A comparison of minimum dietary diversity in Bangladesh in 2011 and 2014

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Abstract

Improving infant and young child feeding practices is critical for improving growth and reducing child mortality and morbidity. This paper aims to compare predictors of minimum dietary diversity, an important indicator of adequate complementary feeding practices, in Bangladesh in 2011 and 2014. The 2011 and 2014 Bangladesh Demographic and Health Survey were used to examine predictors of minimum dietary diversity among 6–23 months. An additional analysis was conducted for the 18–23-month group, because a significant increase in meeting minimum dietary diversity recommendations was seen in this age group only. Factors found to be associated with practices were compared across time points. In 2011, minimum dietary diversity was 23.8% and increased to 28.8% in 2014. Among children 18–23 months, in 2011, minimum dietary diversity was 32.5% and increased to 42.8% in 2014. Among all children, wealth, education, exposure to media, and antenatal care were significant predictors of dietary diversity. In the 18–23-month age group, significant predictors in 2011 were wealth and decision making. In 2014, significant predictors were education and exposure to media. Demographic trends indicated a significant increase in education and exposure to media between 2011 and 2014. As these were significant for minimum dietary diversity in 2014 overall and for 18–23 months, they might be important targets of future interventions, specifically utilizing media channels and tailoring special strategies for women with low education and limited exposure to media.

KEYWORDS

Bangladesh, complementary feeding, minimum dietary diversity

1 | INTRODUCTION

It is well known that the first 1,000 days of life provide a window of opportunity to prevent child deaths and contribute to healthy fetal development, growth, and brain development (World Health Organization [WHO], 2004). Poor child feeding practices, including inadequate quality of complementary foods have serious consequences for growth, development, illness, and survival of children (Saha et al., 2008). Insufficient consumption of complementary foods beginning at 6 months can stunt growth, and as many as 6% of under-5, deaths can be prevented by ensuring quality complementary foods (Black, Morris, & Bryce, 2005; Kabir et al., 2012). The transition from

exclusive breastfeeding to complementary foods during 6 to 24 months of age is a vulnerable period. It is the time when malnutrition starts in many infants, contributing significantly to the high prevalence of malnutrition in children under 5 years of age worldwide (WHO, 2017). Undernutrition of children, particularly in developing countries, contributes to high rates of under-5 mortality, as well as longer term, intergenerational effects such as loss of productivity (Khanal, Sauer, & Zhao, 2013a).

One of the criteria for complementary feeding developed by the WHO is minimum dietary diversity or giving foods from four or more complementary food groups (grains; legumes/nuts; dairy products; flesh foods; eggs; fruits; and vegetables) to infants 6–23 months (Kabir

et al., 2012; WHO, 2004). In Asia, minimum dietary diversity ranges from 15% in India, to 34% in Nepal and 71% in Sri Lanka (Senarath et al., 2012). In Bangladesh, specifically, minimum dietary diversity is low, at 41.9%. However, minimum dietary diversity drops to 19.8% in 6–11 month olds and nearly triples to 59.7% in 18–23 month olds (Kabir et al., 2012). Meeting this minimum standard for nutrition is a challenge, particularly in developing countries where financial and food insecurity is prevalent. Furthermore, comprehensive educational programs are often lacking that would educate caretakers on appropriate quality of complementary nutrition. As complementary feeding is one of the most effective interventions to reduce stunting within the first 2 years of life, understanding factors associated with inappropriate feeding patterns are needed in order to develop comprehensive educational approaches to improve child health (Kabir et al., 2012; Roy & Khatoon, 2015). Bangladesh has some of the highest malnutrition rates in the world in part due to a lack of appropriate, complementary nutrition. Over half of children preschool-age (41.3%) are stunted, 33% are underweight, and 15.6% are wasted (United Nations Children's Fund, 2016). Given the high rates of malnutrition, stunting, underweight, and wasting in Bangladesh, better understanding factors influencing minimum dietary diversity can be critical for improving child health and well-being.

Previous studies have found several factors to be strongly associated with minimum dietary diversity and, ultimately, child nutrition. Kabir et al. (2012) found that mothers who had no education had a higher risk for not introducing timely complementary food and not meeting minimum dietary diversity. This is supported by other studies demonstrating that mothers with higher levels of education were significant predictors of appropriate complementary feeding practices (Pandey et al., 2010; Senarath, Dibley, & Agho, 2010). Affluence impacts feeding practices as well, as children from lower household wealth categories are less likely to have adequate diversity in their diet (Senarath et al., 2012). Finally, access to antenatal care during pregnancy is indicative of meeting minimum dietary diversity; attending fewer antenatal visits during pregnancy is associated with not meeting recommendations for dietary diversity (Senarath et al., 2012); possibly a sign of maternal competence or comprehensive antenatal care with education activities that include infant and young child feeding.

Furthermore, women's role in households and women's empowerment are associated with maternal and child health outcomes including infant and young child feeding practices. Women's empowerment refers to "the expansion of people's ability to make strategic life choices in a context where this ability was previously denied to them" (Kabeer, 1999) and women's ability to influence decision making in social, economic, familial, and legal dimensions (Lee-Rife, 2010). Previous studies have shown that different dimensions of women's empowerment such as decision making, land ownership, and employment are associated with better child feeding practices and child nutrition including minimum dietary diversity, minimum meal frequency, minimum acceptable diet (Na, Jennings, Talegawkar, & Ahmed, 2015), and expenditures on children's needs and education (Agarwal, 2002; Allendorf, 2007; Quisumbing & de la Briere, 2000) in many developing countries. Specific to South Asia, studies have also shown that women's empowerment in the household is related to

Key messages

- Minimum dietary diversity increased between 2011 and 2014, with the greatest changes seen in 18–23 months.
- Wealth, exposure to media, and antenatal care were significant predictors of dietary diversity.
- Future interventions may be successful using media channels to promote adequate minimum dietary diversity.

better nutritional outcomes for children (Cunningham, Ruel, Ferguson, & Uauy, 2015).

Women's empowerment is conceptualized through several constructs including familial, interpersonal, and economic empowerment. Familial and interpersonal empowerment is often characterized by women's decision-making power regarding interpersonal of family affairs (Na et al., 2015). Among the many aspects of empowerment, decision making shows consistent associations with a decreased risk of stunting (Diane & Anu, 2009), increased length-for-age (Shroff et al., 2011), and increased weight-for-age (Aslam & Kingdon, 2012). For instance, Desai and Johnson (2006) found that maternal involvement in at least one decision (health care, large household purchases, daily household purchases, and decision to visit friends/relatives) had children with higher height-for-age scores in India. Decision making and women's position in the household were also found to be a significant predictor of weight-for-age (Kavita, Richard, & Keith, 2006). Related to women's empowerment, access to information (e.g., television, radio, and newspaper) is also associated with better infant and child nutrition outcomes, as less frequent exposure to media (e.g., television, radio, and newspaper) has been associated with inadequate dietary diversity (Senarath et al., 2012; Bangladesh Demographic and Health Survey [BDHS], 2013).

In light of the importance of appropriate infant and young child feeding practices the suboptimal proportion of children meeting minimum dietary diversity and the notable consequences of malnutrition in Bangladesh, the goal of this study was to examine changes in dietary diversity between 2011 and 2014 in Bangladesh. Additionally, we examined which factors related to women's empowerment (e.g., decision making, employment, and access to information), maternal characteristics (e.g., education and antenatal practices), and household (e.g., wealth) were associated with minimum dietary diversity. Although there is some evidence of the importance of these predictors for infant and young child feeding practices, few studies have comparatively examined their impact in Bangladesh using recent, representative, countrywide data, and to our knowledge, no studies have investigated factors associated with change in minimum dietary diversity in Bangladesh in recent years. Here, we used the 2011 and 2014 BDHSs, which offer a rich and comprehensive source of data to examine the relationship between maternal and household characteristics and minimum dietary diversity over two time points. The purpose of this study was to understand factors associated with minimum dietary diversity among children 6–23 months in 2011 and 2014.

2 | METHODS

2.1 | Data

The current cross-sectional data came from two waves of the BDHS in 2011 and 2014. BDHS uses a sampling frame from the list of enumeration areas designated by the 2011 Population and Housing Census of the People's Republic of Bangladesh, provided by the Bangladesh Bureau of Statistics. Enumeration areas are the primary sampling unit and contain approximately 120 households. The 2011 and 2014 BDHS used a two-stage stratified sample of public and private households. Data from 2011 BDHS were collected in May 2011 and May 2014 for the 2014 BDHS report. Details of the sampling strategy are published elsewhere (BDHS, 2013, 2016). Briefly, trained field workers conducted face-to-face interviews with adult members of 17,511 households in 2011 and 17,300 in 2014. Women ages 12–49 were eligible to answer questionnaires on reproductive history, infant and young child feed practices, antenatal care, fertility preferences, and so forth. Background information was also collected for each participant (e.g., age, education, place of residence, and wealth; BDHS, 2013, 2016).

2.2 | Minimum dietary diversity

Minimum dietary diversity was defined as giving children 6–23 months at least four of seven food groups in the past 24 hr. The food groups included grains; legumes/nuts; dairy products; flesh foods; eggs; fruits; and vegetables. Dichotomous indicators for whether children were given food from each food group were created (1 = yes; 0 = no), for a total of seven indicators, one for each complementary food group. A separate indicator was created for minimum dietary diversity (1 = *received food from 4+ groups*, 0 = *received food from <4 groups*). This indicator was created for 2011 and 2014 and was the dependent variable of interest for the analysis.

2.3 | Women's empowerment

Women's empowerment is a multidimensional construct with many different aspects. In the Demographic and Health Survey, variables that were used as proxies for women's empowerment include involvement in decision making, employment, and access to information via radio, newspaper, and television. These variables were selected based on the previous literature (Kabir et al., 2012; Senarath et al., 2012; Senarath et al., 2010). A decision-making scale was created based on women's involvement in decisions regarding (a) health care; (b) household purchases; (c) visiting family and friends; and (d) who spends the respondent's earnings. This scale ranged from 0 to 4 based on the number of decisions in which respondents were involved. A binary variable measuring employment was developed (0 = *not employed in the last 12 months*; 1 = *employed in the last 12 months*). Due to the limited proportion of respondents who worked in the last 12 months, any type of employment (e.g., part-time, seasonal, or full time) was considered "employed" for the purposes of the recoded variable. Finally, three separate binary variables were created indicating whether women had accessed radio, television, and newspapers at least once per week (0 = no; 1 = yes).

2.4 | Antenatal and delivery practices

Two indicators were used as proxies of antenatal and delivery practices. Women were asked how many antenatal visits they attended during their pregnancy, which was treated as a continuous predictor variable. Women were also asked where delivery took place for their last birth (e.g., home, hospital, birthing centre, etc.). This was recoded as a binary variable: delivered in a health facility (including hospitals, birthing centres, health clinics, etc.) or delivered at home.

2.5 | Covariates

Other covariates examined included education, wealth, infant age group, and region of residence. Education was dummy-coded into three categories: no education, primary education, and secondary education or higher. Wealth was assessed using the Demographic and Health Survey indicator and dummy-coded into three categories: lower wealth status (bottom 33%), middle wealth status, and upper wealth status (upper 33%). Infant age was reported in months and grouped into one of the following categories: 6–8, 9–11, 12–17, and 18–23 months. Finally, type of residence was assessed by BDHS classifications of urban and rural.

2.6 | Statistical analysis

2.6.1 | Descriptive statistics

Prevalence of minimum dietary diversity was compared between age groups in 2011 and 2014 to determine how the indicated varied by age group. The proportion meeting standards for minimum dietary diversity only changed significantly in the 18–23-month old group; thus, the final analysis focused on complementary feeding of four or more food groups overall in infants 6–23 months and specifically in infants 18–23 months. We also examined the proportion of children fed from each of the complementary food groups in 2011 and 2014 to see if complementary feeding from certain food groups changed over time.

2.6.2 | Bivariate analysis

Bivariate analyses, including chi squared analyses and *t*-tests, were conducted to examine relationships between the aforementioned variables and minimum dietary diversity in 2011 and 2014. Variables that were significant in bivariate analyses were included in the final logistic regression model. After significant bivariate associations were identified, the researchers compared the variables between 2011 and 2014 to examine whether the distribution of these variables differed significantly in the two samples. The final predictors chosen based on bivariate results were decision making, frequency of watching television, frequency of reading the newspaper, education, wealth index, place of delivery, number of antenatal visits, employment, infant age group, and type of residence. Mean level of education ($t = 7.43$; $p < .001$), frequency of watching television ($t = 25.54$; $p < .001$), number of antenatal visits ($t = 9.31$; $p < .001$) were all significantly greater in 2014 than in 2011. No significant differences existed between the other variables in 2011 and 2014. The sample composition of the different age groups was similar in 2011 and 2014, with a mean age of 14 months ($SD = 5.1$) in 2011 and 14 months ($SD = 5.1$) in 2014.

2.6.3 | Multivariable analysis

Data were weighted using the svy set command in STATA to estimate prevalence and confidence intervals accounting for cluster sampling design. Binary logistic regression was used to determine factors associated with complementary feeding in 2011 and 2014. We used a framework of variables to guide the analysis and individually examined each model. Odds ratios (OR) were computed to assess adjusted risk of independent variables. Statistical significance was determined with a p value of $< .05$. The researchers examined significant factors in 2011 and 2014 to understand which variables may have contributed to a change in complementary feeding between the two years. All analyses were conducted with STATA 14.

3 | RESULTS

3.1 | Infants 6–23 months

A total of 2,264 infants 6–23 months in 2011 and 2,238 in 2014 were included in the analysis. Prevalence of minimum dietary diversity in 2011 was 23.8% ($n = 539$) and in 2014 was 28.8% ($n = 645$; see Figure 1). There was a significant increase in complementary feeding of dairy ($X^2 = 5.46$; $p < .05$) and grains ($X^2 = 5.06$; $p < .05$) in 6–23 month between 2011 and 2014 (see Table 1).

In 2011, women who attained secondary education or higher (OR = 1.91; 95% CI [1.25, 2.63]) were more likely meet dietary diversity than women with no education. Women in the middle (OR = 1.39;

FIGURE 1 Proportion of children meeting recommendations for minimum dietary diversity

95% CI [1.04, 1.93]) and highest (OR = 1.80; 95% CI [1.31, 2.39]) wealth categories had greater odds of meeting minimum dietary diversity than those in the lowest wealth index. Reading the newspaper at least once per week (OR = 1.56; 95% CI [1.09, 2.46]) was associated with greater odds of minimum dietary diversity as well. Delivery in a health care facility significantly predicted minimum dietary diversity (OR = 1.36; 95% CI [1.03, 1.64]). Involvement in more household decisions (OR = 1.14; 95% CI [1.06, 1.25]) and attending a greater number of antenatal visits (OR = 1.07; 95% CI [1.01, 1.13]) were associated with children meeting minimum dietary diversity. Finally, infants who were older were more likely to be fed food from four or more complementary food groups (OR = 1.88; 95% CI [1.61, 2.15]; see Table 2).

In 2014, women who attained secondary education or higher (OR = 2.28; 95% CI [1.58, 3.27]) were more likely meet dietary diversity than women with no education. Reading the newspaper at least once per week (OR = 2.35; 95% CI [1.57, 3.51]) was associated with greater odds of minimum dietary diversity as well. Finally, age of the infant was positively associated with minimum dietary diversity (OR = 1.97; 95% CI [1.78, 2.20]).

3.2 | Infants 18–23 months

A total of 661 infants 18–23 months in 2011 and 670 infants 18–23 months in 2014 were included in the analysis. Prevalence of minimum dietary diversity was 32.5% ($n = 215$) in 2011 and 42.8% ($n = 287$) in 2014, which was significantly different ($t = -2.88$; $p < .01$) from the prevalence in 2011 (see Figure 1). There was a significant increase in complementary feeding of grains ($X^2 = 13.6$; $p < .001$) between 2011 and 2014 (see Table 1).

In 2011, being in the highest wealth index category was positively associated with meeting minimum dietary diversity compared with individuals in the lowest wealth category (OR = 2.35; 95% CI [1.42, 3.94]). Women who were more involved in decision making were also more likely to report meeting minimum dietary diversity for their child (OR = 1.16; 95% CI [1.00, 1.34]). Finally, women in rural regions were more likely to meet minimum dietary diversity standards (OR = 1.54; 95% CI [0.996, 2.33]). In 2014, education, frequency of reading the newspaper, and antenatal visits were associated with minimum dietary diversity. Women with secondary education or higher were more likely to have children meeting minimum dietary diversity compared with women with no education (OR = 2.58; 95% CI [1.49, 4.44]). Additionally, women who read the newspaper at least once per week

TABLE 1 Proportion of children receiving food from each complementary food group

Age group (months)	Year	Dairy	Grains	Vitamin A rich foods	Other fruits and veggies	Eggs	Meat	Legumes	Total (N)
18–23	2011	28.1%	87.9%	42.8%	29.9%	28.4%	58.6%	55.7%	661
	2014	34.3%	88.2%	49.9%	31.9%	37.6%	22.1%	57.3%	670
	X^2	0.21	13.6***	0.91	0.14	0.67	1.13	0.37	
6–23	2011	23.6%	75.9%	34.3%	23.1%	26.6%	43.3%	44.9%	2,264
	2014	31.2%	77.0%	38.3%	23.7%	29.2%	15.5%	44.7%	2,238
	X^2	5.46*	5.06*	0.91	.012	2.99	2.61	1.71	

* $p < .05$

** $p < .01$

*** $p < .001$

TABLE 2 Logistic regression for minimum dietary diversity 6–23 months

	2011 (n = 2,264)			2014 (n = 2,238)		
Predictor	OR	95% CI		OR	95% CI	
Education						
No education *Ref*						
Primary education	1.36	0.935	2.00	1.36	0.934	1.98
Secondary + education	1.91**	1.25	2.63	2.28***	1.58	3.27
Wealth index						
Lowest wealth category *Ref*						
Middle wealth category	1.39*	1.04	1.93	0.959	0.716	1.28
Highest wealth category	1.80***	1.31	2.39	1.15	0.857	1.54
Frequency of television						
<1 time per week *Ref*						
>1 time per week	1.12	0.841	1.38	1.09	0.858	1.40
Frequency of newspaper						
<1 time per week *Ref*						
>1 time per week	1.56*	1.09	2.46	2.35***	1.57	3.51
Decision making	1.14**	1.06	1.25	1.01	0.932	1.08
Place of delivery						
Home birth *Ref*						
Health facility	1.30*	1.03	1.64	1.04	0.990	1.08
Number of antenatal visits	1.07*	1.01	1.13	1.03	0.995	1.05
Employment						
Unemployed *Ref*						
Employed	0.731	0.575	1.27	1.21	0.950	1.54
Region of residence						
Urban *Ref*						
Rural	1.01	0.750	1.21	1.15	0.913	1.47
Infant age group	1.88***	1.61	2.15	1.97***	1.78	2.20

* $p < .05$ ** $p < .01$ *** $p < .001$

(OR = 3.02; 95% CI [1.34, 6.76]) compared with women who did not read the newspaper were more likely to meet minimum dietary diversity. Lastly, women in rural regions also had greater odds of meeting minimum dietary diversity (OR = 1.55; 95% CI [1.04, 2.31]; see Table 3).

4 | DISCUSSION

The present study used minimum dietary diversity as the main outcome variable, specifically examining factors that may explain the increase in prevalence of minimum dietary diversity between 2011 and 2014. Because we were also interested in examining predictors of minimum dietary diversity in 2011 and 2014 in specific age groups, we focused on the 18–23-month age group, as minimum dietary diversity significantly increased between these two time points in this age group alone. Prevalence of minimum dietary diversity for infants 6–23 months was 23.8% in 2011 and 28.8% in 2014, which is lower than previously reported rates (Kabir et al., 2012), and situates Bangladesh between other Asian countries such as India, with minimum dietary diversity reported as low as 15%, and Sri Lanka, at 71% (Senarath et al., 2012). In addition to a

significant increase in minimum dietary diversity, significantly more infants consumed dairy, vitamin A rich foods, and eggs in 2014 than 2011, which may have contributed to the increase in the proportion of infants receiving foods from four or more complementary food groups.

Using the Demographic and Health Survey, we found that significant predictors of minimum dietary diversity in infants 6–23 did indeed change between 2011 and 2014. In 2011, wealth and maternal education were significantly associated with minimum dietary diversity, which complements other studies (Pandey et al., 2010; Senarath et al., 2010; Senarath et al., 2012). Additionally, antenatal care and delivering in a health facility are often a significant predictor appropriate complementary feeding, as we found in 2011; women who more frequently attend antenatal and deliver in a health facility visits may have received more comprehensive education about infant nutrition and care (Senarath et al., 2012). Women who attend more antenatal visits often tend to have more empowerment regarding their health care and their children's, which is linked with better feeding practices (Jennings et al., 2014). Other dimensions of women's empowerment such as decision making and exposure to newspaper were significantly associated with minimum dietary diversity in infants 6–23 months. There is relatively consistent evidence about the association between

TABLE 3 Logistic regression for complementary feeding 18–23 months

Predictor	2011 (n = 661)			2014 (n = 670)		
	OR	95% CI		OR	95% CI	
Education						
No education *Ref*						
Primary education	1.45	0.803	2.66	1.25	0.706	2.21
Secondary + education	1.53	0.934	3.13	2.58**	1.49	4.44
Wealth index						
Lowest wealth category *Ref*						
Middle wealth category	1.27	0.763	2.10	1.16	0.716	1.86
Highest wealth category	2.35**	1.42	3.94	1.57	0.960	2.58
Frequency of television						
<1 time per week *Ref*						
>1 time per week	1.31	0.848	1.97	0.795	0.532	1.19
Frequency of newspaper						
<1 time per week *Ref*						
>1 time per week	1.84	0.894	3.75	3.02**	1.34	6.76
Decision making	1.16*	1.00	1.34	0.976	0.862	1.11
Place of delivery						
Home birth *Ref*						
Health facility	0.962	0.614	1.46	0.999	0.985	1.05
Number of antenatal visits	1.07	0.967	1.19	1.06	0.986	1.15
Employment						
Unemployed *Ref*						
Employed	1.06	0.575	1.77	1.20	0.983	1.47
Region of residence						
Urban *Ref*						
Rural	1.54*	0.996	2.33	1.55*	1.04	2.31

* $p < .05$ ** $p < .01$ *** $p < .001$

decision making and exposure to media (Agarwal, 2002). We also found that as infants got older, they experienced greater odds of minimum dietary diversity. Other studies have found that children in younger age groups are less likely to meet standards for acceptable complementary feeding (Khanal, Sauer, & Zhao, 2013b).

We also investigated determinants in the 18–23-month age group as this age bracket showed a significant increase in meeting minimum dietary diversity between 2011 and 2014. In 2011, wealth and decision making were significant predictors, whereas in 2014, education and exposure to information via media (e.g. newspaper) were significant predictors. The shift in predictors is consistent with the demographic shift in Bangladesh between 2011 and 2014, in which education and frequency of reading the newspaper increased; in this same time period, minimum dietary diversity overall, and specifically in 18–23 month olds, also increased as well. It could be that as more women become empowered and have greater access to resources such as education, media, and health care, minimum dietary diversity in children increases as women become more informed. This is consistent with past examinations showing that women's empowerment is associated with complementary feeding (Cunningham et al., 2015; Na et al., 2015). Moreover, education is consistently noted as a predictor of meeting complementary feeding practices including minimum

dietary diversity (Khanal et al., 2013a; Roy & Khatoon, 2015; WHO, 1992). Typically, countries with higher rates of maternal education have better complementary feeding practices (Senarath et al., 2012), thus as the level of education in Bangladesh increased, it is not surprising that minimum dietary diversity did as well.

Adequate exposure to media (i.e., reads newspaper at least once per week) was linked with meeting dietary diversity recommendations. This same result has been found in other countries as well, such as India and Sri Lanka (Senarath et al., 2012). Exposure to media has also recently emerged as an important predictor of women's empowerment, which is ultimately linked with better health outcomes (Gupta & Yesudian, 2006). Media exposure is thought to be an important source of women's empowerment as it acts as a “catalyst for activities that increase women's access to and control over resources” (Gupta & Yesudian, 2006). Additionally, Alive & Thrive conducted an intensive infant and young child feeding media campaign during 2011–2014 (Menon et al., 2016).

Within the 18–23-month group in 2011, the significant predictors of minimum dietary diversity were decision making and wealth, which is consistent with previous studies as well (Allendorf, 2007; Quisumbing & de la Briere, 2000). Despite their importance for predicting dietary diversity in 2011, these variables were not significantly associated with the outcome variable in 2014. Due to increases

in education and exposure to information via media between 2011 and 2014, the increase in minimum dietary diversity, and the positive association between these variables and diet diversity, it is possible that shifts in these factors between 2011 and 2014 contributed to the rise in the proportion of infants 18–23 months meeting minimum dietary diversity. However, this should be interpreted with caution as we cannot determine this conclusively from the current data.

Finally, we found that living in rural regions was a protective factor for minimum dietary diversity. This needs to be explored further and could be related to more expensive sources of food in urban areas and less access by mothers to home grown produce in urban regions. Families in rural regions can feasibly raise livestock or produce with relatively low inputs, providing access to additional food sources (Stewart, Iannotti, Dewey, Michaelsen, & Onyango, 2013). In Bangladesh, access to small pond fish and wild greens is widespread in rural areas.

It is interesting that the significant predictors were slightly different when examining 6–23 months versus 18–23 months. This suggests that important factors influencing minimum dietary diversity possibly change across age groups. If this is the case, messaging should be tailored for mothers with infants of different ages. Based on this study, these efforts could focus on education, media exposure, and region of residence, particularly targeting women in urban areas as they had lower odds of meeting minimum dietary diversity.

This study provides evidence that maternal education, exposure to media, women's empowerment, and infant age are significant factors that were consistently associated with minimum dietary diversity in infants 6–23 months and the specific 18–23-month age group. These may be important factors to consider and initiatives continue to strive for improvement in promoting adequate dietary diversity in infants and young children.

Despite improvements in meeting minimum dietary diversity in Bangladesh, there is still an alarmingly low level of adherence to WHO recommendations, which merits increased attention to facilitate improvements in the health of infants and young children. This analysis can be used as a baseline to set future goals and objectives, as well as targets of future and current health programs. The determinants that may be associated with an increase in feeding have been noted consistently in other studies and can be used to target interventions—for instance, focusing on children of uneducated women or women without access to media. These findings are relevant to researchers and can help them design and evaluate interventions in subgroups to better increase adherence to recommendations for dietary diversity. Across several countries, the use of peer counselling, mass media delivery, community mobilization, and policy advocacy have had positive effects on infant and young child feeding practices across a wide range of diverse settings (Menon et al., 2016). Extending these strategies further to focus on women with low education, poor media exposure, and lack of access to antenatal care may prove beneficial to increasing dietary diversity among infants in the future.

4.1 | Limitations

The main limitations of this study were the cross-sectional nature and the use of 24-hr recall data for dietary diversity. Particularly as we were examining changes in dietary diversity between two time points,

our findings are limited by the fact that we explored two cross-sectional surveys as opposed to a panel study of the same individuals. Given that the research question pertained to infants in a very specific age bracket, longitudinal data using the same individuals would not have provided sufficient information from two distinct time points. Furthermore, the 24-hr recall based on maternal recall has the potential for response bias, such as social desirability and errors in recall. Finally, because this was a secondary analysis, we were limited in the measurements available for women's empowerment. Although decision making is an often-used proxy for aspects of women's empowerment, there are other aspects such as agency and social support that we were unable to account for. Future studies could expand on these, and previous, results by broadening the types of measures used to operationalize women's empowerment to create a more comprehensive view of its impact on maternal and child health. Additionally, future scales measuring decision making over infant and child feeding could be developed. Despite these limitations, the researchers did conduct the appropriate statistical adjustments to account for survey design and sampling to strengthen the validity of the study.

5 | CONCLUSION

In conclusion, minimum dietary diversity was not adequate among children 6–23 months in Bangladesh, despite improvements from 2011 to 2014. Significant predictors encompassed many aspects of women's empowerment such as decision making and exposure to media and education. This study suggests that these can be possible targets of future interventions to improve minimum dietary diversity in Bangladesh. A variety of strategies, such as peer counselling and community mobilization, can be used to target groups with suboptimal dietary diversity such as uneducated women, women with low exposure to media, and women in poorer wealth categories while continuing to provide programs that cover the entire population.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

SB conducted the data analysis and drafted the manuscript. TS conceived of the study and provided guidance throughout the analysis and drafting of the paper.

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