic status reflect inadequate CFP.[30] Some literature suggests that, a large proportion of children from socio-economically poor households, who are living beyond the poverty line, are food insecure.[31-33]

In this study, a significantly higher proportion of children were found to be food insecure, as they did

Table 3: Prevalence of HHFI based on nutritional practice of children

Indicators	Food insecurity		
	Subject	Prevalence (95% CI)	P values
Juice			
Given	54	20.4 (15.3-26.7)	<0.001
Not given	761	38.6 (35.8-41.5)	
Tinned, powdered or fresh milk			
Given	161	30.8 (26.3-35.8)	0.007
Not given	654	38.1 (35.2-41.1)	
Other liquid			
Given	82	26.9 (21.3-33.4)	0.002
Not given	733	37.7 (34.9-40.6)	
Bread, noodles, other made from grains			
Given	644	38.1 (35.2-41.1)	0.005
Not given	171	30.8 (26.4-35.6)	
Potatoes, cassava, or other tubers			
Given	361	36.6 (32.8-40.6)	0.822
Not given	454	36.1 (32.8-39.5)	
Eggs			
Given	172	27.1 (23.1-31.5)	<0.001
Not given	643	39.4 (36.3-42.6)	
Meat (beef, pork, lamb, chicken, etc)			
Given	72	23.3 (18.2-29.3)	<0.001
Not given	743	38.2 (35.4-41.1)	
Pumpkin, carrots, squash (yellow or orange inside)			
Given	49	28.1 (20.9-36.6)	0.050
Not given	766	36.9 (34.1-39.7)	
Any dark green leafy vegetables			
Given	247	38.0 (33.8-42.5)	0.319
Not given	568	35.5 (32.5-38.7)	
Mangoes, papayas, other vitamin A fruits			
Given	42	27.5 (20.7-35.5)	0.027
Not given	773	36.9 (34.1-39.8)	
Any other fruits			
Given	136	33.4 (27.7-39.5)	0.287
Not given	679	36.9 (34.0-39.9)	
Liver, heart, other organs			
Given	31	26.9 (18.8-36.9)	0.049
Not given	784	36.8 (34.1-39.6)	
Fish or shellfish			
Given	282	33.1 (29.1-37.4)	0.048
Not given	533	38.1 (35.0-41.4)	
Food made from beans, peas, lentils, nuts			
Given	47	31.2 (22.8-41.0)	0.266
Not given	768	36.6 (33.9-39.4)	
Cheese, yogurt, other milk products			
Given	9	27.1 (13.1-47.7)	0.348
Not given	806	36.4 (33.7-39.1)	
Other solid-semisolid food			
Given	377	36.2 (32.7-39.9)	0.949
Not given	438	36.3 (33.0-39.8)	
Currently breastfeeding			
Yes	779	37.0 (34.2-39.8)	0.007
No	36	23.9 (16.8-32.9)	

Note: Values in parenthesis indicate Confidence Interval (CI)

not receive most of the nutritional items. Despite impressive progress in agriculture since independence in 1971, food prices have rapidly increased in the last decade which has resulted in poverty and hunger in Bangladesh.[28] In addition, natural hazards, such as, environmental pollution, floods, global worming etc, sometimes hamper agricultural production which may cause HHFI.[34] Bivariate analysis also showed the significant relationship between HHFI and breastfeeding status. A higher prevalence of breastfed children was found to be food insecure. The immunological and nutritional characteristics of breastfeeding can protect children from continued nutritional hardship. However, continued breastfeeding due to a lack of food availability sometimes causes health hazards to children.[35]

In India, education has a significant impact on HHFI which is consistent with our study.[36] The adjusted logistic model also showed that children of

Table 4: Association between HHFI and multilevel factors

Variables	Unadjusted ORs (95% CI)	P values	Adjusted ORs (95% CI)	P values
Mother's educational status				
No education	4.60 (2.52-8.40)	<0.001	2.20 (1.17-4.10)	0.013
Primary	2.93 (1.66-5.18)	<0.001	1.59 (0.88-2.86)	0.121
Secondary	1.66 (0.96-2.87)	0.071	1.19 (0.68-2.10)	0.543
Higher	1.00		1.00	
Father's educational status				
No education	4.57 (2.89-7.22)	<0.001	2.27 (1.41-3.66)	0.001
Primary	4.12 (2.66-6.39)	<0.001	2.36 (1.50-2.56)	<0.001
Secondary	2.18 (1.42-3.36)	<0.001	1.64 (1.05-2.56)	0.028
Higher	1.00		1.00	
Socio-economic status				
Poorest	18.26 (12.55-26.56)	<0.001	11.35 (7.20-17.91)	<0.001
Poorer	10.69 (7.34-15.57)	<0.001	8.05 (5.20-12.49)	<0.001
Middle	5.04 (3.44-7.41)	<0.001	4.24 (2.75-6.55)	<0.001
Richer	3.10 (2.10-4.58)	<0.001	2.69 (1.77-4.10)	<0.001
Richest	1.00		1.00	
Place of residence				
Urban	1.00		1.00	
Rural	1.79 (1.47-2.18)	<0.001	0.72 (0.57-0.93)	0.01

Note: †Adjusted for all the other variables shown in the table

Table 5: Association between HHFI and nutritional behavior of children

Indicators	Crude OR (95% CI)	P values	Adjusted OR† (95% CI)	P values
Juice				
Given	1.00		1.00	
Not given	2.46 (1.79-3.37)	0.000	1.54 (1.09-2.16)	0.014
Tinned, powdered or fresh milk				
Given	1.00		1.00	
Not given	1.28 (1.03-1.60)	0.024	0.92 (0.72-1.16)	0.474
Other liquid				
Given	1.00		1.00	
Not given	1.37 (1.02-1.76)	0.037	0.96 (0.71-1.31)	0.796
Bread, noodles, other made from grains				
Given	1.00		1.00	
Not given	0.59 (0.47-0.75)	<0.001	0.64 (0.49-0.82)	<0.001
Eggs				
Given	1.00		1.00	
Not given	1.45 (1.17-1.80)*	0.001	0.99 (0.78-1.27)	0.981
Meat				
Given	1.00		1.00	
Not given	1.55 (1.14-2.11)	0.005	1.38 (0.97-1.96)	0.074
Pumpkin, carrots, squash				
Given	1.00		1.00	
Not given	1.02 (0.71-1.46)	0.933	0.74 (0.49-1.11)	0.149
Mangoes, papayas, other vitamin A fruits				
Given	1.00		1.00	
Not given	1.20 (0.82-1.76)	0.342	1.09 (0.73-1.66)	0.655
Liver, heart, other organs				
Given	1.00		1.00	
Not given	1.23 (0.78-1.94)	0.366	0.91 (0.52-1.57)	0.728
Fish or shellfish				
Given	1.00		1.00	
Not given	1.17 (0.96-1.43)	0.099	1.17 (0.94-1.45)	0.150
Currently breastfeeding				
Yes	1.00		1.00	
No	0.81 (0.54-1.21)	0.296	1.02 (0.66-1.55)	0.939

†Adjusted with multilevel factors, such as, mother's educational status, father's educational status, socio-economic status and place of residence

rural settlements were at a reduced risk of experiencing HHFI. However, in unadjusted model, urban children were least risk. Nowadays, women in rural environments are expected to undertake multiple tasks, such as, food production, handicraft and these all contribute to domestic economy. More than half of

Bangladeshi women living in rural areas are housewives are responsible to ensure the food requirements of their dependents in situations of economic deterioration.[37] According to crude regression model, children who did not receive most of the nutritional items had more chance to experience HHFI and in adjusted model, juice was not received by the food insecure children. Nevertheless, in The United States of America, the introduction of juice and HHFS did not show any significant association.[29]

Insufficient domestic production of non-cereal foods (for example, pulses, fruits, meat, milk, eggs etc.), lower socio-economic status, and lack of nutritional knowledge reflect HHFI.[38] This study suggests that nutrition surveillance needs to be strengthened under government structures to allow early detection of changes in nutrition, health, and food security status.[39] The existing food safety net program has to be extended in targeted areas where child malnutrition and HHFI are most prevalent.[45] Gardening through women participation needs to spread in rural, urban and sub-urban areas to improve nutritional security.[40]

This study has several strengths. The main strength of the study was to investigate the pervasive relationship between nutritional factors and HHFI in Bangladesh using a large national representative data. Several limitations of the study are worth mentioning. These include the cross-sectional nature of the data. Most of the nutritional items were given to the children in the 24-hours preceding the survey; however, the children could occasionally receive some other foods but simply did not the previous day. Another limitation involves information bias, which may result from self-reporting age, education, household assets, nutritional indicators etc. Despite these limitations, our study has been able to draw a detailed picture of the association between HHFI and the nutritional behavior of children 6-23 months of age in Bangladesh.

Conclusion

A large number of children in Bangladesh experience HHFI and this condition hampers proper nutritional practice among children in households. HHFI is found to be strongly associated with several individual, household and community factors, such as, parental education, socio-economic status and place of residence. These factors should be considered while developing strategies/interventions to address the issue of a child's HHFI status. Collaborations among various stakeholders (e.g. public and private level organizations) and strengthening of existing programs are also extremely important and necessary. Moreover, longitudinal studies are recommended to assess the cause-effect relationship between plausible factors and HHFI in Bangladesh. Finally, in Bangladesh, further investigations on HHFI are needed. Such research will inspire ingenuity in developing effective strategies to improve the HHFS status of children.

Competing interest

The authors declared they have no conflict of interest.

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