Prevalence of Infant and Young Child Feeding Practices and Differences in Estimates of Minimum Dietary Diversity Using 2008 and 2021 Definitions: Evidence from Bangladesh

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ABSTRACT

Background: Infant and young child feeding (IYCF) practices directly impact the health of <2-y-old children. Minimum dietary diversity (MDD) is an IYCF indicator to assess feeding practices of children aged 6–23 mo. The definition of MDD has recently been updated by the WHO and UNICEF, substituting "≥4 out of 7 food groups" (MDD-7FG) with "≥5 out of 8 food groups" (MDD-8FG).

Objectives: The goals of this study were to estimate the prevalence of IYCF indicators and identify the implications of the change in the prevalence of MDD at the national and regional levels of Bangladesh.

Methods: This study used data from the National Food Security and Nutrition Surveillance 2018–2019 round. A total of 1992 children aged 0–23 mo were included in this analysis. IYCF indicators and MDD were calculated according to the WHO-UNICEF guidelines. The difference between the prevalence of MDD-7FG and MDD-8FG is presented as percentage points.

Results: The prevalence of early initiation of breastfeeding was 43.8%, and exclusive breastfeeding was 56.2%. Approximately 55% of children maintained MDD (MDD-7FG), 48% received minimum meal frequency, and 28% received a minimum acceptable diet. Compared with MDD-7FG, the prevalence of MDD-8FG was lower among 6–23-mo-old children. The difference between MDD prevalence (MDD-8FG vs. MDD-7FG) was high for boys (44.0% vs. 53.2%), children aged 12–23 mo (53.4% vs. 63.4%), in urban areas (30.2% vs. 42.4%), in the Dhaka administrative division (42.0% vs. 56.3%), among uneducated mothers (37.1% vs. 47.1%), in households with ≤4 members (44.3% vs. 55%), and for middle-class households (40.3% vs. 57.6%).

Conclusions: The new method led to a decrease in the prevalence of MDD in Bangladesh. As the country prepares to implement the new indicator, it is critical to disseminate the new knowledge and its positive implication for improved child feeding and nutrition. *Curr Dev Nutr* 2022;6:nzac026.

Introduction

Despite recent rapid economic growth, developing countries have a high prevalence of early childhood malnutrition (1). Bangladesh has received widespread recognition for achieving notable progress in reducing under-5 childhood stunting and wasting in the last 20 y, and this has been acknowledged as a major accomplishment worldwide (2).

However, undernutrition remains a significant public health issue in Bangladesh. Undernutrition is considered to be responsible for nearly 45% of all childhood deaths annually worldwide (3). South Asia has the world's highest rate of stunting and wasting (4, 5). In addition to the effects of childhood diseases, early childhood undernutrition has enduring consequences on physical as well as cognitive development (6).

Inappropriate infant feeding practices have a significant impact on the growth, illness, and survival of the children (7). Inadequate complementary feeding after the completion of the first 6 mo of life can result in stunting, and approximately 6% of mortality in children aged <5 y can be averted by appropriate complementary feeding practices (8, 9). Switching from exclusive breastfeeding to complementary feeding is critical for ensuring satisfactory nutrition. Malnutrition starts for the vast majority of the children in this period and is responsible for the global burden of under-5 malnutrition (10).

Acknowledging the influence of infant and young child feeding (IYCF) practices on the nutritional status of children aged <2 y, the WHO and UNICEF developed a set of indicators to assess child feeding practices (11). Minimum dietary diversity (MDD) is one of the indicators developed by the WHO for evaluating complementary feeding of 6–23-mo-old infants. MDD is a frequently used indicator for the national nutrition monitoring framework in low- and middle-income countries (12).

Previously, MDD was estimated based on consumption of ≥4 out of 7 food groups (grains, legumes/nuts, flesh food, dairy products, eggs, fruits, and vegetables) in the previous 24 h (MDD-7FG) (13). The dairy products food group includes dairy and infant formula or other breast-milk substitutes. Breast-milk consumption was not counted here, as breast milk is not a complementary food, and MDD estimated complementary feeding (13). According to this guidance, comparing MDD-7 food groups (MDD-7FG) between breastfed and non-breastfed children in the same population might be problematic. Non-breastfed children who received breast-milk substitute/infant formula might have a higher score than breastfed children who did not receive these food groups. Considering this, in 2017, technical expert advisors from WHO and UNICEF reappraised the MDD definition. The updated MDD definition includes breast milk as the eighth food group and the threshold increased to ≥5 out of 8 food groups (MDD-8FG) (14). The updated MDD-8FG is now comparable between breastfed and non-breastfed children's groups.

The comparison of these 2 methods has not been done, and as per our knowledge, the implementation of changing to a new method has not been studied at the country level in Bangladesh. This article aims to estimate the changes in shifting from MDD-7FG to MDD-8FG at the national, regional, and divisional levels of Bangladesh to highlight the implications for national policymakers and program managers. Moreover, this study reports information on IYCF practices from a nationally representative sample.

Methods

Study design and site

The Bangladesh National Food Security and Nutrition Surveillance 2018–2019 round was a nationally representative cross-sectional study conducted from September 2018 to October 2019. We collected data from 82 randomly selected clusters (57 rural, 15 non-slum urban, and 10 slums) from 8 administrative divisions (Dhaka, Chattogram, Sylhet, Khulna, Barishal, Rajshahi, Rangpur, Mymensingh) of Bangladesh. In the main survey, we collected data from 6 age groups: children (0 to <5 y), adolescent girls (10–19 y), adolescent boys (10–19 y), women

(20–59 y), men (20–59 y), and elderly people (≥60 y). However, in this analysis, we included children aged 0–23 mo.

Sampling techniques

The sampling was done separately for rural, non-slum urban, and slum areas. For the rural clusters, at first, 2 districts from each of the 8 divisions were randomly selected in the 4-stage sampling. In the second stage, 1 subdistrict was randomly selected from each selected district. In the third stage, 2 unions (lowest level of the administrative unit in rural Bangladesh) from each selected subdistrict were randomly selected (total of 32 unions). Each chosen union was then subdivided into segments of 250–400 households. We randomly selected 2 segments as the study clusters from rural areas from the listed segments. We selected a total of 64 clusters from rural areas.

Non-slum urban clusters were selected based on the Bangladesh Bureau of Statistics 2011 Census report (15). Depending on the proportion of the urban population, 1–2 wards (lowest level of an administrative unit in urban area) were chosen at random from each administrative division. Later, we identified the "Mahallas" (similar to the villages in the rural area) with >250 households in the selected wards. Each segment of the "Mahallas" with >500 households was divided into 2 or more segments, each with 250–400 households. We randomly chose 1 Mahalla/segment from each selected ward as the non-slum urban cluster. For selecting slum areas, the Census of Slum Areas and Floating Population (2014) was consulted. At first, we listed the slums with ≥300 households in all the 8 divisional headquarters. We divided each slum with more than 500 homes into 2 segments within clearly defined geographical limits. We then randomly selected 2 slums from the Dhaka and Chittagong division and 1 from each of the other 6 divisional headquarters as the slum clusters. Finally, we selected 90 clusters (64 rural, 16 non-slum urban, and 10 slums). However, data were collected from 82 clusters because of administrative and financial constraints.

We calculated the sample size to generate the estimate at the national and divisional levels. In the case of children (0 to <5 y) and other population groups included in the main study, the observed prevalence (p) of the studied variables ranged between 4% and 98% (16). Considering the probability of type I error ($\alpha = 0.05$), margin of error ($d = 0.05$) or p/2 when $P \leq 0.1$, and a design effect = 1.61, we calculated that we needed 62 under-5 boys and girls from each study cluster. In each cluster, data collectors first listed members of all households by age group. If there was any household with >1 child aged <5 y, we randomly selected one of them. We then selected 80 children from the updated list using simple random sampling so that we could enroll 62 children from a cluster. **Figure 1** represents the steps of study participant selection.

Data collection

Five research teams collected data, with each team comprising 1 project officer and 4–5 data collectors. Data collectors interviewed the participants and collected anthropometric measurements. The project officers supervised the day-to-day data-collection activities. Face-to-face interviews were performed to obtain survey data using a standardized questionnaire with modules for several age groups, including children aged <5 y. Questions about IYCF and dietary intake were asked to the mother/caretaker for 0–23-mo-old children. Mothers/caregivers were requested to provide information on the feeding
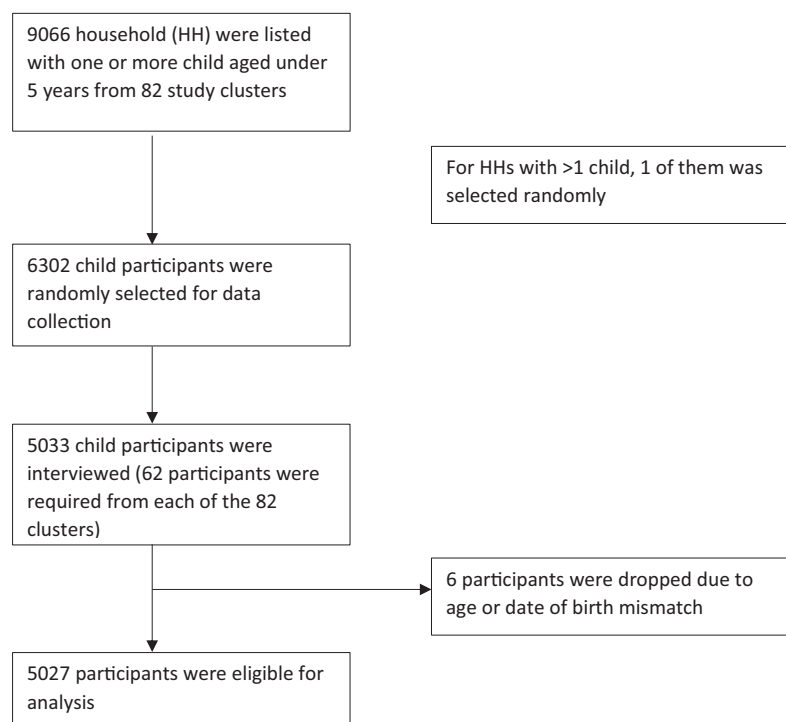
FIGURE 1   Study flow chart shows the process of selection of study participants (0–5 y).

practices of their children. Data collection was done using tablet computers (Samsung Galaxy Tab A7) and a customized Survey CTO application.

IYCF indicators

IYCF indicators were defined and estimated per the WHO-UNICEF–recommended guidelines published in 2008 ([13]). The IYCF indicators analyzed in this study were as follows: early initiation of breastfeeding (proportion of children born in the last 24 mo who are breastfed within 1 h of birth), exclusive breastfeeding up to 6 mo (proportion of infants 0–5 mo of age who are fed exclusively with breast milk), continuation of breastfeeding up to 1 y (proportion of children 12–15 mo of age who are fed breast milk), introduction of solid, semi-solid, or soft foods (proportion of infants 6–8 mo of age who receive solid, semi-solid, or soft foods), MDD/MDD-7FG (proportion of children 6–23 mo of age who receive foods from ≥4 food groups, minimum meal frequency (MMF) (proportion of breastfed and non-breastfed children 6–23 mo of age who receive solid, semi-solid, or soft foods the minimum number of times or more), minimum acceptable diet (MAD; proportion of children 6–23 mo of age who receive an MAD apart from breast milk, and consumption of iron-rich/iron-fortified food for children up to 6–23 mo old (proportion of children 6–23 mo of age who receive an iron-rich food or iron-fortified food that is specially designed for infants and young children, or that is fortified in the home) ([13]).

However, to estimate the changes in MDD, we calculated the MDD-8FG as per the updated guideline (2021) ([14]). MDD-7FG was calculated as the proportion of the children aged 6–23 mo who consumed ≥4 out of 7 food groups described above in the last 24 h. MDD-8FG was calculated as the proportion of the children aged 6–23 mo who con-

sumed ≥5 out of 8 food groups in the last 24 h. In MDD-8FG, the food groups were similar to MDD-7FG, and the eighth food group was breast milk.

Quality control

Project officers and data collectors received rigorous training on face-to-face interview techniques. To verify the data quality, within 48 h following the data collector's initial visit, project officers re-interviewed approximately 5% of the randomly selected subsample. Statisticians compared the surveillance data with the quality-control data and sent feedback to the field team for any discrepancies. Project officers also directly observed approximately 5% of the interviews (randomly selected) and provided corrective feedback to the interviewers in case of any observed deviation from the procedure.

Statistical analysis

We performed descriptive analysis to report the sociodemographic characteristics of the respondents. We performed principal component analysis to calculate the wealth quintiles of the households. We derived sampling weights based on the likelihood of each participant in the final sample being chosen, and we used these weights to calculate the prevalence of IYCF indicators. We used a multistage sampling technique and the "Primary Sampling Unit (PSU)" command of the analysis software (StataCorp). The calculated prevalence of IYCF indicators was further stratified by gender and regional level. Both MDD-7FG and MDD-8FG were calculated and stratified by gender, age group, at the regional and divisional level, mother's education and occupation, father's education and occupation, breastfeeding status, household size, and according to wealth index. The difference between

MDD-7FG and MDD-8FG is presented in percentage points with 95% CIs. We performed all of the data analysis using Stata version 15.1 (StataCorp).

Ethical consideration

Ethical approval from the Institutional Review Board of the BRAC James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh, was sought and approved (reference number: 2018–020-IR) before conducting the study. Before beginning data collection in a region, community sensitization meetings with local leaders and representatives from potential respondents were organized to obtain community permission. Written informed consent was obtained after explaining the study objectives and procedures. For the participants aged <18 y, informed consent was obtained from their parents. Throughout the study procedure, complete privacy, confidentiality, and anonymity were maintained. No patient and/or the public were involved in designing, conducting, reporting, or disseminating the plans of the study.

Results

Sociodemographic characteristics of the study participants

A total of 1992 children aged 0–23 mo were included, and of them, 973 were boys and 1019 were girls (**Table 1**). Approximately 19.5% of the children were aged 0–5 mo, 25.6% aged 6–11 mo, and 54.9% aged 12–23 mo. Approximately 16% of the study children were from the Chittagong division, followed by the Rangpur division (15.0%). Seven out of 10 children were from rural areas. With regard to the mother's education, 12.7% of the mothers had no formal education, whereas 23.0% of the mothers had completed secondary education. The majority of the mothers (93.1%) were homemakers. Nearly 30% of the fathers were day laborers. Although 49.4% of households had ≥5 family members, 50.6% of households had ≤4 family members. With regard to the breastfeeding status of the 6–23-mo-old children, 60.1% of the children were breastfed at the time of the survey.

Prevalence of IYCF core indicators

Table 2 illustrates the prevalence of WHO–UNICEF (2008)–recommended IYCF core indicators ([13]). From the 1992 children aged 0–23 mo, 43.8% were breastfed within 1 h after birth, and the prevalence was highest in slum areas (44.9%) and among girls (44.8%) (Table 2). The prevalence of exclusive breastfeeding was 56.2% for infants aged 0–5 mo, which was lower in slum areas (49.3%) than in rural and urban areas and highest among boys (56.8%). During the survey period, 94.3% of mothers reported that they continued breastfeeding their children up to 1 year, which was higher among mothers from rural areas (94.6%) compared with mothers from urban and slum areas. Nearly 4 out of 5 (80.4%) children were introduced to solid, semi-solid, or soft foods at 6–8 mo of age, which was more frequent in slum areas (87.9%). Approximately 55% of the mothers could maintain MDD (MDD-7FG) at the national level, with a lower prevalence in slum areas (42.1%), and the prevalence was highest for girls (56.0%). At the national level, 47.5% of children received MMF, with a high prevalence in slum areas (60.7%) compared with rural and urban areas. The prevalence of MMF was also highest among girls

TABLE 1 Sociodemographic characteristics of the study children aged 0–23 mo[1]

Variables	n (%)
Gender	
Boy	973 (48.9)
Girl	1019 (51.1)
Age	
0–5 mo	389 (19.5)
6–11 mo	509 (25.6)
12–23 mo	1094 (54.9)
Division	
Barisal	197 (9.9)
Chattogram	316 (15.9)
Dhaka	268 (13.5)
Mymensingh	275 (13.8)
Khulna	241 (12.1)
Rajshahi	237 (11.9)
Rangpur	299 (15.0)
Sylhet	159 (8.0)
Place of residence	
Rural	1381 (69.3)
Non-slum urban	348 (17.5)
Slum	263 (13.2)
Mother's education	
No education	252 (12.7)
Primary incomplete	228 (11.4)
Primary complete	307 (15.4)
Secondary incomplete	746 (37.4)
Secondary complete and higher	459 (23.0)
Mother's occupation	
Other[2]	137 (6.9)
Homemaker	1855 (93.1)
Father's education	
No education	458 (23.0)
Primary incomplete	253 (12.7)
Primary complete	345 (17.3)
Secondary incomplete	492 (24.7)
Secondary complete and higher	444 (22.3)
Father's occupation	
Farmer	189 (9.5)
Day laborer	595 (29.9)
Salaried staff	439 (22.0)
Business	389 (19.5)
Other	380 (19.1)
Household size	
≤4 members	1007 (50.6)
≥5 members	985 (49.4)
Wealth quintile	
Poorest	403 (20.2)
Poorer	397 (19.9)
Middle	399 (20.0)
Richer	399 (20.0)
Richest	394 (19.8)
Breastfeeding status (6–23 mo, n = 1603)	
Breastfed	964 (60.1)
Non-breastfed	639 (39.9)

[1]n = 1992.
[2]Service holders, business, day laborer, farmer.

(53.3%). At the national level, 28.0% of children received MAD, and the prevalence of consumption of iron and iron-rich food was 53%; both indicators have a low prevalence in urban areas. The prevalence of MAD was highest for girls compared with boys (31.9%); however,

TABLE 2 Prevalence of the WHO-UNICEF–recommended (2008) infant and young child feeding indicators in Bangladesh

Indicators (n)	National	Place of residence, % (95% CI)			Gender, % (95% CI)	
		Rural	Non-slum urban	Slum	Boy	Girl
Early initiation of breastfeeding[1] (1992)	43.8 (38.9, 48.7)	43.9 (38.8, 49.0)	40.4 (27.5, 54.8)	44.9 (32.3, 58.2)	42.6 (37.0, 48.3)	44.8 (39.4, 50.4)
Exclusive breastfeeding up to 6 mo[2] (388)	56.2 (45.5, 66.3)	56.2 (45.2, 66.6)	56.6 (24.7, 83.9)	49.3 (24.1, 74.8)	56.8 (44.8, 68.0)	55.5 (41.8, 68.4)
Continued breastfeeding at 1 y[3] (220)	94.3 (86.9, 97.7)	94.6 (86.4, 97.9)	91.3 (57.1, 98.8)	90.3 (78.9, 95.9)	93.6 (79.8, 98.2)	95.1 (85.5, 98.5)
Introduction of solid, semi-solid, or soft food[4] (258)	80.4 (72.2, 86.6)	80.2 (71.6, 86.6)	83.9 (61.7, 94.4)	87.9 (75.3, 94.6)	81.3 (68.6, 89.6)	79.4 (66.8, 88.1)
Minimum dietary diversity[5] (1603)	54.7 (47.0, 62.2)	55.3 (47.3, 63.0)	42.4 (26.0, 60.6)	42.1 (28.3, 57.3)	53.2 (45.1, 61.1)	56.0 (47.0, 64.7)
Minimum meal frequency[6] (1603)	47.5 (44.2, 50.8)	47.3 (43.9, 50.7)	49.9 (40.0, 59.9)	60.7 (42.8, 76.0)	40.8 (35.4, 46.4)	53.3 (48.2, 58.4)
Minimum acceptable diet[7] (1603)	28.0 (23.0, 33.6)	28.2 (23.0, 34.1)	22.5 (12.3, 37.6)	25.9 (10.1, 52.2)	23.5 (18.8, 28.9)	31.9 (25.0, 39.8)
Consumption of iron rich food[8] (1603)	53.0 (46.3, 59.5)	53.7 (46.8, 60.4)	36.8 (21.3, 55.6)	43.2 (36.2, 50.6)	54.9 (48.1, 61.5)	51.3 (42.3, 60.2)

[1] Proportion of children born in the last 24 mo who are breastfeeding within 1 h of birth.
[2] Proportion of infants 0–5 mo of age who are fed exclusively with breast milk.
[3] Proportion of children 12–15 mo of age who are fed breast milk.
[4] Proportion of infants 6–8 mo of age who receive solid, semi-solid, or soft foods.
[5] Proportion of children 6–23 mo of age who receive foods from ≥4 food groups.
[6] Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods the minimum number of times or more.
[7] Proportion of children 6–23 mo of age who receive a minimum acceptable diet apart from breast milk.
[8] Proportion of children 6–23 mo of age who receive an iron-rich food or iron-fortified food that is specially designed for infants and young children, or that is fortified in the home.

for consumption of iron-rich food, boys had a higher prevalence than girls.

Estimated changes in the prevalence of MDD

As presented in **Table 3**, the prevalence of MDD-8FG in children aged 6–23 mo was 46.2%, the prevalence of MDD-7FG was 54.7%, and the difference was −8.5 percentage points (Table 3). The prevalence of MDD-8FG was consistently lower than MDD-7FG across the sociodemographic characteristics; however, the magnitude was different. The difference between MDD prevalence (MDD-8FG vs. MDD-7FG) was high for boys (44.0% vs. 53.2%), for children aged 12–23 mo (53.4% vs. 63.4%), children from non-slum urban areas (30.2% vs. 42.4%) and the Dhaka administrative division (42.0% vs. 56.2%), among the children whose mothers had no formal education (37.1% vs. 47.1%) and were homemakers (45.6% vs. 54.3%), among the children whose fathers had no formal education (39.5% vs. 48.9%) and who were day laborers (42.8% vs. 54.3%), children from the households with ≤4 family members (44.3% vs. 55%), and children from middle-class households (40.3% vs. 57.6%).

We also compared the prevalence of MDD-7FG and MDD-8FG between currently breastfeeding and non-breastfeeding children aged 6–23 mo. As depicted in **Figure 2**, we did not find any difference in the prevalence of MDD-7FG for breastfed and non-breastfed children. However, for MDD-8FG, we found a striking difference between breastfed and non-breastfed children (54.9% vs. 35.1%).

Discussion

This study reported the prevalence of IYCF practices at the national and regional levels of Bangladesh. Another objective of the study was to compare the prevalence of MDD using MDD-7FG and MDD-8FG methods, as the definition has been modified recently. In our study, the prevalence of early initiation of breastfeeding was 43.8%, prevalence of exclusive breastfeeding was 56.2%, and 80.4% introduced solid, semi-solid, or soft foods between 6-8 mo of age of their children. Approximately 54.7% of children maintained MDD, 47.5% received MMF, and 28% received MAD. We observed a low prevalence of MDD-8FG compared with MDD-7FG that differed by 8.5 percentage points.

Our results on IYCF indicators suggest that most of the feeding indicators need improvement to achieve optimal feeding practices in Bangladesh. We also observed regional and divisional variations in the IYCF indicators. Early initiation of breastfeeding is crucial for the proper development of children (17). We found that early breastfeeding initiation is lower in urban areas than in rural and slum areas. Our findings aligned with those of an earlier study in Bangladesh that found a low prevalence of early initiation of breastfeeding in urban areas (18). This might be due to the high rate of cesarean delivery in urban areas, resulting in delayed initiation of breastfeeding (19). Thereby, it is urgent to promote early breastfeeding initiation among urban women. In addition, interventions to educate women and family members to initiate breastfeeding early will increase breastfeeding initiation. The low prevalence of exclusive breastfeeding is also a concern and has not improved since 2014 (20). We observed that exclusive breastfeeding status was lower in slum areas compared with rural and urban areas. This observation is in accordance with other

TABLE 3 Comparison of the prevalence of MDD of children aged 6–23 months according to the old (7 food groups, 2008) and new (8 food groups, 2021) methods in Bangladesh[1]

Characteristics (age 6–23 mo) (n)	Seven food groups (MDD-7FG), % (95% CI)	Eight food groups (MDD-8FG), % (95% CI)	Differences (MDD-8FG − MDD-7FG), percentage points
Overall	54.7 (47.0, 62.2)	46.2 (39.8, 52.8)	−8.5
Gender			
Boys (782)	53.2 (45.1, 61.1)	44.0 (37.4, 50.9)	−9.2
Girls (821)	56.0 (47.0, 64.7)	48.2 (40.8, 55.7)	−7.8
Age group			
6–11 mo (509)	36.3 (29.3, 44.0)	31.2 (24.6, 38.6)	−5.2
12–23 mo (1094)	63.4 (53.7, 72.1)	53.4 (44.5, 62.1)	−10.0
Place of residence			
Rural (1095)	55.3 (47.3, 63.0)	47.0 (40.3, 53.7)	−8.3
Non-slum urban (280)	42.4 (25.0, 62.0)	30.2 (15.7, 50.1)	−12.2
Slum (228)	42.2 (26.7, 59.3)	36.4 (18.6, 58.9)	−5.8
Division name			
Barisal (158)	61.5 (51.6, 70.6)	57.2 (46.0, 67.7)	−4.3
Chattogram (255)	30.0 (21.8, 39.7)	23.8 (17.4, 31.8)	−6.2
Dhaka (222)	56.2 (47.7, 64.5)	42.0 (33.1, 51.4)	−14.3
Mymensingh (214)	60.1 (45.9, 72.7)	56.2 (41.2, 70.1)	−3.9
Khulna (191)	71.0 (58.3, 81.0)	62.7 (52.2, 72.2)	−8.3
Rajshahi (193)	69.5 (57.0, 79.7)	56.9 (53.0, 60.8)	−12.6
Rangpur (239)	51.0 (28.8, 72.7)	41.0 (23.4, 61.2)	−10.0
Sylhet (131)	26.1 (10.1, 52.6)	23.0 (9.9, 44.8)	−3.1
Mother's education			
No education (200)	47.1 (34.1, 60.5)	37.1 (25.9, 49.9)	−10.0
Primary incomplete (189)	47.7 (38.3, 57.2)	42.1 (33.1, 51.7)	−5.6
Primary complete (251)	48.6 (41.0, 56.4)	41.6 (33.3, 50.4)	−7.1
Secondary incomplete (596)	58.5 (47.3, 68.9)	48.6 (38.6, 58.7)	−9.9
Secondary complete and higher (367)	58.5 (47.4, 68.8)	50.9 (40.0, 61.7)	−7.6
Mother's occupation			
Other (115)	61.7 (48.8, 73.1)	56.6 (43.8, 68.7)	−5.1
Homemaker (1488)	54.3 (46.3, 62.0)	45.6 (38.9, 52.5)	−8.7
Father's education			
No education (375)	48.9 (40.4, 57.4)	39.5 (31.3, 48.4)	−9.4
Primary incomplete (207)	54.8 (37.6, 70.8)	46.7 (31.8, 62.2)	−8.1
Primary complete (274)	52.6 (41.9, 63.2)	43.2 (34.5, 52.4)	−9.4
Secondary incomplete (390)	56.4 (46.6, 65.7)	48.2 (39.7, 56.7)	−8.2
Secondary complete and higher (357)	61.3 (51.6, 70.2)	54.2 (44.9, 63.1)	−7.1
Father's occupation			
Farmer (145)	62.3 (50.2, 73.0)	54.1 (39.8, 67.7)	−8.2
Day laborer (488)	54.3 (43.5, 64.7)	42.8 (34.8, 51.3)	−11.5
Salaried staff (347)	52.2 (43.7, 60.5)	46.0 (37.3, 54.9)	−6.2
Business (313)	54.8 (44.5, 64.7)	52.9 (42.7, 62.9)	−1.9
Other (310)	54.4 (40.4, 67.7)	43.3 (31.2, 56.2)	−11.1
Household size			
≤4 members (831)	55.0 (46.8, 62.8)	44.3 (38.2, 50.5)	−10.7
≥5 members (772)	54.5 (46.4, 62.3)	47.9 (40.4, 55.5)	−6.6
Wealth quintile			
Poorest (321)	52.8 (45.4, 60.1)	44.2 (36.8, 52.0)	−8.5
Poorer (324)	48.3 (36.6, 60.2)	43.3 (33.0, 54.2)	−5.0
Middle (326)	57.6 (44.4, 69.8)	40.3 (31.1, 50.1)	−17.3
Richer (330)	60.3 (49.2, 70.4)	53.7 (42.7, 64.3)	−6.6
Richest (302)	57.9 (46.6, 68.4)	53.4 (42.4, 64.0)	−4.5

[1]n = 1603. MDD, minimum dietary diversity; MDD-7FG, indicator for consumption of ≥4 out of 7 food groups; MDD-8FG, indicator for consumption of ≥5 out of 8 food groups.

studies in Bangladesh, which also showed that exclusive breastfeeding is lower in slum areas (21). It is urgent to identify the reasons that hinder the improvement in exclusive breastfeeding to reduce childhood morbidity and mortality and achieve Sustainable Development Goals.

The prevalence of continued breastfeeding at 1 y in our study is similar to the Bangladesh Demographic and Health Survey 2014 report (96%) (16). We found that 80.4% of the 6–8-mo-old children received timely complementary feeding, which shows an improvement in the timely introduction of solid, semi-solid, and soft foods since 2014 (20).
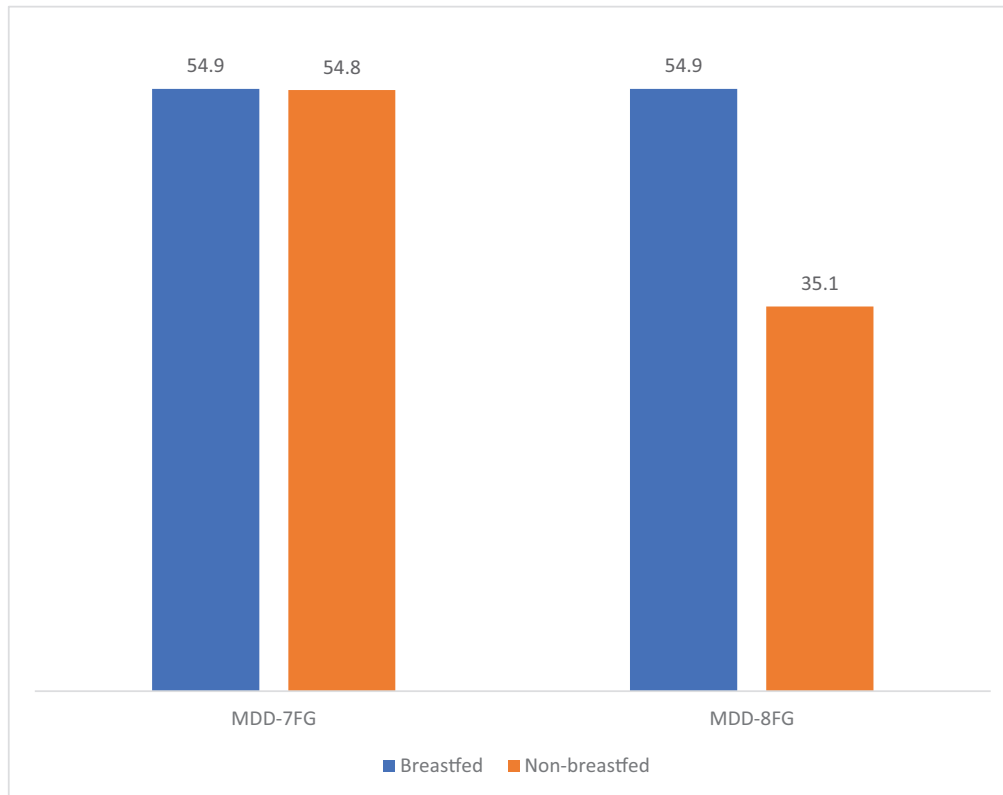
FIGURE 2   Differences in the prevalence of MDD (MDD-7FG and MDD-8FG) between the breastfed and non-breastfed children of 6–23 mo of age. MDD, minimum dietary diversity; MDD-7FG, indicator for consumption of ≥4 out of 7 food groups; MDD-8FG, indicator for consumption of ≥5 out of 8 food groups.

Among the children aged 6–23 mo, the rate of MAD was relatively lower, but it also showed an improvement in the MAD rate in comparison with data available from 2014 (20). The prevalence of timely introduction of complementary feeding and MMF was lower in rural and urban areas than in slum areas. The prevalence of MAD and consumption of iron-rich food were consistently lower in urban areas. These findings indicate the necessity of evaluating the rural and urban populations to improve the complementary feeding practices.

We found that 54.7% of the children could attain MDD (MDD-7FG) at the national level, a tremendous improvement from 2014 (28.8%) (22). There was an increasing trend observed for MDD in Bangladesh (22). Our observed rate of MDD (MDD-7FG) was higher in rural areas in contrast to urban and slum areas. A similar finding has also been previously reported in Bangladesh (22). Families living in rural areas usually raise livestock and have access to ponds for fish and green leafy vegetables, which gives them opportunities for additional food sources. The regional variations in IYCF practices may need to be studied further, which has implications for national nutrition initiatives aiming to encourage better IYCF practices in areas where they are required. Migration of the rural population to urban areas may impact the feeding practices of the children. In the long run, improvement in education and awareness can improve infant and child feeding practices. Bangladesh has a high rate of childhood infectious diseases (23). Therefore, accel-

erating optimal breastfeeding is critical as optimal breastfeeding is protective against infectious diseases (24).

Despite improvements in meeting the MDD in Bangladesh, there is still an alarmingly low adherence to WHO recommendations, which indicates the necessity to facilitate improvements in IYCF practices. The estimated prevalence of MDD-7FG was 54.7% and of MDD-8FG was 46.2%. The observed difference between MDD-7FG and MDD-8FG was −8.5 percentage points. The shift of MDD estimation from the old method to the new method involved 2 changes: the addition of breast milk as a separate food group and the cutoff changes from 4 to 5 food groups. These revisions resulted in distinct changes in the prevalence of MDD. The prevalence of MDD-8FG compared with MDD-7FG was lower at the national level, at the regional level, and at divisional levels in Bangladesh. This difference is more pronounced among the older children (12–23 mo) in urban areas, in the Dhaka division, among uneducated mothers, in small families, and among the children from middle-class families. A recently conducted multicountry study found a lower MDD rate when MDD-8FG was used in eastern and southern African countries (25). We noticed that the prevalence of MDD-7FG did not differ between breastfed and non-breastfed children. As the MDD-7FG did not include breast milk, therefore, adding breast milk in the food group did not have any effect on the prevalence of MDD-7FG. Due to this reason, comparing MDD-7FG between

breastfed and non-breastfed children is problematic. For MDD-8FG, the low prevalence among non-breastfed children compared with breastfed children indicates the discontinuation of breastfeeding for children aged 6–23 mo.

Breast milk is not a complementary food; however, breastfeeding up to 2 y has some nutritional value for the breastfeeding child (26). MDD-7FG excluded an essential diet component; furthermore, the MDD calculation was different for breastfed children and non-breastfed children. The cutoff value for MDD-7FG was ≥4 for both breastfed and non-breastfed children, whereas a non-breastfed child was favored as infant formula was included in the MDD-7FG dietary list. The updated MDD-8FG can be viewed as an ideal indicator that removes that advantage for non-breastfed children. MDD-8FG adds 1 point for breast milk and another point for dairy if the child is consuming both. Another IYCF indicator, MAD, is also based on MDD. Since MAD requires milk feeds for a non-breastfed child, having breast milk as a food group will simplify the calculation of MAD. After adding breast milk as a food group in MDD-8FG, we observed a 10-percentage-point decrease in MDD-8FG among 12–23-mo-old children compared with 6–11-mo-old children, which likely reflects the cessation of the continuation of breastfeeding among the older age group and our findings of the prevalence of MDD-8FG between breastfed and non-breastfed children support this. It is recommended to redesign the existing nutrition programs in Bangladesh to accelerate the continuation of breastfeeding up to age 2 y. Intervention could involve measures such as flexible work schedules and workplaces that are breastfeeding-friendly. Health care professionals can play a crucial role by encouraging mothers to continue breastfeeding.

The shift to the new MDD-8FG will have important implications for monitoring the country-level progress as many programs and strategies promote the IYCF practices. The majority of the programs rely on point estimates for the baseline survey and monitoring progress, which means that the percentage-point differences between the MDD-8FG and MDD-7FG will have meaningful consequences. Furthermore, to perform a trend analysis of MDD, it is necessary to consider this change in Bangladesh and elsewhere. The global nutrition policymakers faced a similar transition when the National Center for Health Statistics for calculating anthropometric indicators was replaced by the introduction of the WHO Growth Standards 2006 (27). It took several years for countries to start using the revised standards. Lessons learned from this transition can be applied to adapt to the new MDD definition. There is no evidence that MDD-8FG has been adopted in Bangladesh at the country level and by the stakeholders. Training and advocacy programs need to be initiated to ensure that the MDD-8FG indicator is well understood and adopted throughout the country to ensure the diet quality of young children. Further research is necessary to identify the association of childhood growth status and other health and well-being indicators with the MDD-8FG compared with the MDD-7FG and validate the MDD-8FG in different settings throughout the country.

The study's main strength is its broad geographic coverage, enabling the findings to apply to Bangladesh's entire 0–23-mo-old age group. In addition, it is the first study in Bangladesh that reports the changes in the prevalence of MDD with the changes in the MDD definition. However, the study has a few limitations. All dietary data were collected using interviews, which are susceptible to recall bias. This study only focused on the changes in MDD. A revised set of IYCF indicators has been recently published by WHO, which should be investigated further.

In conclusion, global policymakers often fail to recognize the importance of optimal breastfeeding practices on childhood undernutrition. These result in a lack of implementation, monitoring, and funding for the proper implementation of IYCF practices. The low prevalence of IYCF indicators from our study suggests that effective strategies for effective IYCF practices should be implemented to improve child health. The addition of breast milk and the low prevalence of MDD-8FG show that the breastfeeding programs need to highlight how the indicator should be interpreted at the country level and disseminate its beneficial implications for enhancing proper child feeding and nutrition.

Data Availability

Data are available upon reasonable request. All requests can be sent to the Institutional Review Board, BRAC James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh, to the following e-mail address: irb-jpgsph@bracu.ac.bd.

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