

Feeding Pattern and Nutritional Status of Under Two Years of Children in Climate-vulnerable Southern Barisal and Khulna Region of Bangladesh

Farzana Sultana Bari¹, Md. Ruhul Amin², Mohammad Abdul Mannan¹, Nazma Shaheen^{2*}

¹Prime Asia University, Banani, Dhaka-1212,

²Institute of Nutrition and Food Science, University of Dhaka, Dhaka-100

Abstract

Globally, undernutrition is responsible for almost half of all infant deaths. Recommended infant and young child feeding (IYCF) practices have been considered to be protective against undernutrition. The objective of the study was to assess the pattern of IYCF practices as well as the nutritional status of children 0-23 months in Barisal and Khulna region of Bangladesh. To assess the current feeding practices and factors associated with nutritional status, the present study used secondary data from a baseline survey of the project titled, "Integrated Agriculture and Health-based Interventions for Improved Food and Nutrition Security in Selected Districts of Southern Bangladesh". Socio-demographic, anthropometric and IYCF indicators were analyzed. The results showed that 30.6% of children met minimum dietary diversity (MDD) whereas 76.2% of children attained minimum meal frequency (MMF) and 29.1% of children had minimum acceptable diet (MAD) subsequently. The prevalence of stunting, wasting and underweight was 27.1%, 8.9% and 20.1%, respectively. All indicators of the IYCF were significantly associated with age and MAD was statistically significant with the children's household wealth index and sex. There was a high prevalence of underweight among children who did not receive MDD (25.4%), MMF (26.5%), or (MAD) (25.3%), compared to children who received MDD (20.6%), MMF (22.9%), or MAD (20%). In comparison with national data, IYCF practices in Barisal districts are better than those in Khulna districts, but still fall below the national target of 34% by 2025. Therefore, to optimize the IYCF practices among the children extensive programmes and research work are required.

Keywords: IYCF indicators, Nutritional status, Under 2 years children, Bangladesh

Introduction

Undernutrition is estimated to be associated with 2.7 million child deaths annually, or 45% of all child deaths¹, while more than two-thirds of those deaths were due to improper feeding practices². All types of malnutrition are generally driven by the poor quality of diets in early childhood and as such globally, 2 out of 3 children are not fed the diets required to support children's optimal growth and brain development³. Infant and young child feeding are particularly important to improve child survival, lower morbidity and mortality, reduce the risk of chronic disease, and promote sufficient growth and development⁴. However, inappropriate complementary feeding practices have been widely documented as a major public health problem in many developing countries⁶. Feeding habits have a significant impact on the

nutritional status of children under the age of two¹⁰. WHO suggests using eight infant and young child feeding (IYCF) core measures, including early initiation of breastfeeding; exclusive breastfeeding for six months; continued breastfeeding at one year; introduction of solid, semi-solid, or soft foods; and introduction of solid, semi-solid, or soft foods minimum dietary diversity; minimum meal frequency; minimum acceptable diet; and consumption of iron-rich or iron-fortified foods to measure feeding practice precisely and compare within and across countries¹¹. Achievement of the Minimum acceptable diet (MAD) is necessary for better growth and proper nutrition of the children as chronic malnutrition is significantly associated with dietary diversity in different settings, especially in South-East Asia, including Bangladesh¹².

*Corresponding author, Email: nazmashaheen@du.ac.bd

In Bangladesh, poor infant and young child feeding practices pose the most significant challenge to maintaining good nutritional status, contributing to the high levels of malnutrition¹³. According to BDHS 2017, the nationwide prevalence of malnutrition such as stunting, wasting and underweight were 31%, 28 % and 8% respectively. In addition, the proportion of children aged 6-23 months who were fed with an adequately diverse diet was 38%, the minimum meal frequency was 81 %, and overall, the minimum acceptable diet was 35% in 2017¹⁴. Several studies reported in different low- and middle-income countries conclude that children's nutritional status is significantly associated with IYCF practices¹⁵. There is a lack of research on IYCF practices and the health outcomes of children in resource-poor settings like Bangladesh¹⁶. The scenario is more critical in the southern districts of Bangladesh as they are geographically vulnerable.

In the southern districts of Bangladesh, climate change, frequent natural disasters, salinity and land degradation have contributed to limiting dietary diversity and creating a significant burden of malnutrition¹⁷. Furthermore, according to the Second National Plan of Action for Nutrition (NPAN2), the goal is to reduce stunting among under5 children by 25% and to increase the proportion of children aged 6-23 months receiving a minimum acceptable diet to more than 40%¹⁸. To reach this goal, IYCF is considered one of the most important determinants.

The global strategy for achieving 17 Sustainable Development Goals (SDGs) is to implement healthy nutrition policies by 2030¹⁹. In this regard, the current study would be of value in providing useful information and minimizing information gaps about food consumption and the relationship between IYCF practices and child nutritional status in the southern Bangladeshi counties of Barishal and Khulna.

Methodology

Study site and participants

Secondary data were used for this study, which was collected from Barishal and Khulna districts, the

southern part of Bangladesh, disaster-prone area²⁰ that have not yet been blessed enough through development activities of the country. Raw data were from the baseline survey of the project titled “Integrated Agriculture and Health-Based Interventions for Improved Food and Nutrition Security in Selected Districts of Southern Bangladesh”¹⁷. The project was being supported by Food and Agriculture Organization (FAO) and The United Nations Children's Fund (UNICEF), and The United States Agency for International Development (USAID). Satkhira (Khajra, Anulia of Assasuni and Munshiganj and Bhurulia of ShyamnagarUpazila) and Khulna (Kamarkhola and Sutarkhali and Dakshin of Dacope and Bedkashi and Maharajpur of KoyraUpazila) and Barishal (Batamara and Shafipur of MuladiUpazila) districts were selected for data collection.

For this study, we used data from 269 children aged 0-23 months to assess IYCF practices and data from 636 children aged 0-59 months.

Outcome variables

To assess children's feeding practices, we used three IYCF indicators-minimum dietary diversity (MDD), minimum meal frequency (MMF) & minimum acceptable diet (MAD)⁴. Binary variables corresponding to each of the definitions of IYCF indicators were created following the WHO recommendations¹¹. These outcome variables were recoded according to the following definitions

Minimum dietary diversity (MDD) : It is identified as the proportion of children aged 6 to 23 months who ate foods from four or more food groups. The minimum dietary diversity variable was created from the diet diversity score of each child and coded as “1” if the child had eaten at least from 4 or more food groups the day before the interview and as “0” if less than four food groups²¹.

Minimum meal frequency (MMF): It is classified as the proportion of children both breastfed and non-breastfed aged 6-23 months who received solid, semi-solid, or soft foods at least once or more (including milk feeds for non-breastfed children)⁸.

Minimum acceptable diet (MAD): Proportion of children aged 6-23 months who receive a minimum acceptable diet. This indicator is a composite of children fed with a minimum dietary diversity and a minimum meal frequency.²¹

Early initiation of breastfeeding: Proportion of children born in the last 24 months who were put to the breast within one hour of birth²¹.

Exclusive breastfeeding under 6 months: Proportion of infants 0-59 months of age who are fed exclusively with breastmilk²¹.

Independent variables

Measures

Socio-demographic variables: Questions regarding socio-demographic variables included the age of the children where the age group is classified: 6–11 months, 12–17 months and 18–23 months²². Education qualification and occupation of household head (HH), and wealth index were assessed in this study.

Wealth Index: Principal component analysis was used to create the wealth index. Wealth index was calculated based on the Demographic and Health Surveys (DHS) Working Papers series²³. In this analysis wealth index was constructed following the assets and services owned by the households (electricity, electronic devices, furniture, agricultural and other productive tools etc.), the main materials used to build the wall, roof and floor of their living house, number of rooms in the household. A weight was attached to each item from the first principal component. Households were divided

into SES quintiles based on wealth index: quintile 1 (poorest), quintile 2 (poorer), quintile 3 (normal), quintile 4 (richer), and quintile 5 (richest).

Anthropometric assessment: For under-five children, length/height-for-age, weight-for-age, and weight-for-height categories were developed by World Health Organization. WHO (2006) identified stunting (low height-for-age), underweight (low weight-for-age), wasting (low weight-for-height) are defined as Z-scores of -2 standard deviations²⁴.

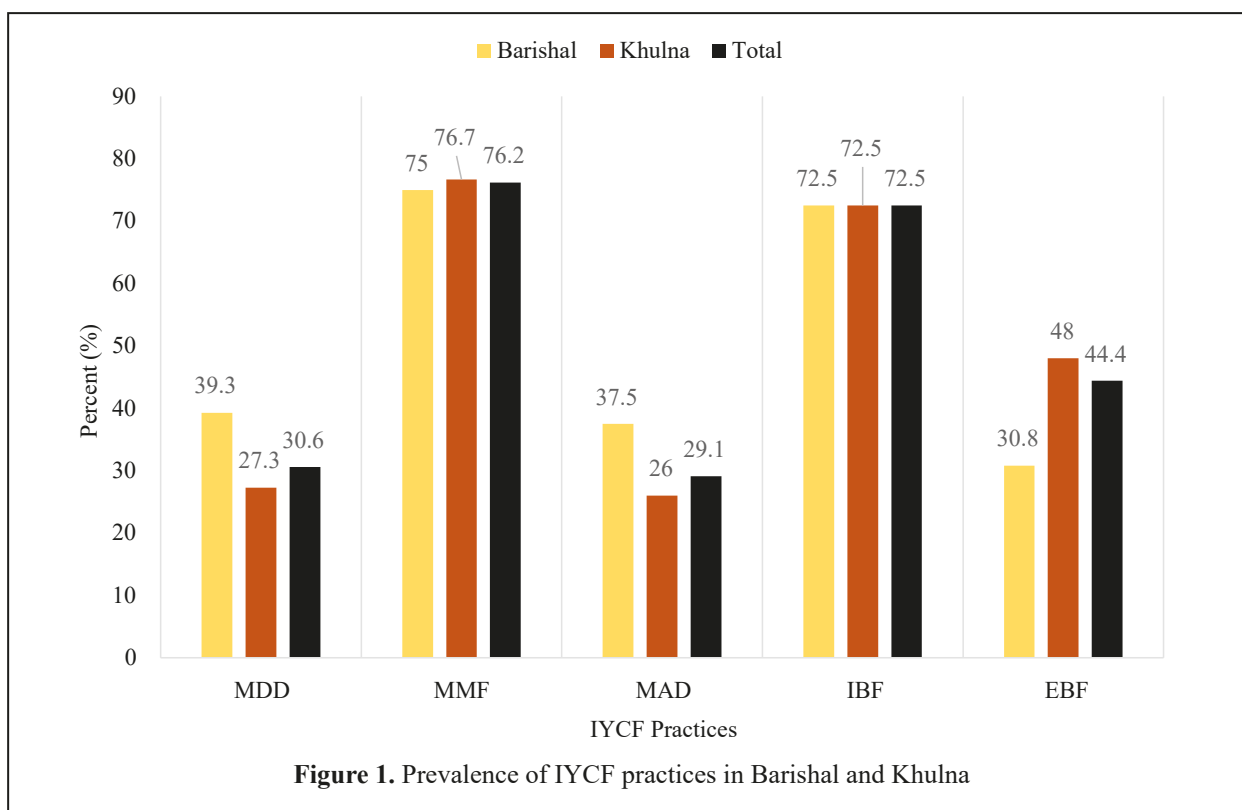
Statistical analysis: all the statistical analyses were computed on STATA, 14. Frequency and percentage were calculated for categorical variables. The association between each of the independent variables and outcome variables were evaluated by the Chi-square test. A P-value less than 0.05 was regarded as significant for this study.

Results

A total of 269 children aged 0-23 months were included in the study. Table 1 shows the sociodemographic characteristics of the respondents. The majority of the respondents (74.3%) were from Khulna district. Age distribution showed that 23.4% of children were between the age groups of 0-5 months while 25.7% belong to 6-11 months. About 44.6% respondents were female among the total sample. Approximately, 35.7% of the household head had incomplete secondary level education while 32% had no education. About 36.8% of the household head were casual workers followed by 33.1% service/ business/ professional/ technical workers and 7.4% other occupations (*housewife, unemployed, retired, old, servant, tuition, handicraft, kabiraj, imam, beggar etc.*) (Table 1). Figure 1 shows MDD in Barishal was 39.3% whereas in Khulna it was only 27.3% while MAD was 37.5% in Barishal and only 26% in Khulna.

Table 1. Sociodemographic characteristics of children aged 0-23 months (N = 269)

Characteristics	N	%
Region		
Barisal	69	25.7
Khulna	200	74.3
Children's age (in months)		
0-5	63	23.4
6-11	69	25.7
12-17	69	25.7
18-23	68	25.3
Sex		
Male	149	55.4
Female	120	44.6
Educational qualification of household head		
No education	86	32
Primary incomplete	57	21.2
Secondary incomplete	96	35.7
S.S.C and Higher	30	11.2
Religion		
Muslim	223	82.9
Others (Hindu/Christian/Buddhist)	46	17.1
Main occupation of the Household head		
Agriculture	59	21.9
Casual worker	99	36.8
Service/business/professional/Technicalwork	89	33.1
Other occupation	20	7.4
Wealth quintiles		
Poorest	48	17.8
Poorer	54	20.1
Middle	52	19.3
Richer	60	22.3
Richest	55	20.4



Note. MDD = Minimum Dietary Diversity; MMF = Minimum Meal frequency; MAD = Minimum Acceptable Diet; IBF = Initiation of Breastfeeding; EBF = Exclusive Breastfeeding; IYCF = Infant Young Children Feeding Practices

Table 2 displays the prevalence as well as the factors that are associated with IYCF practices. The prevalence of MDD was 30.6%, whereas MMF was 76.2% and MAD was 29.1%, initiation of breastfeeding was 72.5% and exclusive breastfeeding was 44.4% subsequently. According to the region it was found that MDD is 39.3%, MMF is 75%, MAD is 29.1%, and 3-IYCF practice is 29.1%, in Barisal whereas 27.3%, 76.7%, 37.5% and 37.5% in Khulna subsequently. About 14.5% of children aged 6-11 months had received MDD compared to 44.1% of children at the age of 18-23 months. About 11.6% of 6-11 months aged children had received MAD while 44.1% had at 18-23 months of age. About 66.7% of children aged

6-11 months had recommended MMF while it was 85.3% at 18-23 months children. All the results were significantly associated. Female infants were more likely to have less MDD, MMF, MAD and 3 IYCF practices compared to males, and the association between MMF and gender of the children was statistically significant ($p=0.01$). Children of the richest wealth index had received highest dietary diversity (46.5%) and highest meal frequency (86%). Moreover, they also received the highest MAD (44.9%), 3 IYCF and initiation of breastfeeding (82.8%) and the associations were found significant. But exclusive breastfeeding (54.5%) was found highest among the poorest wealth quintile.

Table 2: Prevalence of infant and young child feeding practices among children age 6-23 months

Characteristics	MDD ¹ % (n)	MMF ² % (n)	MAD ³ % (n)	IBF ⁴ (0-23months) % (n)	EBF ⁵ (0-5 months) % (n)
Children's age in months ^{1*,2*,3*}					
0-5	-	-	-	71.4(45)	44.4(28)
6-11	14.5(10)	66.7(46)	11.6(8)	69.6(48)	
12-17	33.3(23)	76.8(53)	31.9(22)	71(49)	
18-23	44.1(30)	85.3(58)	44.1(30)	77.9(53)	
Gender ^{2*}					
Male	34.8(39)	83(93)	33.9(38)	72.5(108)	51.4(19)
Female	25.5(24)	68.1(64)	23.4(22)	72.5(87)	34.6(9)
Educational qualification of household head					
No education	29.7(19)	67.2(43)	26.6(17)	65.1(56)	40.9(9)
Primary incomplete	25.6(11)	76.7(33)	25.6(11)	77.2(44)	35.7(5)
Secondary incomplete	30.7(23)	81.3(61)	29.3(22)	77.1(74)	57.1(12)
S.S.C and Higher	41.7(10)	83.3(20)	41.7(10)	70(21)	33.3(2)
Religion					
Muslim	30.6(52)	74.1(126)	28.8(49)	71.3(159)	60(6)
Others	30.6(11)	86.1(31)	30.6(11)	78.3(36)	41.5(22)
Main occupation of the HH's head					
Agriculture/fishing	27.9(12)	74.4(32)	25.6(11)	76.3(45)	37.5(6)
Casual worker	24.7(18)	68.5(50)	24.7(18)	64.6(64)	42.3(11)
Service/business/ professional/technical work	38.6(27)	85.7(60)	37.1(26)	80.9(72)	52.6(10)
Other occupations ^{**}	27.8(5)	77.8(14)	27.8(5)	65(13)	50(1)
Wealth quintiles ^{3*,4*,5*}					
Poorest	16.2(6)	70.3(26)	13.5(5)	56.3(27)	54.5(6)
Poorer	22(9)	73.2(30)	19.5(8)	68.5(37)	23.1(3)
Middle	34.3(12)	71.4(25)	34.3(12)	73.1(38)	52.9(9)
Richer	32(16)	78(39)	32(16)	80(48)	40(4)
Richest	46.5(20)	86(37)	44.2(19)	81.8(45)	50(6)

Note. Other occupations: housewife, unemployed, retired, old, servant, tuition, handicraft, kabiraj, imam, beggar etc.

1 = MDD (Minimum Dietary Diversity); 2 = MMF (Minimum Meal frequency); 3 = MAD (Minimum acceptable diet); 4 = IBF (Initiation of breastfeeding); 5 = EBF (Exclusive breastfeeding)

*p value=<0.05

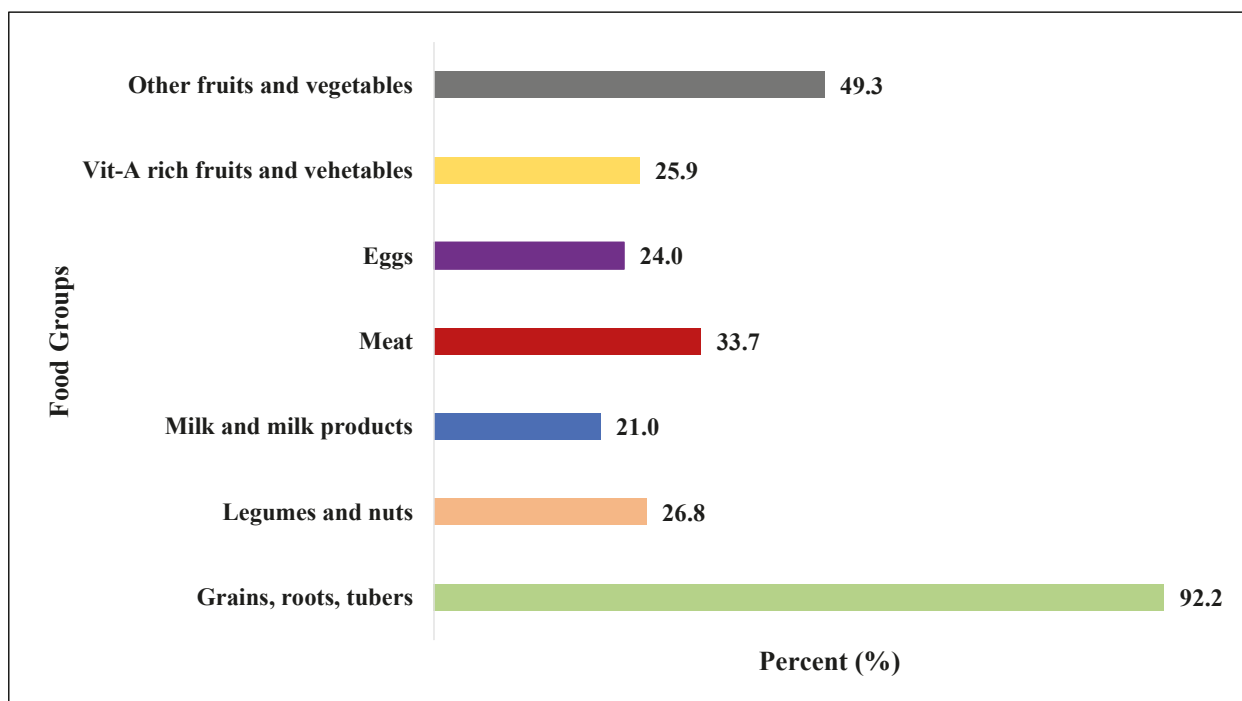


Figure 2. Percent distribution of consumption of 7 different food groups by 6-23 months old children

Figure 2 shows the most consumed food groups were grain, roots, and tubers (92.2%), followed by other fruits and vegetables (49.3%) and fleshy foods (33.7%). Milk and milk products were the least consumed food group (21%) among the children.

Table 3 showed that the prevalence of stunting, wasting and underweight was 27.1%, 8.9% and 20.1%, respectively and the prevalence of malnutrition was found more in Barishal compared to Khulna. The prevalence of stunting and underweight was 18.8% and 15.9% among children aged 6-11 months which

increased to 42.6% and 32.4%, respectively, among the children of 18-23 months. The results were found statistically significant. Wasting was found significantly more among males (13.4%) compared to females (4.3%) ($p=0.024$). The children from the least wealth quintile had the highest rate of wasting (13.6%) compared to those from the richest quintile (9.5%). Alternatively, children of the highest wealth had a maximum prevalence of stunting (31%) as well as being underweight. (35.7%) while compared to the poorest wealth quintile. However, the results were statistically insignificant.

Table 3. Associations between nutritional status and socio-demographic indicators

Background Characteristics	Stunting		Wasting		Underweight	
	% (n)	P-value	% (n)	P-value	% (n)	P-value
Overall	27.1(73)		8.9(24)		20.1(54)	
Region						
Barisal	34.8(24)	0.098	7.2(5)	0.571	24.6(17)	0.272
Khulna	24.5(49)		9.5(19)		18.5(37)	
Children's age in months						
0-5	14.3(9)	0.001	7.9(5)	0.803	7.9(5)	0.004
6-11	18.8(13)		7.2(5)		15.9(11)	
12-17	31.9(22)		8.7(6)		23.2(16)	
18-23	42.6(29)		11.8(8)		32.4(22)	
Sex						
Male	28.9(43)	0.479	11.4(17)	0.111	20.8(31)	0.739
Female	25(30)		5.8(7)		19.2(23)	
Educational qualification of household head						
No education	31.4(27)	0.469	9.3(8)	0.973	22.1(19)	0.927
Primary incomplete	28.1(16)		8.8(5)		19.3(11)	
Secondary incomplete	26(25)		9.4(9)		19.8(19)	
S.S.C and Higher	16.7(5)		6.7(2)		16.7(5)	
Religion						
Muslim	28.7(64)	0.205	9(20)	0.953	20.6(46)	0.618
Others	19.6(9)		8.7(4)		17.4(8)	
Main occupation of the HH's head						
Agriculture/fishing	20.3(12)	0.561	10.2(6)	0.921	13.6(8)	0.584
Casual worker	28.3(28)		9.1(9)		22.2(22)	
Service/business/professional/technical work	27(24)		9(8)		21.3(19)	
Other occupations	35(7)		5(1)		20(4)	
Wealth quintiles						
Poorest	20.3(12)	0.861	16.9(10)	0.252	20.3(12)	0.484
Poorer	20.5(9)		4.5(2)		18.2(8)	
Middle	28.8(17)		6.8(4)		18.6(11)	
Richer	34(18)		5.7(3)		13.2(7)	
Richest	31.5(17)		9.3(5)		29.6(16)	

Note. Other occupations: housewife, unemployed, retired, old, servant, tuition, handicraft, kabiraj, imam, beggar etc.

*p value <0.05

Table 4 indicates that the prevalence of stunting was lower (30.6%) among the children who had received minimum meal frequency than those who had not received MMF (32.7% against 30.6%). Though the prevalence of underweight was higher among the children who had not received MDD (25.4% vs 20.6%), MMF (26.5% vs 22.9%) and MAD (25.3% vs 20%) compared to those who received MDD,

MMF and MAD. However, the results were not statistically significant. Wasting was found less (3.6%) among the exclusively breastfed children under five months of age. The prevalence of stunting (26.2%), wasting (8.2%) and underweight (18.5%) were found less among the children who initiated early breastfeeding compared to those who failed to do the same.

Table 4. Prevalence of malnutrition among children aged 0-23 months by IYCF indicators

Feeding Practices	Stunting		Wasting		Underweight	
	% (n)	P-value	% (n)	P-value	% (n)	P-value
Minimum dietary diversity						
<4 groups	28.2(40)	0.232	7.7(11)	0.259	25.4(36)	0.465
>=4 groups	36.5(23)		12.7(8)		20.6(13)	
Minimum meal frequency						
No	32.7(16)	0.784	6.1(3)	0.390	26.5(13)	0.605
Yes	30.6(48)		10.2(16)		22.9(36)	
Minimum acceptable diet						
No	29.5(43)	0.434	7.5(11)	0.191	25.3(37)	0.413
Yes	35(21)		13.3(8)		20(12)	
Exclusive breastfeeding under 5 months						
No	5(14.3)	1.000	4(11.4)	0.252	2(5.7)	0.466
Yes	4(14.3)		1(3.6)		3(10.7)	
Early initiation of breast feeding (0-23 months)						
No	29.7(22)	0.556	10.8(8)	0.503	24.3(18)	0.284
Yes	26.2(51)		8.2(16)		18.5(36)	

Discussion

This study aimed to provide empirical evidence of the feeding practices of children under 2 years of age in the Barishal and Khulna districts of Bangladesh that have been affected by frequent natural disasters and calamities.

The present study indicates that stunting, wasting and underweight prevalence in Barishal Division was lower than national statistics²⁵ which is similar to study findings conducted in the community-based survey in the Barishal district²⁶. In addition, IYCF practices such as MDD and MMF and MAD were found to be higher than the national data which suggests that IYCF could play a significant role in reducing malnutrition, as Black et al. reported that even with adequate breastfeeding, children will become stunted without adequate quantities and quality of complementary foods after six months⁶. The practice of IYCF in the Khulna Division is poorer and incomparable to national data, even if the stunting, wasting and underweight of the current study were found to be lower than the national average

IYCF practices were found significantly associated with the age of the child, whereas Molla et al. found that older children had higher IYCF practices²⁷. Furthermore, this study is also consistent with studies conducted in northern Ghana²⁸ which indicated that consumption of food groups increases as the child age increases. The possible reason may be the late introduction of complementary feeding because the younger the child, the less ability their intestines have to digest solid, semisolid, and soft foods²⁹. Furthermore, children under the age of two are often contaminated by enteric pathogens found in complementary foods as well as unhygienic dietary practices, which is more likely to cause diarrhoea and eventually malnutrition. Females are more likely to have fewer minimum meal frequencies compared to males, which is statistically significant. ($p=0.012$). In contrast, in another study, girls were found to eat more frequently than boys³⁰. The study found that children from the richest wealth index received a higher MAD

compared with children from the rest of the wealth quintile. As shown in a similar study, the wealthiest quintiles had better access and affordability to MAD than the poorest quintiles³¹. On the other hand, our study found the prevalence of stunting and underweight were higher among the richest wealth quintile which is similar to the findings that the prevalence of stunting and underweight was elevated among the richest groups^{32,33} as economic growth alone would not be able to help meet the goals of MDG unless it was coupled with direct nutrition interventions³⁴.

The prevalence of exclusive breastfeeding is lower (44%) than the national data (55%)²⁵ as well as a study conducted in Bangladesh³⁵. Initiation of Breastfeeding is much higher than other national reports of Nepal (70%), Bangladesh (71%), and Sri Lanka (84%)⁵.

When comparing the 18-23 month group with the 6-11 month group, stunting and underweight are more than twice as prevalent. This is because infants aged 6–11 months seem to benefit from magical prevention of breastfeeding while complementary feeding tends to be allowed, leading to adverse effects on children's anthropometric growth²⁸. Similarly, in another study, stunting and underweight were moderately high among older children whose complementary foods (CF) were introduced after the first six months³⁶. IYCF practices did not appear to be related to the effects of MDD but in another study, the effects of MDD were found to be associated with decreased stunting, wasting, and underweight³⁷. Conversely, the prevalence of underweight was lower among children who received recommended MAD which is consistent with the fact that a low rate of MAD is associated with high levels of child undernutrition³⁸, while others did not observe these correlations³⁹.

Some IYCF indicators do not correlate well with child anthropometric measures, which could be due to a lack of sensitivity⁴⁰. According to Saaka et al., the 24-hour recall does not always provide a comprehensive picture because it looks only at the previous day's feeding, not the feed previously administered⁴¹.

Conclusion

The IYCF practices remain an important and modifiable component of children's nutritional status, but the level of attainment observed in the study is not satisfactory. Despite this, there is still much that can be done to improve the situation. More research is needed to determine the importance of IYCF practices concerning child growth outcomes in different contexts. The study generated vital evidence that can be used in taking initiatives for nutrition interventions among the poor people of the southern region, which can have a profound impact on the nutrition status of children, and thus on the future of the country.

Acknowledgements

We convey our gratitude to Dr Zeba Mahmud for sharing the dataset of the Food Security Nutrition Surveillance Project (FSNSP), BRAC Institute of Global Health (BIGH), BRAC University. We would also like to thank Avonti Basak Tukun and Saiful Islam, Institute of Nutrition and Food Science, University of Dhaka and Lalita Bhattacharjee, Senior Nutrition Advisor Meeting the Undernutrition Challenge Food and Agriculture Organization of the United Nations for their continuous support throughout the research project.

References

1. Lassi ZS, Rind F, Irfan O, Hadi R, Das JK, Bhutta ZA. Impact of Infant and Young Child Feeding (IYCF) Nutrition Interventions on Breastfeeding Practices, Growth and Mortality in Low- and Middle-Income Countries: Systematic Review. *Nutrients*. 2020;12(3):722.
2. Solomon D, Aderaw Z, Tegegne TK. Minimum dietary diversity and associated factors among children aged 6-23 months in Addis Ababa, Ethiopia. *Int J Equity Health*. 2017;16(1):181-.
3. UNICEF. Improving young children's diets during the complementary feeding period. UNICEF Programming Guidance New York: UNICEF. 2020:76.
4. WHO. Infant and young child feeding. 2021.
5. Biks GA, Tariku A, Wassie MM, Derso T. Mother's Infant and Young Child Feeding (IYCF) knowledge improved timely initiation of complementary feeding of children aged 6–24 months in the rural population of northwest Ethiopia. *BMC research notes*. 2018;11(1):1-7.
6. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. *Lancet (London, England)*. 2008;371(9610):417-40.
7. UNICEF. Children, food and nutrition: growing well in a changing world. *The State of the World's Children*. 2019;2019.
8. UNICEF. *The State of The World's Children 2019-Growing Well in a Changing World*. 2019.
9. Malnutrition: A brief guide to malnutrition and its impact globally and in Bangladesh. [press release]. 2020. Available from: <https://www.icddrb.org/news-and-events/presscorner/media-resources/malnutrition>.
10. Ministry of health & family welfare (MOHFW), Bangladesh, 2017. 2nd National Plan of Action for Nutrition Bangladesh. [online] p.15.

11. WHO. Indicators for assessing infant and young child feeding practices part 3: country profiles. 2010.
12. Arimond M, Ruel MT. Dietary diversity is associated with child nutritional status: evidence from demographic and health surveys. *The Journal of nutrition*. 2004;134(10):2579-85.
13. S.K.Roy. National Strategy for Infant and Young Child Feeding in Bangladesh. 2007.
14. NIPORT NIOPRaT. Bangladesh Demographic and Health Survey,2017-18.. National Institute of Population Research and Training (NIPORT) aI. (2019) Bangladesh Demographic and Health Survey (BDHS) 2017-2018.
15. Fekadu Y, Mesfin A, Haile D, Stoecker BJ. Factors associated with nutritional status of infants and young children in Somali Region, Ethiopia: a cross- sectional study. *BMC Public Health*. 2015;15(1):846.
16. Sheikh N, Akram R, Ali N, Haque SR, Tisha S, Mahumud RA, et al. Infant and young child feeding practice, dietary diversity, associated predictors, and child health outcomes in Bangladesh. *Journal of Child Health Care*. 2020;24(2):260-73.
17. BRAC Institute of Global Health (BIGH) BU. Baseline Survey Report on Integrated Agriculture And Health Based Interventions For Improved Food And Nutrition Security In Selected Districtsof Southern Bangladesh. 2013 December, 2013.
18. Services NN. 2nd National Plan of Action for Nutrition, Bangladesh (NPAN2) 2020.
19. Lee BX, Kjaerulf F, Turner S, Cohen L, Donnelly PD, Muggah R, et al. Transforming our world: implementing the 2030 agenda through sustainable development goal indicators. *Journal of public health policy*. 2016;37(1):13-31.
20. Islam MR. Bangladesh Disaster-related Statistics 2020. 2016.
21. WHO. Indicators for assessing infant and young child feeding practices: part 2: measurement. 2010.
22. WHO WHO-. Indicators for assessing infant and young child feeding practices: part 1: definitions: conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA: World Health Organization; 2008.
23. Fort AL, Kothari MT, Abderrahim N. DHS Working Papers. *Calverton Macro Int*. 2008:1-47.
24. Franck G, Joseph CD. Associated Factors to Nutritional Status and Infant and Young Child Feeding (IYCF) Practices in Rural Area of Burkina Faso: A Study in Ouargaye Health District. *American Journal of Pediatrics*. 2019;5(3):82-90.
25. National Institute of Population Research and Training N. Bangladesh Demographic and Health Survey,2014. 2014.
26. Hasib M, Hassan MN, Hasan M. Impact of Nutritional Health Services over the Nutritional Status of Under five Children in the City of Barishal, Bangladesh: A Community Based Survey.
27. Molla A, Egata G, Getacher L, Kebede B, Sayih A, Arega M, et al. Minimum acceptable diet and associated factors among infants and young children aged 6–23 months in Amhara region, Central Ethiopia: community-based cross-sectional study. *BMJ open*. 2021;11(5):e044284.

28. Anin SK, Saaka M, Fischer F, Kraemer A. Association between Infant and Young Child Feeding (IYCF) Indicators and the Nutritional Status of Children (6–23 Months) in Northern Ghana. *Nutrients*. 2020;12(9):2565.
29. Beyene M, Worku AG, Wassie MM. Dietary diversity, meal frequency and associated factors among infant and young children in Northwest Ethiopia: a cross-sectional study. *BMC public health*. 2015;15(1):1-9.
30. Mekonnen TC, Workie SB, Yimer TM, Mersha WF. Meal frequency and dietary diversity feeding practices among children 6–23 months of age in Wolaita Sodo town, Southern Ethiopia. *Journal of Health, Population and Nutrition*. 2017;36(1):18.
31. Nguyen PH, Avula R, Ruel MT, Saha KK, Ali D, Tran LM, et al. Maternal and child dietary diversity are associated in Bangladesh, Vietnam, and Ethiopia. *The Journal of nutrition*. 2013;143(7):1176-83.
32. Hong R, Banta JE, Betancourt JA. Relationship between household wealth inequality and chronic childhood under-nutrition in Bangladesh. *Int J Equity Health*. 2006;5(1):1-10.
33. Subramanian S, Kawachi I, Smith GD. Income inequality and the double burden of under-and overnutrition in India. *Journal of Epidemiology & Community Health*. 2007;61(9):802-9.
34. Haddad L, Alderman H, Appleton S, Song L, Yohannes Y. Reducing child malnutrition: How far does income growth take us? *The World Bank Economic Review*. 2003;17(1):107-31.
35. Saizuddin M, Hasan MS. Infant and young child feeding (IYCF) practices by rural mothers of Bangladesh. *Journal of National Institute of Neurosciences Bangladesh*. 2016;2(1):19-25.
36. Das S, Gulshan J. Different forms of malnutrition among under five children in Bangladesh: a cross sectional study on prevalence and determinants. *BMC Nutrition*. 2017;3(1):1.
37. Oduor FO. Malnutrition, dietary diversity, morbidity and associated factors among schoolchildren in Kibwezi district, Kenya 2013.
38. Marriott BP, White A, Hadden L, Davies JC, Wallingford JC. World Health Organization (WHO) infant and young child feeding indicators: associations with growth measures in 14 low-income countries. *Maternal & child nutrition*. 2012;8(3):354-70.
39. Reinbott A, Kuchenbecker J, Herrmann J, Jordan I, Muehlhoff E, Kevanna O, et al. A child feeding index is superior to WHO IYCF indicators in explaining length-for-age Z-scores of young children in rural Cambodia. *Paediatrics and international child health*. 2015;35(2):124-34.
40. Jones AD, Ickes SB, Smith LE, Mbuya MN, Chasekwa B, Heidkamp RA, et al. World Health Organization infant and young child feeding indicators and their associations with child anthropometry: a synthesis of recent findings. *Maternal & child nutrition*. 2014;10(1):1-17.
41. Saaka M, Wemakor A, Abizari A-R, Aryee P. How well do WHO complementary feeding indicators relate to nutritional status of children aged 6–23 months in rural Northern Ghana? *BMC public health*. 2015;15(1):1-12.