Trends in Complementary Feeding Indicators and Intake from Specific Food Groups among Children Aged 6–23 Months in Bangladesh

Sabuj Kanti Mistry 1,2,3,4,*, Md Belal Hossain 1,5, Nafis Md Irfan 6,7,8, Manika Saha 9, Silvia Saberin 10, Abu Ahmed Shamim 11 and Amit Arora 12,13,14,15

Abstract: The present study aims to comprehensively analyse trends in complementary feeding indicators (Introduction of solid, semi-solid, and soft foods at 6–8 months (INTRO), Minimum Dietary Diversity (MDD), Minimum Meal Frequency (MMF) and Minimum Acceptable Diet (MAD)) among children aged 6–23 months in Bangladesh. The study used data from four rounds (2007, 2011, 2014, and 2017–2018) of nationally representative Bangladesh Demographic and Health Surveys (BDHSs). The Cochran–Armitage test was performed to capture the trends in complementary feeding practices and intake from specific food groups. BDHSs are periodically conducted cross-sectional surveys in all seven administrative divisions of Bangladesh. The present analysis was performed among 8116 children (1563 in 2007, 2137 in 2011, 2249 in 2014, and 2167 in 2017–2018) aged 6–23 months. Overall, a decreasing trend was observed in all the complementary feeding indicators except INTRO from 2007 to 2014, but a substantial increase in MDD, MMF and MAD was noted in 2017–2018. A statistically significant reduction in consumption from different food groups such as legumes and nuts (p < 0.001), dairy products (p = 0.001), vitamin-A-rich fruits or vegetables (p < 0.001), and other fruits and vegetables (p < 0.001) was also observed. However, a positive trend was noted in the consumption of grains/roots/tubers (p = 0.027), and meat/fish/egg (p < 0.001). After experiencing a significant decreasing trend during 2007–2014, the recent BDHS indicates improvements in all complementary feeding indicators among young children in Bangladesh, which calls for integrated, multisectoral, and multicomponent interventions to sustain this progress.

Keywords: complementary feeding; infant and young child feeding; minimum acceptable diet; minimum dietary diversity; minimum meal frequency
1. Introduction

Malnutrition is among the significant public health challenges among young children in low- and middle-income countries. According to the World Health Organization, around 45% of the deaths are attributed to nutrition-related factors among children aged less than five years [1]. The first 1000 days of life is recognised as the ‘critical window’ for optimal growth and development for a child [2]. It is well established that initiation of breastfeeding within the first hour of birth and exclusive breastfeeding to 6 months of life can protect the infant from various infectious diseases and reduce the risk of neonatal mortality [3]. However, children are at an increased risk of malnutrition after 6 months of life as, at this stage, the mother’s milk alone is no longer sufficient to meet the energy and nutritional requirements for infants [4]. This transition from exclusive breastfeeding to family foods, starting around the period of 6 months of age and continuing until 24 months, is referred to as complementary feeding [3]. There is an estimate that 6% of all deaths in children under the age of 5 years in developing countries can be prevented if appropriate complementary feeding practices are followed [5]. Therefore, timely introducing complementary feeding and giving nutritionally adequate and safe complementary foods starting at the period of six months is recommended by the World Health Organization (WHO) [6].

Late introduction and inadequate quantity of complementary feeding can result in faltered physical growth and cognitive development among infants [7,8]. Additionally, inappropriate complementary feeding practices have been found as a determinant of increased malnutrition outcomes (such as wasting, stunting and underweight) and under-5 child mortality worldwide [9,10]. If a child remains malnourished during this period, it results in a compromised immune system and a higher risk of severe infectious diseases including diarrhoea and pneumonia [11,12]. Malnutrition during these young ages can also lead to irreversible adverse effects for the rest of their lives and they may never meet their full physical and intellectual potential [8,13,14].

In Bangladesh, malnutrition continues to be a serious public health problem among young children and still, around one-third of children aged under five years are stunted [15]. Late introduction and inappropriate complementary feeding practices are among the major causes of child malnutrition in Bangladesh [16]. Many underlying and immediate causes of malnutrition are related to food insecurity and inappropriate feeding practices, which are often compounded by socio-economic and political contexts [8]. Previous studies have shown different socio-economic and individual factors influence complementary feeding practices among young children in Bangladesh [16–18]. In addition, factors such as women’s empowerment, exposure to mass media, and antenatal care practices have been associated with young children’s dietary diversity [19].

Considering the importance of infant and young child feeding (IYCF) practices, the Government of Bangladesh has incorporated IYCF in many national health policies and programs such as the health population and nutrition sector development program HPNSDP (2011–2016) [20], second National Plan of Action for Nutrition (NPAN2) (2016–2025) [21] and National Strategy for IYCF in Bangladesh (2007) [22]. In addition, The National Women Development Policy 2011 and National Labour Policy 2012 provide extended maternity leave to support IYCF to their children [23]. Further, implementation of the Baby-Friendly Hospital Initiative, enforcing the Breast Milk Substitutes (BMS) (Regulation of Marketing) Act, helps to protect young children from commercial baby foods and to promote improved IYCF, including exclusive breastfeeding [24].

Bangladesh demographic and health surveys (BDHSs) are periodically conducted nationwide data, which follow a well-established methodology and incorporate large numbers of covariates of IYCF. A recent study [25] analysed four rounds of BDHS data from 2004 to 2014 and found stagnating trends in complementary feeding practices in young children. As new BDHS (2017–2018) data are available, a national-level analysis with updated information will provide essential and updated information for the stakeholders.
Therefore, the present study has been undertaken to analyse the trends in complementary feeding practices among children aged 6–23 months using data from the most recent four rounds of BDHSs, including the most recent one (2007, 2011, 2014 and 2017–2018). The study presents the trends in different complementary feeding indicators and explains the trends in intake of complementary foods from different food groups. Findings from this study will contribute to implementing important and effective initiatives by programme and policymakers to improve complementary feeding practices to combat widespread malnutrition among young children in Bangladesh.

2. Materials and Methods

2.1. Data Sources

Data from the four most recent rounds (2007, 2011, 2014, and 2017–2018) of BDHSs were used in this study. These nationally representative cross-sectional surveys followed a two-stage stratified random sampling design and covered all seven administrative divisions of Bangladesh. The detailed methodology of the respective surveys can be found in the BDHS reports [15,26,27]. BDHS 2007, 2011, 2014, and 2017–2018 collected information from 10,996, 17,749, 17,863, and 20,127 ever-married women aged 15–49 years, respectively, with a response rate of around 98%. Among these 66,735 selected women from four rounds of surveys, 61,716 were usual residents (de jure population), and the remaining were non-residents to certain geographical areas. BDHSs usually collect information about mothers and their children born within five years preceding the survey. For the present analysis, we considered information of a total of 8116 children (1563 in 2007, 2137 in 2011, 2249 in 2014, and 2167 in 2017–2018) aged 6–23 months (see Figure 1).

![Figure 1. Study profile and participants enrolment.](image-url)
2.2. Outcome Measures

We measured the trends in complementary feeding practices using the four indicators recommended by the World Health Organization (WHO) [28]. These include Introduction of solid, semi-solid and soft foods (INTRO); Minimum Dietary Diversity (MDD); Minimum Meal Frequency (MMF); Minimum Acceptable Diet (MAD) for infant and young children. Mothers of children were interviewed regarding these indicators and were asked to recall foods given to their children in the last 24 h preceding the survey date. Brief definitions of the four outcome variables (as per WHO recommendations) are given below; these outcome variables were measured as per the given definitions:

- **Timely introduction of solid, semi-solid and soft foods (INTRO):** the proportion of children between 6 and 8 months of age who received solid, semi-solid or soft foods.

- **Minimum dietary diversity (MDD):** the proportion of children who received at least four or more food groups out of six food groups. Instead of seven food groups recommended by the WHO guidelines, the complementary food items provided in the last 24 h were classified into six food groups in the BDHS data as flesh foods, and eggs were combined as one group. These six groups include (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products; (4) meat/fish/egg; (5) vitamin-A-rich fruits and vegetables; and (6) other fruits and vegetables. It is notable to mention that egg intake was captured separately from the 2011 BDHS. Therefore, trend analysis for egg intake during 2011 to 2017–2018 are also presented in this study.

- **Minimum meal frequency (MMF):** the proportion of children aged 6–23 months (breast-fed and non-breastfed children) who received solid, semi-solid or soft foods the minimum number of times or more in the previous day of the survey. Minimum meal frequency was defined as having at least 2 meals/day for 6–8 months, 3 or more meals/day for 9–23 months old, breastfed children and 4 or more meals/day for non-breastfed children.

- **Minimum acceptable diet (MAD):** the proportion of children aged 6–23 months who received and satisfied both the conditions of minimum dietary diversity and minimum meal frequency.

2.3. Explanatory Variables

Socio-demographic variables considered in this study were: administrative division (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet, and Mymensingh); place of residence (urban/rural); household wealth quintile (poorest, poorer, middle, richer, and richest); child age (6–8 months, 9–11 months, 12–17 months, 18–23 months); child gender (male/female); birth order (1, 2, ≥3); maternal age at child’s birth (<20 years, 20–29 years, ≥30 years); maternal education (no education, grade 1–4, 5–9, and 10 or more); maternal occupation (housewife/working outside); fathers’ education (no education or grade 1–4, 5–9, 10 or more); fathers’ occupation (services holder/business; agriculture-based work, non-agriculture-based work, and others).

The household wealth index was constructed using factor analysis by the DHS team and categorized as poorest, poorer, middle, richer, and richest. The details can be found in BDHS reports [15,26,27]. Body mass index (BMI) for mothers was calculated as weight in kg/(height in meter)$^2$, which was categorized using the Asian cut-off for underweight (BMI < 18.5), normal (18.5–22.9), overweight (23.0–24.9), and obese (≥25.0) [29].

2.4. Statistical Analysis

To assess the distribution of the different variables, we performed descriptive analysis. The Cochran–Armitage test [30,31] was performed to determine the trends of complementary feeding practices among different categories of covariates. All tests were performed at a 5% level of significance. Sampling weights were used in all analyses to ensure the actual representation of the nationwide data. All analyses were performed using the statistical software package STATA (Version 13.0).
3. Results

3.1. Trends in Complementary Feeding Practice

The trends in INTRO among 6–8 months aged children and MDD among 6–23 months aged children in Bangladesh from 2007 to 2018 are shown in Table 1 and Figure 2. The proportion of children aged 6–8 months who received solid, semi-solid or soft foods decreased from 72.8% to 68.0% during the period of 2007 to 2014 and increased to 75.0% in 2017–2018. However, this increasing trend was not statistically significant ($p = 0.505$). Additionally, a nearly steady but insignificant trend in INTRO among children from all groups was observed.

![Figure 2. Trends of recommended infant and young child feeding (IYCF) practices among 6–23 months aged children in Bangladesh, 2007–2018.](image)

The trends of MDD among 6–23 months aged children are also shown in Table 1 and Figure 2. The proportion of MDD reduced from 41.4% to 27.3% from 2007 to 2014 and then increased to 56.7% in 2017–2018, resulting in a significantly increasing trend ($p < 0.001$). Additionally, a significantly increasing trend was observed in all strata except that of the Rajshahi Division, where a not significantly increasing trend was noted.

The MMF decreased from 79.9% to 61.8% from 2007 to 2014 and after that increased to 78.7% in 2017–2018 (Table 2 and Figure 2). Overall, it showed a decreasing trend, but was not statistically significant ($p = 0.935$). A substantial reduction in MMF was observed among children from the Dhaka and Rajshahi divisions, those aged 18–23 months, those whose mother had no or primary education or were underweight, and those whose father was an agriculture-based worker, unemployed/student, retired, or a beggar. It was also noted that MMF was significantly increased in Chittagong and Rangpur Division, those whose mother was overweight, and those whose father had completed secondary education and was involved in non-agriculture-based work.

The MAD decreased from 39.4% in 2007 to 23.1% in 2014 and then significantly increased to 52.1% in 2017–2018, resulting in a significantly increasing trend ($p < 0.001$) (Table 2 and Figure 2). Additionally, a significantly increasing trend was observed in all strata except that of the Rajshahi Division and those whose father was involved in non-agriculture-based work.
Table 1. Trends of introduction of solid, semi-solid or soft foods (among 6–8 months aged children) and minimum dietary diversity (among 6–23 months aged children) in Bangladesh, 2007–2018.

| Characteristics | Introduction of Solid, Semi-Solid or Soft Foods (%) | Minimum Dietary Diversity (%) |
|-----------------|------------------------------------------------------|-------------------------------|
|                 | 2007 | 2011 | 2014 | 2017–2018 | % Change | 2007 | 2011 | 2014 | 2017–2018 | % Change | p \(^4\) |
| Overall         | 72.8 | 66.7 | 68.0 | 75.0      | 3.0      | 0.505 | 41.4 | 24.3 | 27.3 | 56.7      | 37.1     | <0.001 |
| Household characteristics |         |         |         |         |         |         |         |         |         |         |         |
| Administrative division |         |         |         |         |         |         |         |         |         |         |         |
| Barisal         | 69.9  | 60.5  | 77.8  | 66.0     | -5.6     | 0.868 | 35.9 | 23.1 | 29.6 | 54.7      | 52.6     | 0.002  |
| Chittagong      | 52.1  | 55.4  | 56.6  | 69.8     | 33.9     | 0.056 | 35.4 | 20.8 | 22.4 | 57.2      | 61.7     | <0.001 |
| Dhaka           | 79.8  | 68.4  | 76.3  | 87.2     | 9.4      | 0.156 | 42.3 | 25.4 | 28.4 | 54.3      | 28.4     | <0.001 |
| Khulna          | 79.1  | 90.1  | 76.6  | 80.1     | 1.3      | 0.673 | 45.7 | 31.1 | 36.2 | 59.1      | 29.3     | 0.003  |
| Rajshahi        | 81.9  | 77.7  | 81.6  | 69.0     | -15.8    | 0.180 | 51.9 | 30.9 | 27.3 | 57.0      | 9.8      | 0.834  |
| Rangpur         | -     | 74.8  | 59.7  | 69.3     | -7.3     | 0.493 | -    | 23.4 | 28.7 | 66.2      | 183.3    | <0.001 |
| Sylhet          | 66.4  | 50.6  | 47.3  | 59.4     | -10.5    | 0.467 | 24.7 | 14.2 | 24.2 | 52.8      | 114.2    | <0.001 |
| Place of residence |       |         |         |         |         |         |         |         |         |         |         |
| Urban           | 81.8  | 76.0  | 68.6  | 80.5     | -1.6     | 0.809 | 45.4 | 34.9 | 32.6 | 60.1      | 32.4     | <0.001 |
| Rural           | 70.6  | 64.6  | 67.7  | 72.8     | 3.0      | 0.544 | 40.2 | 21.1 | 25.5 | 55.4      | 38.1     | <0.001 |
| Household wealth status |         |         |         |         |         |         |         |         |         |         |         |
| Poorest         | 71.0  | 52.8  | 60.1  | 63.6     | -10.5    | 0.581 | 32.2 | 12.4 | 18.0 | 48.4      | 50.4     | <0.001 |
| Poorer          | 60.9  | 64.3  | 75.3  | 69.4     | 13.9     | 0.129 | 32.0 | 16.8 | 22.3 | 54.8      | 71.6     | <0.001 |
| Middle          | 77.1  | 71.5  | 63.0  | 80.8     | 4.7      | 0.988 | 45.2 | 25.5 | 28.4 | 56.4      | 24.7     | 0.001  |
| Richer          | 80.5  | 70.1  | 77.4  | 70.8     | -12.1    | 0.408 | 45.4 | 33.2 | 31.8 | 54.6      | 20.4     | 0.006  |
| Richest         | 83.6  | 81.9  | 65.6  | 91.2     | 9.1      | 0.783 | 54.2 | 37.0 | 37.3 | 70.1      | 29.5     | <0.001 |
| Child characteristics |       |         |         |         |         |         |         |         |         |         |         |
| Age (month)     |       |         |         |         |         |         |         |         |         |         |         |
| 6–8             | 72.8  | 66.7  | 68.0  | 75.0     | 3.0      | 0.505 | 45.4 | 34.9 | 32.6 | 60.1      | 32.4     | <0.001 |
| 9–11            | -     | -     | -     | -        | -        | -     | 31.8 | 19.6 | 19.6 | 43.8      | 37.9     | 0.015  |
| 12–17           | -     | -     | -     | -        | -        | -     | 49.1 | 27.8 | 27.9 | 66.5      | 35.4     | <0.001 |
| 18–23           | -     | -     | -     | -        | -        | -     | 56.1 | 33.7 | 42.1 | 70.2      | 25.0     | <0.001 |
| Gender          |       |         |         |         |         |         |         |         |         |         |         |
| Male            | 76.7  | 66.2  | 69.5  | 76.7     | 0.0      | 0.774 | 42.4 | 24.6 | 26.0 | 57.5      | 35.7     | <0.001 |
| Female          | 69.5  | 67.3  | 66.3  | 72.8     | 4.8      | 0.658 | 40.4 | 24.1 | 28.8 | 55.8      | 38.2     | <0.001 |
| Birth order     |       |         |         |         |         |         |         |         |         |         |         |
| 1               | 82.3  | 74.4  | 66.9  | 76.4     | -7.2     | 0.205 | 48.3 | 30.1 | 33.1 | 62.2      | 28.6     | <0.001 |
| 2               | 73.5  | 67.1  | 71.3  | 78.1     | 6.2      | 0.290 | 41.6 | 25.1 | 24.8 | 54.0      | 29.7     | <0.001 |
| ≥3              | 65.1  | 60.8  | 65.8  | 68.9     | 5.9      | 0.467 | 35.1 | 18.7 | 22.8 | 53.5      | 52.4     | <0.001 |
| Maternal characteristics |       |         |         |         |         |         |         |         |         |         |         |
| Age at child’s birth (years) |       |         |         |         |         |         |         |         |         |         |         |
| <20             | 73.6  | 63.6  | 62.7  | 71.5     | -2.9     | 0.659 | 40.4 | 27.5 | 28.0 | 55.2      | 36.8     | <0.001 |
| 20–29           | 74.0  | 69.1  | 69.6  | 73.1     | -1.2     | 0.909 | 43.0 | 23.4 | 27.2 | 57.5      | 33.7     | <0.001 |
| ≥30             | 68.5  | 61.7  | 69.7  | 86.1     | 25.7     | 0.027 | 37.3 | 24.0 | 26.9 | 55.8      | 49.8     | <0.001 |
Table 1. cont.

| Characteristics | Introduction of Solid, Semi-Solid or Soft Foods (%) | Minimum Dietary Diversity (%) |
|-----------------|------------------------------------------------------|-------------------------------|
|                 | 2007 2011 2014 2017–2018 % Change | p 4 | 2007 2011 2014 2017–2018 % Change | p 4 |
| Level of education |                                             |     |                                   |     |
| 0–4             | 63.0 54.9 62.5 63.1 -0.2 | 0.822 | 31.5 | 15.7 | 15.8 | 47.1 | 49.7 | <0.001 |
| 5–9             | 77.6 72.1 71.6 75.8 -2.4 | 0.760 | 47.5 | 25.5 | 28.1 | 56.7 | 19.5 | <0.001 |
| 10+             | 95.2 83.0 71.1 85.3 -10.4 | 0.303 | 55.9 | 43.9 | 45.1 | 67.4 | 20.6 | <0.001 |
| Occupation      |                                             |     |                                   |     |
| Housewife       | 70.2 65.5 68.8 76.0 8.2 | 0.163 | 40.8 | 23.8 | 27.4 | 55.6 | 36.5 | <0.001 |
| Working outside | 81.2 87.3 64.7 73.4 -9.5 | 0.127 | 43.4 | 31.7 | 27.2 | 58.3 | 34.5 | <0.001 |
| Body mass index (kg/m²) |                                             |     |                                   |     |
| <18.5           | 78.9 56.8 63.2 73.5 -6.8 | 0.207 | 37.6 | 20.0 | 22.0 | 57.5 | 53.1 | <0.001 |
| 18.5–22.9       | 70.2 71.2 67.0 69.9 -0.4 | 0.688 | 40.2 | 24.6 | 27.1 | 54.4 | 35.3 | <0.001 |
| 23.0–24.0       | 66.5 58.4 71.5 81.9 22.3 | 0.047 | 48.2 | 28.9 | 32.5 | 60.6 | 25.9 | <0.001 |
| ≥25.0           | 69.8 80.7 77.3 82.0 17.4 | 0.483 | 63.8 | 34.0 | 34.5 | 58.4 | -8.5 | 0.053 |
| Paternal characteristics |                                             |     |                                   |     |
| Level of education |                                             |     |                                   |     |
| 0–4             | 69.2 61.0 62.2 69.0 -0.2 | 0.798 | 34.1 | 17.7 | 20.0 | 50.5 | 47.9 | <0.001 |
| 5–9             | 78.4 67.1 69.8 75.2 -4.0 | 0.715 | 43.4 | 25.5 | 28.4 | 55.2 | 27.2 | <0.001 |
| 10+             | 72.3 85.2 77.5 83.1 14.9 | 0.410 | 60.3 | 38.9 | 40.1 | 69.1 | 14.6 | <0.001 |
| Occupation      |                                             |     |                                   |     |
| Service holder/businessman |                                             |     |                                   |     |
| Agriculture-based worker |                                             |     |                                   |     |
| Non-agriculture-based worker |                                             |     |                                   |     |
| Others 5        | 63.5 59.4 48.2 68.4 7.8 | 0.709 | 29.5 | 15.1 | 20.1 | 56.1 | 90.0 | <0.001 |

1 The administrative division Rangpur was created in 2010; 2 The administrative division Mymensingh was created in 2015; 3 “+” represents increase, “-” represents decrease between 2007 and 2018; 4 p-value for the Cochran–Armitage test of % change between 2007 and 2018; 5 Unemployed/student, retired, beggar, etc.

Table 2. Trends of minimum meal frequency and minimum acceptable diet among 6–23 months aged children in Bangladesh, 2007–2018.

| Characteristics | Minimum Meal Frequency (%) | Minimum Acceptable Diet (%) |
|----------------|---------------------------|-----------------------------|
|                 | 2007 2011 2014 2017–2018 % Change | p 4 | 2007 2011 2014 2017–2018 % Change | p 4 |
| Overall         | 79.9 62.0 61.8 78.7 1.4 | 0.935 | 39.4 | 20.2 | 23.1 | 52.1 | 32.2 | <0.001 |
| Household characteristics Administrative division | | | | | | | | |
| Barisal         | 72.3 61.2 60.0 74.7 -3.3 | 0.688 | 32.7 | 17.3 | 24.4 | 49.2 | 50.2 | 0.004 |
| Chittagong      | 65.7 52.2 54.6 75.4 -14.8 | 0.005 | 32.5 | 16.2 | 17.3 | 49.9 | 53.8 | <0.001 |
| Dhaka           | 83.0 62.9 60.3 79.1 4.7 | 0.025 | 39.7 | 22.2 | 25.0 | 51.3 | 29.2 | <0.001 |
| Khulna          | 88.4 80.2 79.2 82.6 6.6 | 0.211 | 44.7 | 28.0 | 31.6 | 54.5 | 21.9 | 0.022 |
| Rajshahi        | 91.3 62.5 70.8 73.4 19.6 | <0.001 | 51.6 | 24.8 | 25.8 | 52.0 | 0.7 | 0.238 |
| Rangpur 1       | - 70.6 65.4 85.6 -21.3 | <0.001 | - | 19.2 | 23.5 | 63.6 | 230.7 | <0.001 |
Table 2. cont.

| Characteristics                  | Minimum Meal Frequency (%) | Minimum Acceptable Diet (%) |   |
|----------------------------------|---------------------------|-----------------------------|---|
|                                  | 2007 | 2011 | 2014 | 2017–2018 | % Change ³ | p ⁴ | 2007 | 2011 | 2014 | 2017–2018 | % Change ³ | p ⁵ |
| Sylhet                           | 72.3 | 55.8 | 57.4 | 76.2  | −5.4 | 0.407 | 23.8 | 11.3 | 17.9 | 47.1  | 98.1 | <0.001  |
| Mymensingh ²                     | −    | −    | −    | 84.7  | −    | −    | −    | −    | −    | 49.1  | −    | −    |
| Place of residence               |      |      |      |       |      |      |      |      |      |       |      |      |
| Urban                            | 83.2 | 65.4 | 65.9 | 80.7  | 3.0  | 0.931 | 43.5 | 28.4 | 27.4 | 55.4  | 27.3 | <0.001  |
| Rural                            | 78.9 | 60.9 | 60.3 | 78.0  | 1.1  | 0.840 | 38.2 | 17.7 | 21.6 | 51.0  | 33.3 | <0.001  |
| Household wealth status          |      |      |      |       |      |      |      |      |      |       |      |      |
| Poorest                          | 83.6 | 52.9 | 53.7 | 75.6  | 9.6  | 0.098 | 31.8 | 10.2 | 14.7 | 44.6  | 40.3 | <0.001  |
| Poorer                           | 76.2 | 61.8 | 61.1 | 79.4  | −4.3 | 0.293 | 31.7 | 13.8 | 17.5 | 50.5  | 59.3 | <0.001  |
| Middle                           | 78.8 | 66.8 | 63.0 | 77.1  | 2.2  | 0.518 | 43.2 | 22.4 | 23.2 | 50.0  | 15.7 | 0.030   |
| Richer                           | 82.0 | 61.5 | 65.9 | 78.6  | 4.2  | 0.935 | 42.9 | 27.3 | 28.1 | 50.9  | 18.4 | 0.006   |
| Richest                          | 78.9 | 69.4 | 66.4 | 83.1  | −5.3 | 0.305 | 49.3 | 30.1 | 33.1 | 65.5  | 32.9 | <0.001  |
| Child characteristics            |      |      |      |       |      |      |      |      |      |       |      |      |
| Age (month)                      |      |      |      |       |      |      |      |      |      |       |      |      |
| 6–8                              | 59.9 | 51.3 | 48.8 | 62.2  | −3.8 | 0.804 | 9.0  | 6.3  | 5.8  | 19.3  | 115.0 | <0.001  |
| 9–11                             | 73.8 | 57.2 | 52.3 | 70.3  | 4.7  | 0.286 | 28.7 | 14.9 | 16.1 | 38.9  | 35.8 | 0.002   |
| 12–17                            | 83.8 | 62.7 | 67.2 | 84.1  | −0.4 | 0.063 | 46.8 | 23.3 | 24.4 | 62.0  | 32.5 | <0.001  |
| 18–23                            | 89.7 | 70.2 | 68.0 | 85.0  | 5.2  | 0.036 | 54.1 | 27.9 | 34.6 | 63.8  | 17.9 | <0.001  |
| Gender                           |      |      |      |       |      |      |      |      |      |       |      |      |
| Male                             | 80.6 | 62.9 | 62.9 | 78.1  | 3.1  | 0.634 | 39.9 | 20.4 | 22.7 | 51.8  | 29.9 | <0.001  |
| Female                           | 79.1 | 61.0 | 60.6 | 79.4  | −0.4 | 0.722 | 39.0 | 20.0 | 23.6 | 52.5  | 34.6 | <0.001  |
| Birth order                      |      |      |      |       |      |      |      |      |      |       |      |      |
| 1                                | 82.5 | 64.6 | 64.2 | 82.6  | 0.0  | 0.764 | 45.4 | 26.0 | 27.8 | 57.7  | 27.2 | <0.001  |
| 2                                | 80.0 | 62.8 | 61.7 | 75.9  | 5.1  | 0.621 | 40.0 | 19.0 | 20.6 | 49.1  | 22.7 | <0.001  |
| ≥3                               | 77.5 | 59.0 | 58.9 | 77.5  | −0.1 | 0.839 | 33.9 | 16.0 | 19.9 | 49.1  | 45.1 | <0.001  |
| Maternal characteristics         |      |      |      |       |      |      |      |      |      |       |      |      |
| Age at child’s birth (years)     |      |      |      |       |      |      |      |      |      |       |      |      |
| <20                              | 82.4 | 62.7 | 61.5 | 77.9  | 5.4  | 0.072 | 39.3 | 23.4 | 22.9 | 50.8  | 29.3 | 0.008   |
| 20–29                            | 79.4 | 62.2 | 62.5 | 78.3  | 1.3  | 0.917 | 40.6 | 19.5 | 23.1 | 52.5  | 29.3 | <0.001  |
| ≥30                              | 78.0 | 60.5 | 60.0 | 80.4  | −3.1 | 0.116 | 35.8 | 18.9 | 23.5 | 52.3  | 46.2 | <0.001  |
| Level of education               |      |      |      |       |      |      |      |      |      |       |      |      |
| 0–4                              | 77.5 | 54.6 | 55.2 | 75.1  | 3.1  | 0.010 | 30.6 | 13.3 | 12.7 | 42.5  | 38.9 | <0.001  |
| 5–9                              | 82.0 | 63.7 | 63.1 | 77.6  | 5.4  | 0.574 | 44.6 | 20.8 | 23.7 | 52.0  | 16.5 | 0.015   |
| 10+                              | 81.0 | 75.5 | 69.4 | 85.6  | −5.6 | 0.107 | 53.0 | 37.2 | 39.7 | 63.3  | 19.3 | <0.001  |
| Occupation                       |      |      |      |       |      |      |      |      |      |       |      |      |
| Housewife                        | 78.9 | 61.4 | 60.8 | 76.3  | 3.3  | 0.076 | 38.7 | 19.7 | 22.6 | 49.7  | 28.5 | <0.001  |
| Working outside                  | 83.2 | 68.8 | 65.1 | 82.5  | 0.8  | 0.754 | 42.1 | 26.7 | 24.8 | 55.9  | 33.0 | <0.001  |
| Characteristics | Minimum Meal Frequency (%) | Minimum Acceptable Diet (%) |
|-----------------|-----------------------------|------------------------------|
|                 | 2007 | 2011 | 2014 | 2017–2018 | % Change | p     | 2007 | 2011 | 2014 | 2017–2018 | % Change | p     |
| Body mass index (kg/m²) |      |      |      |           |          |       |      |      |      |           |          |       |
| <18.5           | 83.8 | 61.2 | 61.6 | 78.8      | 6.0      | 0.001 | 36.6 | 17.0 | 18.1 | 51.5      | 40.8     | <0.001 |
| 18.5–22.9       | 78.1 | 62.3 | 59.6 | 76.9      | 1.6      | 0.356 | 38.3 | 20.2 | 22.8 | 49.9      | 30.0     | 0.008  |
| 23.0–24.0       | 73.4 | 60.1 | 65.0 | 82.5      | −12.4    | <0.001 | 44.8 | 22.8 | 27.1 | 58.2      | 30.1     | <0.001 |
| ≥25.0           | 79.1 | 65.1 | 67.3 | 80.2      | −1.3     | 0.048 | 58.0 | 28.7 | 30.7 | 53.3      | −8.0     | 0.036  |
| Paternal characteristics |      |      |      |           |          |       |      |      |      |           |          |       |
| Level of education |      |      |      |           |          |       |      |      |      |           |          |       |
| 0–4             | 79.8 | 56.7 | 55.3 | 78.5      | 1.6      | 0.074 | 33.6 | 15.1 | 16.1 | 47.1      | 40.1     | <0.001 |
| 5–9             | 80.1 | 64.8 | 64.2 | 75.9      | 5.2      | 0.453 | 41.4 | 21.5 | 24.3 | 49.2      | 18.9     | <0.001 |
| 10+             | 79.7 | 69.7 | 70.0 | 84.1      | −5.5     | 0.035 | 54.1 | 30.7 | 35.0 | 65.2      | 20.7     | <0.001 |
| Occupation      |      |      |      |           |          |       |      |      |      |           |          |       |
| Service holder/businessman | 78.9 | 66.4 | 63.1 | 79.3      | −0.6     | 0.848 | 44.4 | 24.5 | 27.9 | 56.2      | 26.6     | <0.001 |
| Agriculture-based worker | 83.1 | 62.3 | 57.2 | 78.3      | 5.8      | 0.005 | 39.9 | 17.9 | 18.8 | 47.7      | 19.5     | 0.200  |
| Non-agriculture-based worker | 78.2 | 60.8 | 66.9 | 79.5      | −1.7     | 0.002 | 43.0 | 21.1 | 25.5 | 51.9      | 20.6     | <0.001 |
| Others          | 79.2 | 54.3 | 54.6 | 75.0      | 5.4      | 0.007 | 28.8 | 11.9 | 15.3 | 50.3      | 74.3     | <0.001 |

1 The administrative division Rangpur was created in 2010; 2 The administrative division Mymensingh was created in 2015; 3 “+” represents increase, “−” represents decrease between 2007 and 2018, respectively; 4 p-value for the Cochran–Armitage test of % change between 2007 to 2018, respectively; 5 Unemployed/student, retired, beggar, etc.
3.2. Trends in Consumption from Different Food Groups

Overall trends in the consumption of food items from six food groups are shown in Figure 3. The consumption of grains, roots, or tubers significantly decreased from 84.6% to 78.2% from 2007 to 2014 but increased to 87.4% in 2017–2018. Although a significant increase in meat/fish/egg consumption (46.9% to 67.2%) was observed, there was a substantial reduction in consumption of legumes or nuts (29.7% to 21.5%), dairy products (39.7% to 32.2%), vitamin-A-rich fruits or vegetables (53.8% to 37.7%), and other fruits or vegetables (46.4% to 26.6%) from 2007 to 2017–2018.

The consumption of grains/roots/tubers significantly reduced among children from the Rajshahi division but increased among children from the Chittagong and Sylhet divisions, those living in urban areas, those from poorer and the richest households, and those whose mother only had primary or secondary education (Table 3). On the other hand, the consumption of legumes/nuts decreased over time for all children regardless of age, gender, place of residence, wealth status, and parents’ education and occupation.

![Figure 3. Trends of intake from different food groups among 6–23 months aged children in Bangladesh, 2007–2018.](image)

A significant reduction in consumption of dairy products was observed among children regardless of age, gender, place of residence, wealth status, and parents’ education and occupation (Table 4). On the other hand, meat/fish/egg consumption increased over time among all children regardless of age, gender, place of residence, wealth status, and parent’s education and occupation.

Table 5 shows the trends in consuming vitamin-A rich fruits or vegetables and other fruits or vegetables among children aged 6–23 months in Bangladesh from 2007 to 2018. The consumption of vitamin-A-rich fruits/vegetables and other fruits/vegetables decreased over time among all children regardless of age, gender, place of residence, wealth status, and parent’s education and occupation.
Table 3. Trends of consuming grains, roots or tubers, and legumes or nuts among 6–23 months aged children in Bangladesh, 2007–2018.

| Characteristics          | Grains, Roots or Tubers (%) | Legumes or Nuts (%) |
|--------------------------|-----------------------------|--------------------|
|                          | 2007 | 2011 | 2014 | 2017–2018 | % Change | 2007 | 2011 | 2014 | 2017–2018 | % Change | p^5 |
| Overall                  | 84.6 | 78.8 | 78.2 | 87.4      | 3.2      | 0.027 | 29.7 | 5.8  | 7.0  | 21.5      | 27.5    | <0.001 |
| Household characteristics |      |      |      |           |          |       |      |      |      |           |         |      |
| Administrative division  |      |      |      |           |          |       |      |      |      |           |         |      |
| Barisal                  | 82.1 | 77.8 | 79.9 | 84.2      | 2.6      | 0.524 | 34.9 | 9.3  | 9.9  | 22.9      | 34.3    | 0.045 |
| Chittagong               | 76.0 | 73.4 | 75.4 | 88.6      | 16.7     | <0.001 | 26.7 | 3.6  | 6.3  | 24.6      | 7.9     | 0.568 |
| Dhaka                    | 86.1 | 76.4 | 75.0 | 84.7      | -1.6     | 0.289 | 33.7 | 5.9  | 9.5  | 21.5      | 36.1    | <0.001 |
| Khulna                   | 90.7 | 89.4 | 86.0 | 89.6      | -1.3     | 0.613 | 23.8 | 10.2 | 6.6  | 17.1      | 28.2    | 0.116 |
| Rajshahi                 | 92.5 | 83.8 | 85.4 | 86.1      | -7.0     | 0.012 | 30.5 | 5.7  | 3.2  | 15.2      | 50.2    | <0.001 |
| Sylhet                   | 77.0 | 72.7 | 74.7 | 88.8      | 15.3     | 0.010 | 22.1 | 4.8  | 5.8  | 30.8      | -39.7   | 0.031 |
| Place of residence       |      |      |      |           |          |       |      |      |      |           |         |      |
| Urban                    | 85.6 | 80.8 | 80.3 | 90.4      | 5.6      | 0.032 | 39.1 | 7.6  | 10.0 | 24.6      | 37.1    | <0.001 |
| Rural                    | 84.4 | 78.2 | 77.5 | 86.2      | 2.2      | 0.212 | 26.9 | 5.3  | 6.0  | 20.4      | 24.1    | <0.001 |
| Household wealth status  |      |      |      |           |          |       |      |      |      |           |         |      |
| Poorest                  | 86.3 | 76.0 | 79.6 | 88.1      | 2.1      | 0.188 | 24.6 | 3.5  | 4.3  | 19.6      | 20.6    | 0.144 |
| Poorer                   | 80.2 | 78.9 | 75.5 | 88.5      | 10.3     | 0.011 | 25.2 | 6.1  | 5.4  | 18.5      | 26.7    | 0.014 |
| Middle                   | 86.2 | 80.0 | 76.5 | 83.9      | -2.6     | 0.325 | 28.4 | 5.5  | 5.5  | 18.5      | 34.7    | 0.001 |
| Richer                   | 85.2 | 78.7 | 80.1 | 84.3      | -1.1     | 0.986 | 29.3 | 6.8  | 9.3  | 21.5      | 26.8    | 0.094 |
| Richest                  | 85.8 | 81.1 | 79.0 | 92.0      | 7.3      | 0.045 | 41.9 | 7.6  | 10.8 | 30.1      | 28.1    | 0.003 |
| Child characteristics    |      |      |      |           |          |       |      |      |      |           |         |      |
| Age (month)              |      |      |      |           |          |       |      |      |      |           |         |      |
| 6–8                      | 56.0 | 47.9 | 39.7 | 56.0      | 0.0      | 0.465 | 9.1  | 4.2  | 2.6  | 8.3       | 9.4     | 0.475 |
| 9–11                     | 86.6 | 79.4 | 76.7 | 89.8      | 3.7      | 0.397 | 24.2 | 4.4  | 7.1  | 19.9      | 17.8    | 0.434 |
| 12–17                    | 91.4 | 84.2 | 87.2 | 93.3      | 2.0      | 0.035 | 32.8 | 6.7  | 5.7  | 23.6      | 27.9    | 0.006 |
| 18–23                    | 93.0 | 90.5 | 88.8 | 94.7      | 1.8      | 0.458 | 40.3 | 6.6  | 10.7 | 26.4      | 34.6    | <0.001 |
| Gender                   |      |      |      |           |          |       |      |      |      |           |         |      |
| Male                     | 85.2 | 78.5 | 78.5 | 87.4      | 2.5      | 0.129 | 28.5 | 5.4  | 6.8  | 21.0      | 26.1    | 0.002 |
| Female                   | 84.0 | 79.1 | 77.9 | 87.3      | 3.9      | 0.112 | 30.9 | 6.3  | 7.3  | 22.1      | 28.5    | <0.001 |
| Birth order              |      |      |      |           |          |       |      |      |      |           |         |      |
| 1                        | 85.1 | 79.6 | 81.0 | 87.2      | 2.4      | 0.228 | 34.0 | 6.7  | 7.4  | 23.3      | 31.3    | <0.001 |
| 2                        | 85.2 | 81.0 | 77.8 | 88.0      | 3.3      | 0.318 | 30.7 | 6.4  | 6.8  | 20.4      | 33.6    | 0.003 |
| ≥3                       | 83.8 | 76.3 | 75.0 | 86.9      | 3.7      | 0.764 | 25.3 | 4.5  | 6.8  | 20.7      | 18.1    | 0.031 |
| Maternal characteristics |      |      |      |           |          |       |      |      |      |           |         |      |
| Age at child’s birth (years) |      |      |      |           |          |       |      |      |      |           |         |      |
| <20                      | 84.0 | 77.7 | 79.9 | 84.6      | 0.7      | 0.764 | 29.3 | 4.9  | 7.7  | 19.7      | 32.9    | <0.001 |
| 20–29                    | 84.5 | 79.1 | 78.5 | 87.4      | 3.5      | 0.063 | 29.9 | 6.3  | 6.7  | 23.1      | 22.7    | 0.001 |
| ≥30                      | 86.0 | 79.0 | 75.3 | 89.4      | 3.9      | 0.174 | 29.4 | 5.1  | 7.4  | 18.8      | 36.1    | 0.015 |
Table 3. cont.

| Characteristics               | Grains, Roots or Tubers (%) | Legumes or Nuts (%) |
|-------------------------------|----------------------------|---------------------|
|                               | 2007  | 2011  | 2014  | 2017–2018 | % Change  | p 4    | 2007  | 2011  | 2014  | 2017–2018 | % Change  | p 5    |
| Level of education            |       |       |       |          |           |        |       |       |       |          |           |        |
| 0–4                           | 82.7  | 74.4  | 71.6  | 85.1     | 2.9       | 0.670  | 27.1  | 3.7   | 5.8   | 18.5     | 31.6      | <0.001 |
| 5–9                           | 86.5  | 80.0  | 80.4  | 87.6     | 1.3       | 0.171  | 29.6  | 6.8   | 7.6   | 21.8     | 26.5      | 0.037  |
| 10+                           | 85.4  | 86.1  | 82.7  | 89.3     | 4.5       | 0.213  | 38.4  | 7.9   | 7.4   | 24.2     | 36.9      | 0.009  |
| Occupation                    |       |       |       |          |           |        |       |       |       |          |           |        |
| Housewife                     | 83.2  | 78.5  | 77.5  | 86.2     | 3.5       | 0.190  | 31.1  | 5.6   | 7.4   | 23.1     | 25.8      | <0.001 |
| Working outside               | 89.4  | 82.2  | 80.4  | 89.2     | −0.2      | 0.796  | 25.0  | 7.9   | 5.9   | 19.1     | 23.4      | 0.070  |
| Body mass index (kg/m²)       |       |       |       |          |           |        |       |       |       |          |           |        |
| <18.5                         | 87.1  | 78.4  | 76.4  | 86.9     | −0.2      | 0.175  | 28.7  | 5.9   | 7.0   | 23.7     | 17.4      | <0.001 |
| 18.5–22.9                     | 83.7  | 79.3  | 78.2  | 86.5     | 3.4       | 0.188  | 28.9  | 5.4   | 6.2   | 20.4     | 29.6      | <0.001 |
| 23.0–24.0                     | 76.8  | 76.5  | 78.9  | 88.1     | 14.7      | 0.001  | 31.9  | 6.9   | 7.8   | 20.5     | 35.9      | 0.622  |
| ≥25.0                         | 87.5  | 79.9  | 81.0  | 89.2     | 1.9       | 0.071  | 38.7  | 6.6   | 9.3   | 23.1     | 40.3      | 0.608  |
| Paternal characteristics      |       |       |       |          |           |        |       |       |       |          |           |        |
| Level of education            |       |       |       |          |           |        |       |       |       |          |           |        |
| 0–4                           | 85.1  | 77.3  | 76.2  | 86.3     | 1.4       | 0.944  | 26.7  | 5.4   | 6.7   | 18.3     | 31.6      | <0.001 |
| 5–9                           | 83.9  | 78.1  | 78.2  | 87.1     | 3.8       | 0.047  | 30.7  | 4.9   | 6.9   | 22.3     | 27.4      | 0.057  |
| 10+                           | 84.6  | 83.8  | 82.3  | 89.5     | 5.9       | 0.051  | 37.0  | 8.5   | 8.0   | 25.2     | 32.0      | 0.029  |
| Occupation                    |       |       |       |          |           |        |       |       |       |          |           |        |
| Service holder/businessman    | 84.2  | 81.3  | 77.8  | 85.6     | 1.7       | 0.808  | 29.6  | 6.2   | 7.4   | 21.9     | 26.2      | 0.023  |
| Agriculture-based worker      | 85.1  | 79.8  | 79.5  | 86.5     | 1.7       | 0.907  | 28.2  | 5.1   | 3.7   | 20.9     | 25.9      | <0.001 |
| Non-agriculture-based worker  | 86.9  | 77.4  | 79.9  | 88.8     | 2.2       | 0.009  | 36.3  | 6.8   | 8.9   | 22.5     | 38.1      | 0.005  |
| Others 5                      | 81.8  | 74.9  | 72.9  | 87.1     | 6.5       | 0.652  | 23.2  | 3.1   | 7.4   | 18.2     | 21.4      | 0.005  |

1 The administrative division Rangpur was created in 2010; 2 The administrative division Mymensingh was created in 2015; 3 “+” represents increase, “−” represents decrease between 2007 and 2018; 4 p-value for the Cochran–Armitage test of % change between 2007 and 2018; 5 Unemployed/student, retired, beggar, etc.
Table 4. Trends of consuming dairy products and meat/fish/egg among 6–23 months aged children in Bangladesh, 2007–2018.

| Characteristics                  | Dairy Products (%) | Meat/Fish/EGG (%) |
|----------------------------------|-------------------|-------------------|
|                                  | 2007  | 2011  | 2014  | 2017–2018 | % Change | p 4  | 2007  | 2011  | 2014  | 2017–2018 | % Change | p 4  |
| Overall                          | 39.7  | 32.7  | 37.6  | 32.2      | 18.7     | 0.001 | 46.9  | 53.0  | 55.0  | 67.2       | 43.2     | <0.001|
| Household characteristics        |       |       |       |           |          |       |       |       |       |            |          |      |
| Administrative division          |       |       |       |           |          |       |       |       |       |            |          |      |
| Barisal                          | 40.4  | 25.5  | 35.7  | 25.1      | 38.0     | 0.090 | 43.0  | 51.4  | 57.6  | 65.9       | 53.3     | 0.001|
| Chittagong                       | 34.3  | 32.3  | 28.2  | 24.9      | 27.4     | 0.002 | 42.9  | 49.5  | 52.9  | 67.6       | 57.7     | <0.001|
| Dhaka                            | 45.4  | 35.2  | 46.1  | 44.9      | 1.1      | 0.270 | 45.3  | 49.9  | 53.1  | 63.6       | 40.3     | <0.001|
| Khulna                           | 43.8  | 32.2  | 35.1  | 25.5      | 41.8     | 0.002 | 59.0  | 67.7  | 62.9  | 72.9       | 23.4     | 0.036|
| Rajshahi                         | 39.6  | 39.4  | 42.8  | 35.3      | 10.9     | 0.506 | 53.7  | 60.6  | 54.5  | 68.6       | 27.8     | 0.002|
| Rajshpur 1                       | -     | 31.8  | 35.5  | 27.7      | 13.1     | 0.317 | -     | 59.4  | 65.8  | 77.3       | 30.1     | <0.001|
| Sylhet                           | 27.2  | 19.5  | 25.0  | 19.8      | 27.2     | 0.300 | 36.5  | 38.7  | 49.1  | 62.3       | 71.0     | <0.001|
| Place of residence               |       |       |       |           |          |       |       |       |       |            |          |      |
| Urban                            | 47.3  | 44.9  | 44.3  | 35.1      | 25.9     | <0.001| 51.8  | 60.0  | 59.9  | 70.6       | 36.3     | <0.001|
| Rural                            | 37.4  | 29.0  | 35.3  | 31.2      | 16.6     | 0.041 | 45.5  | 50.9  | 53.3  | 65.9       | 45.0     | <0.001|
| Household wealth status          |       |       |       |           |          |       |       |       |       |            |          |      |
| Poorest                          | 23.1  | 14.7  | 20.9  | 19.7      | 14.8     | 0.842 | 43.4  | 40.3  | 46.8  | 63.2       | 45.9     | <0.001|
| Poorer                           | 29.8  | 22.3  | 30.0  | 28.5      | 4.4      | 0.702 | 36.0  | 50.5  | 49.2  | 65.1       | 81.1     | <0.001|
| Richer                           | 47.4  | 43.6  | 47.2  | 35.3      | 25.6     | 0.005 | 54.1  | 61.0  | 60.0  | 67.2       | 24.2     | 0.001|
| Richest                          | 62.7  | 50.5  | 49.8  | 46.3      | 26.2     | <0.001| 57.2  | 60.4  | 62.5  | 72.3       | 26.3     | <0.001|
| Child characteristics            |       |       |       |           |          |       |       |       |       |            |          |      |
| Age (month)                      |       |       |       |           |          |       |       |       |       |            |          |      |
| 6–8                              | 39.8  | 29.8  | 36.4  | 31.9      | 19.9     | 0.163 | 12.9  | 20.0  | 19.3  | 30.6       | 136.8    | <0.001|
| 9–11                             | 43.7  | 32.7  | 34.6  | 32.2      | 26.2     | 0.012 | 31.2  | 48.4  | 43.0  | 55.7       | 78.5     | <0.001|
| 12–17                            | 41.7  | 32.5  | 38.0  | 33.2      | 20.6     | 0.040 | 54.3  | 58.7  | 61.5  | 75.2       | 38.5     | <0.001|
| 18–23                            | 36.0  | 34.7  | 39.6  | 31.5      | 12.7     | 0.291 | 65.6  | 68.6  | 72.9  | 81.6       | 24.3     | <0.001|
| Gender                           |       |       |       |           |          |       |       |       |       |            |          |      |
| Male                             | 42.3  | 34.6  | 39.4  | 34.4      | 18.6     | 0.010 | 48.9  | 54.1  | 53.6  | 66.9       | 36.9     | <0.001|
| Female                           | 37.1  | 30.8  | 35.7  | 29.8      | 19.6     | 0.019 | 45.0  | 51.9  | 56.6  | 67.5       | 50.0     | <0.001|
| Birth order                      |       |       |       |           |          |       |       |       |       |            |          |      |
| 1                                | 43.4  | 37.9  | 43.7  | 35.6      | 18.0     | 0.049 | 53.1  | 60.8  | 59.1  | 69.4       | 30.7     | <0.001|
| 2                                | 39.3  | 35.4  | 39.7  | 32.8      | 16.5     | 0.089 | 44.5  | 54.1  | 54.6  | 67.8       | 52.3     | <0.001|
| ≥3                               | 36.7  | 26.1  | 27.6  | 27.8      | 24.1     | 0.001 | 43.2  | 45.3  | 50.2  | 64.0       | 48.2     | <0.001|
| Maternal characteristics         |       |       |       |           |          |       |       |       |       |            |          |      |
| Age at child’s birth (years)     |       |       |       |           |          |       |       |       |       |            |          |      |
| <20                              | 36.9  | 32.8  | 42.0  | 29.9      | 18.9     | 0.374 | 46.8  | 58.0  | 53.5  | 65.5       | 40.1     | <0.001|
| 20–29                            | 40.4  | 32.1  | 38.1  | 32.5      | 19.5     | 0.011 | 48.2  | 53.0  | 55.3  | 68.1       | 41.3     | <0.001|
| ≥30                              | 40.9  | 34.6  | 31.1  | 33.5      | 18.2     | 0.037 | 42.9  | 47.6  | 55.6  | 66.0       | 53.9     | <0.001|
Table 4. cont.

| Characteristics                  | Dairy Products (%) | Meat/Fish/EGG (%) |
|----------------------------------|--------------------|------------------|
|                                  | 2007               | 2011 | 2014 | 2017–2018 | % Change | 2007 | 2011 | 2014 | 2017–2018 | % Change | p 1 |
| Level of education               |                    |      |      |           |          |      |      |      |           |          |     |
| 0–4                              | 27.5               | 18.6 | 25.2 | 23.5       | 14.6      | 0.285 | 38.5 | 43.1 | 44.4       | 59.2      | 53.6 | <0.001 |
| 5–9                              | 46.9               | 36.9 | 40.0 | 31.2       | 33.3      | <0.001 | 51.9 | 56.2 | 57.3       | 69.5      | 34.1 | <0.001 |
| 10+                              | 58.3               | 55.9 | 52.2 | 44.5       | 23.7      | <0.001 | 59.8 | 68.3 | 66.2       | 70.3      | 17.6 | 0.018  |
| Occupation                       |                    |      |      |           |          |      |      |      |           |          |     |
| Housewife                        | 40.1               | 32.2 | 37.6 | 33.4       | 16.7      | 0.030 | 47.3 | 52.4 | 53.7       | 66.4      | 40.4 | <0.001 |
| Working outside                  | 38.3               | 39.7 | 37.9 | 30.5       | 20.4      | 0.004 | 45.5 | 60.8 | 59.1       | 68.3      | 50.0  | <0.001 |
| Body mass index (kg/m^2)         |                    |      |      |           |          |      |      |      |           |          |     |
| <18.5                            | 31.3               | 26.7 | 31.4 | 29.1       | 6.9       | 0.863 | 46.1 | 48.9 | 51.6       | 67.9      | 47.2  | <0.001 |
| 18.5–22.9                        | 39.6               | 32.5 | 36.3 | 28.6       | 27.8      | <0.001 | 45.9 | 55.1 | 54.2       | 65.9      | 43.8  | <0.001 |
| 23.0–24.0                        | 58.6               | 39.2 | 39.3 | 34.8       | 40.6      | <0.001 | 47.3 | 52.3 | 60.2       | 68.7      | 45.4  | <0.001 |
| ≥25.0                            | 64.7               | 48.9 | 52.6 | 41.9       | 35.2      | <0.001 | 59.1 | 57.2 | 60.2       | 68.2      | 15.3  | 0.011  |
| Paternal characteristics         |                    |      |      |           |          |      |      |      |           |          |     |
| Level of education               |                    |      |      |           |          |      |      |      |           |          |     |
| 0–4                              | 28.1               | 21.0 | 29.0 | 23.7       | 15.8      | 0.439 | 41.1 | 48.1 | 48.0       | 65.4      | 59.0  | <0.001 |
| 5–9                              | 45.1               | 37.9 | 38.9 | 31.3       | 30.7      | <0.001 | 47.9 | 54.0 | 56.3       | 65.2      | 36.1  | <0.001 |
| 10+                              | 65.6               | 52.7 | 52.7 | 47.4       | 27.7      | <0.001 | 63.3 | 63.5 | 66.4       | 73.4      | 16.1  | 0.001  |
| Occupation                       |                    |      |      |           |          |      |      |      |           |          |     |
| Service holder/businessman       | 50.8               | 40.8 | 44.6 | 40.8       | 19.8      | 0.015 | 55.5 | 57.8 | 60.7       | 68.0      | 22.5  | <0.001 |
| Agriculture-based worker         | 31.8               | 27.2 | 32.9 | 23.0       | 27.7      | 0.081 | 44.1 | 49.1 | 47.8       | 64.5      | 46.3  | <0.001 |
| Non-agriculture-based worker     | 42.7               | 33.7 | 38.9 | 32.4       | 24.0      | 0.006 | 51.2 | 52.5 | 56.9       | 67.2      | 31.2  | <0.001 |
| Others 5                         | 32.6               | 23.1 | 29.0 | 27.7       | 15.0      | 0.268 | 35.2 | 52.7 | 51.0       | 68.9      | 95.7  | <0.001 |

1 The administrative division Rangpur was created in 2010; 2 The administrative division Mymensingh was created in 2015; 3 ‘+’ represents increase, ‘−’ represents decrease between 2007 and 2018; 4 p-value for the Cochran–Armitage test of % change between 2007 and 2018; 5 Unemployed/student, retired, beggar, etc.
Table 5. Trends in consumption of fruits and vegetables among 6–23 months aged children in Bangladesh, 2007–2018.

| Characteristics                  | Vitamin-A Rich Fruits or Vegetables (%) | Other Fruits or Vegetables (%) |
|----------------------------------|----------------------------------------|--------------------------------|
|                                  | 2007  | 2011  | 2014  | 2017–2018 | % Change 3 | p 4  | 2007  | 2011  | 2014  | 2017–2018 | % Change 3 | p 4  |
| Overall                          | 53.8  | 36.6  | 40.4  | 37.7      | 29.9      | <0.001| 46.4  | 17.6  | 19.7  | 26.6      | 42.7      | <0.001|
| Household characteristics        |       |       |       |           |           |      |       |       |       |           |           |      |
| Administrative division          |       |       |       |           |           |      |       |       |       |           |           |      |
| Barisal                          | 42.5  | 40.6  | 45.0  | 35.7      | 16.2      | 0.465 | 39.6  | 10.6  | 15.5  | 23.5      | 40.6      | 0.026 |
| Chittagong                       | 45.1  | 35.7  | 36.1  | 40.4      | 10.5      | 0.197 | 42.2  | 11.5  | 17.8  | 30.9      | 26.8      | 0.005 |
| Dhaka                            | 55.1  | 36.2  | 39.1  | 38.5      | 30.1      | <0.001| 43.1  | 17.9  | 19.1  | 24.3      | 43.5      | <0.001|
| Khulna                           | 56.8  | 35.8  | 53.4  | 24.5      | 56.9      | <0.001| 47.7  | 26.4  | 32.8  | 27.2      | 43.0      | 0.002 |
| Rajshahi                         | 66.5  | 39.5  | 38.9  | 37.3      | 43.9      | <0.001| 61.2  | 24.3  | 15.0  | 23.3      | 61.9      | <0.001|
| Rangpur 1                        | -     | 38.9  | 39.6  | 47.0      | -21.1     | 0.067 | -     | 19.1  | 20.8  | 31.7      | -65.6     | 0.001 |
| Sylhet                           | 42.6  | 31.1  | 44.9  | 36.8      | 13.6      | 0.875 | 33.7  | 17.3  | 22.5  | 22.4      | 33.7      | 0.067 |
| Mymensingh 2                     | -     | -     | 33.4  | -         | -         | -     | -     | 27.6  | -     | -         | -         |      |
| Place of residence               |       |       |       |           |           |      |       |       |       |           |           |      |
| Urban                            | 50.9  | 40.2  | 38.2  | 39.6      | 22.3      | 0.001 | 50.7  | 20.7  | 23.6  | 26.3      | 48.2      | <0.001|
| Rural                            | 54.6  | 35.6  | 41.2  | 37.0      | 32.2      | <0.001| 45.1  | 16.7  | 18.3  | 26.7      | 40.8      | <0.001|
| Household wealth status          |       |       |       |           |           |      |       |       |       |           |           |      |
| Poorest                          | 50.9  | 29.2  | 37.9  | 35.5      | 30.2      | 0.002 | 45.2  | 14.5  | 20.0  | 20.4      | 54.8      | <0.001|
| Poorer                           | 50.3  | 33.2  | 41.4  | 35.8      | 28.9      | 0.001 | 38.6  | 17.4  | 17.0  | 24.7      | 36.1      | <0.001|
| Richer                           | 57.2  | 41.2  | 42.6  | 37.0      | 35.4      | <0.001| 50.3  | 14.3  | 17.0  | 30.0      | 40.4      | <0.001|
| Richest                          | 57.0  | 39.3  | 39.6  | 33.2      | 41.8      | <0.001| 47.4  | 20.8  | 21.7  | 26.4      | 44.3      | <0.001|
| Child characteristics            |       |       |       |           |           |      |       |       |       |           |           |      |
| Age (month)                      |       |       |       |           |           |      |       |       |       |           |           |      |
| 6–8                              | 27.0  | 13.9  | 18.6  | 14.6      | 46.0      | 0.001 | 21.8  | 5.0   | 5.6   | 12.2      | 44.1      | <0.001|
| 9–11                             | 48.3  | 31.8  | 30.6  | 31.0      | 35.9      | <0.001| 39.8  | 15.2  | 20.3  | 19.5      | 51.0      | <0.001|
| 12–17                            | 59.0  | 40.6  | 46.1  | 43.2      | 26.8      | <0.001| 52.1  | 18.5  | 17.7  | 31.4      | 39.7      | <0.001|
| 18–23                            | 65.9  | 48.3  | 51.0  | 46.2      | 30.0      | <0.001| 57.6  | 25.5  | 28.7  | 31.9      | 44.6      | <0.001|
| Gender                           |       |       |       |           |           |      |       |       |       |           |           |      |
| Male                             | 53.0  | 36.9  | 38.7  | 40.1      | 24.3      | <0.001| 49.1  | 16.5  | 19.1  | 26.9      | 45.3      | <0.001|
| Female                           | 54.5  | 36.4  | 42.4  | 35.0      | 35.8      | <0.001| 43.8  | 18.8  | 20.4  | 26.3      | 39.9      | <0.001|
| Birth order                      |       |       |       |           |           |      |       |       |       |           |           |      |
| 1                                | 57.3  | 40.7  | 41.0  | 40.5      | 29.4      | <0.001| 48.7  | 19.2  | 20.0  | 30.6      | 37.2      | <0.001|
| 2                                | 51.2  | 35.3  | 39.7  | 35.0      | 31.6      | <0.001| 46.1  | 17.6  | 18.0  | 24.9      | 46.0      | <0.001|
| ≥3                               | 52.5  | 34.1  | 40.6  | 37.6      | 28.4      | <0.001| 44.7  | 16.3  | 21.3  | 24.0      | 46.3      | <0.001|
| Maternal characteristics         |       |       |       |           |           |      |       |       |       |           |           |      |
| Age at child’s birth (years)     |       |       |       |           |           |      |       |       |       |           |           |      |
| <20                              | 54.9  | 40.7  | 40.3  | 36.1      | 34.2      | <0.001| 44.0  | 17.9  | 16.6  | 27.3      | 38.0      | <0.001|
| 20–29                            | 54.4  | 34.7  | 40.7  | 37.6      | 30.9      | <0.001| 48.8  | 16.7  | 19.6  | 25.7      | 47.2      | <0.001|
| ≥30                              | 50.4  | 38.7  | 39.8  | 39.3      | 22.0      | 0.012 | 41.9  | 20.4  | 23.9  | 28.4      | 32.2      | 0.004|

Note: % change indicates the percentage change from 2007 to 2018.
| Characteristics                      | Vitamin-A Rich Fruits or Vegetables (%) | Other Fruits or Vegetables (%) |
|--------------------------------------|-----------------------------------------|---------------------------------|
|                                      | 2007  | 2011  | 2014  | 2017–2018 | % Change | 2007  | 2011  | 2014  | 2017–2018 | % Change | p<sup>1</sup> |
|                                      |       |       |       |          |          |       |       |       |          |          |          |
| Level of education                   |       |       |       |          |          |       |       |       |          |          |          |
| 0–4                                  | 49.9  | 30.9  | 36.1  | 34.7     | 30.4     | <0.001| 39.8  | 15.3  | 16.0     | 21.7     | 45.5     | <0.001 |
| 5–9                                  | 56.7  | 36.8  | 40.2  | 34.7     | 38.7     | <0.001| 51.1  | 17.3  | 20.2     | 25.6     | 49.9     | <0.001 |
| ≥10+                                 | 58.3  | 52.4  | 48.8  | 48.3     | 17.0     | 0.014 | 54.3  | 25.5  | 24.7     | 34.6     | 36.3     | <0.001 |
| Occupation                           |       |       |       |          |          |       |       |       |          |          |          |
| Housewife                            | 53.2  | 36.2  | 41.2  | 36.9     | 30.7     | <0.001| 43.4  | 17.4  | 19.2     | 25.9     | 40.3     | <0.001 |
| Working outside                      | 55.7  | 42.0  | 37.9  | 39.0     | 30.0     | <0.001| 56.7  | 20.0  | 21.5     | 27.7     | 51.2     | <0.001 |
| Body mass index (kg/m<sup>2</sup>)   |       |       |       |          |          |       |       |       |          |          |          |
| <18.5                                | 54.9  | 35.2  | 36.8  | 34.8     | 36.6     | <0.001| 47.8  | 15.0  | 14.3     | 20.9     | 56.3     | <0.001 |
| 18.5–22.9                            | 51.7  | 35.7  | 40.5  | 38.0     | 26.6     | <0.001| 44.0  | 18.7  | 20.2     | 25.7     | 41.6     | <0.001 |
| 23.0–24.0                            | 56.9  | 42.3  | 45.8  | 38.1     | 33.1     | 0.003 | 43.2  | 18.8  | 26.8     | 29.3     | 32.2     | 0.334  |
| ≥25.0                                | 61.0  | 41.0  | 43.0  | 39.5     | 35.2     | 0.002 | 61.9  | 19.9  | 23.0     | 32.2     | 48.0     | 0.003  |
| Paternal characteristics             |       |       |       |          |          |       |       |       |          |          |          |
| Level of education                   |       |       |       |          |          |       |       |       |          |          |          |
| 0–4                                  | 51.8  | 32.6  | 36.0  | 35.3     | 31.7     | <0.001| 43.8  | 17.1  | 18.4     | 23.5     | 46.4     | <0.001 |
| 5–9                                  | 52.2  | 35.3  | 42.7  | 35.1     | 32.7     | <0.001| 46.6  | 15.1  | 18.7     | 25.9     | 44.5     | <0.001 |
| ≥10+                                 | 63.4  | 49.5  | 44.9  | 46.0     | 27.4     | <0.001| 54.3  | 23.8  | 24.5     | 32.9     | 39.5     | <0.001 |
| Occupation                           |       |       |       |          |          |       |       |       |          |          |          |
| Service holder/businessman           | 58.8  | 41.0  | 46.1  | 42.8     | 27.2     | <0.001| 46.6  | 17.6  | 21.6     | 28.5     | 38.9     | <0.001 |
| Agriculture-based worker             | 53.1  | 37.2  | 33.9  | 34.7     | 34.7     | <0.001| 48.5  | 18.0  | 16.5     | 25.0     | 48.4     | <0.001 |
| Non-agriculture-based worker         | 52.3  | 33.8  | 40.8  | 37.1     | 29.1     | <0.001| 48.9  | 17.6  | 21.1     | 26.4     | 46.0     | <0.001 |
| Others<sup>5</sup>                   | 50.8  | 34.0  | 39.0  | 33.4     | 34.3     | <0.001| 40.7  | 17.0  | 17.9     | 24.1     | 40.9     | <0.001 |

1 The administrative division Rangpur was created in 2010; 2 The administrative division Mymensingh was created in 2015; 3 “+” represents increase, “-” represents decrease between 2007 and 2018; 4 <sup>p</sup>-value for the Cochran–Armitage test of % change between 2007 and 2018; 5 Unemployed/student, retired, beggar, etc.
4. Discussion

The present analyses were performed by pooling data from the four most recent rounds of nationally representative Demographic and Health Surveys of Bangladesh. Along with identifying trends in complementary feeding indicators, this study also investigated trends in dietary consumption from different food groups. Overall, a significantly increasing trend was observed for MDD and MAD, which may partially be attributable to the recent enactment of several IYCF policies in Bangladesh, such as the BMS Act 2013 [24] and NPAN 2 [21]. Consumption of food items from different food groups (grains, roots, tubers; legumes or nuts; dairy products; vitamin-A rich fruits or vegetables; other fruits or vegetables) decreased over time apart from an increasing trend in grains/roots/tubers and meat/fish/egg consumption. Divisional disaggregated data revealed the most remarkable reducing or non-significant trend in the Rajshahi division. These findings draw further attention to policymakers and program implementers to ascertain the probable reasons and inputs such as strengthening health systems and channelling behaviour change communication to be provided in this region to reduce regional variability and vulnerability.

While comparing complementary feeding practices across different strata, the most significant reduction was observed among children from the poorest wealth quintiles. Rural children were more vulnerable to a greater reduction in MDD and MAD, while a more substantial reduction in INTRO was observed among urban children in Bangladesh. One possible explanation could be that urban people have more purchasing power than rural families, and with the increase in income, children’s diets become more diversified [19,32]. However, there is also counterevidence (analysis from BDHS 2007 and 2014) revealing that children’s dietary diversity is achieved more in rural regions of Bangladesh [19]. The plausible reasons could be the easy access that rural people have to varied foods through different activities such as homegrown food production, livestock raising and fish-pond culture [33].

While exploring complementary feeding practices across child characteristics, no substantial gender differences were observed. However, the time trend analyses showed a more significant reduction in INTRO and MDD among boys than girls. It is also important to note that the achievement of an increasing trend in MDD, MMF, and MAD was lowest among children aged 6–8 months compared to older children (12–17 months and 18–23 months). Therefore, there is a need to focus on younger children, particularly when complementary feeding is initiated, and greater attention is required when designing feeding programs and policies. We found that children from the higher birth order achieved an increasing trend in INTRO, MDD, MMF, and MAD compared to the first birth order, implying that as mothers have more children, it becomes easier for them to achieve optimal feeding practices. Similar findings are also reported in other studies conducted in Ethiopia and India, where increased birth order is associated with the better achievement of INTRO, MDD and MAD [34,35]. These findings suggest that mothers become more experienced by nurturing their first child and perform better complementary feeding practices for subsequent children.

Although a significant improvement in feeding indicators in all education groups in 2017–2018 was observed, the current study findings revealed that higher maternal education was associated with the better achievement of INTRO, MDD, MMF, and MAD during 2007–2014. A similar trend was also observed for paternal education. These findings are corroborated by many other national studies across different regions such as Sri Lanka [36], India [37], Tanzania [38], and Nigeria [9]. A possible explanation of this relationship is that education helps mothers improve their knowledge on appropriate infant and young child feeding practices [39,40]. Thus, the universal coverage of primary education and the Bangladesh government’s initiative to provide increased access to higher education for girls resulted in better compliance with complementary feeding guidelines.

Maternal employment has an equivocal impact on the complementary feeding practice of young children due to women empowerment. In contrast, there is well-documented
evidence suggesting that maternal employment leads to time constraints for mothers, who allocate less time for cooking diverse foods [41,42]. The current study revealed a greater reduction in INTRO and less improvement in MMF and MDD among working mothers compared to housewives. Therefore, it is pertinent to support working mothers with initiatives such as setting up breast-friendly workplaces or arranging childcare centres near their workplace. Our study findings also identified children of younger mothers (aged <20 years) who reported lower achievement in INTRO, MDD and MAD compared to older mothers (>30 years) as younger mothers may need additional support in achieving optimal feeding practices. Similar findings have been reported in the literature in nationally representative studies from Nepal and India [35,43]. Therefore, policymakers need to prioritize young mothers in delivering appropriate complementary feeding messages.

A decreasing trend was observed between 2007 and 2018 in the consumption of foods from different food groups such as legumes and nuts; dairy products; vitamin-A-rich fruits or vegetables; and other fruits or vegetables while consumption of grains/roots/tubers and meat/fish/egg was significantly increased during this time. These trends in consumption were consistent regardless of the age, gender, place of residence, wealth status of the children as well as the occupation and education of their parents. In contrast, trend analysis (2001–2014) from Nepal reported a reduction in the consumption of grains, roots, and tubers while an increased consumption in other five food groups among young children [32]. If compared with other South Asian countries, children from Bangladesh had higher consumption of meat and dairy products compared to those from Afghanistan, Nepal, and Pakistan, while consumption of vitamin-A-rich fruits and vegetables is similar to that of Afghanistan, Sri Lanka and Maldives [1]. It is notable to mention that there is a possibility of seasonal variation in fruits/vegetable consumption as BDHSs are carried out at different times of the year. It is also worthy to note that some BDHSs covered both summer and winter seasons, and the respondents were asked to report the consumption of both fruits and/or vegetables; thus, the seasonal variation may be minimized.

Overall, the study attempted to underpin different indicators of complementary feeding practices and consumption of various food groups in children aged 6–23 months in Bangladesh across different times (from 2007 to 2018) and how these indicators changed across different strata with time. Findings of the present study impart several suggestions such as a strong focus on young children, intensive training to young mothers on optimal feeding practices, supporting working mothers with setting up breastfeeding-friendly workplaces or childcare facilities at or near workplaces, and considering the divisional, regional (rural/urban), birth order, and parental education variability in complementary feeding practices while designing and implementing feeding programs and policies. Despite improvements in women’s education, increased per capita income, reduced child marriages, increased access to health care services, and antenatal visits, trends in complementary feeding practices in children aged 6–23 months have been declining in Bangladesh until 2014. An upward trend has been noted in 2017–2018 BDHS in some of the indicators and appropriate attention is needed to sustain the progress. More effort is required to ascertain how adherence to complementary feeding guidelines can be improved and future well-designed studies are warranted to elucidate the causality and factors associated with complementary feeding practices.

While the study’s main strength is the use of data from nationally representative surveys that employed well-established methods and standardised questionnaires to collect information, the study was also subjected to several limitations. Firstly, the BDHSs questionnaire measures complementary feeding indicators using 24 h recall data, which may lead to recall bias and social desirability bias by mothers, providing an under- or over-estimation of indicators. Secondly, in measuring association and predicting causality, a further well-designed longitudinal study considering potential confounding variables is required. However, the present study has generated valuable findings using large-scale nationally representative survey data that still have program implications. Moreover, it is also notable to mention that a previous publication presented the trends in feeding practices.
using the same survey for the period of 2004–2014. Yet, we have added the latest round of survey in our analysis (2017–2018).

5. Conclusions

The study reported a decreasing trend in almost all complementary feeding indicators and consumption from different food groups among children aged 6–23 months in Bangladesh from 2007 to 2014. However, the recent BDHS (2017–2018) noted improvements in all complementary feeding indicators. Policymakers and practitioners need to focus on an integrated, multicomponent, and multisectoral intervention to sustain this progress, and focus should be given to behaviour change communication targeting the most vulnerable populations.

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Institutional Review Board Statement: BDHS data are publicly accessed data and we received them from MEASURE DHS on request. Ethical approval for these data was sought from the Government of Bangladesh.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data are available upon reasonable request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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