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Early Neonatal Feeding Is Common and Associated with Subsequent Breastfeeding Behavior in Rural Bangladesh[1–3]

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Abstract

Exclusive breastfeeding of newborns, a practice recommended by WHO, is hindered in many countries by practices such as prelacteal feeding (feeding other foods before breast milk is fed to infants). This paper describes maternal and infant characteristics and trends over time associated with early neonatal feeding (ENF) in Bangladesh. The analysis used data from 24,992 participants in a randomized controlled trial supplementing vitamin A and β-carotene to women in northwestern rural Bangladesh. A majority of newborns (89.2%) were fed substances other than breast milk in the first 3 d of life. Early neonatal feeding practices were found to be significantly associated with lower maternal education, higher gravidity, lower socioeconomic status, and younger maternal age. A perceived inability to suckle normally after birth was closely related to the risk of an infant being fed a food other than breast milk in the first 3 d of life [OR = 0.09 (95% CI: 0.08, 0.11)]. Only 18.8% of newborns fed an early neonatal food were exclusively breastfed between 3 d and 3 mo postpartum compared with 70.6% of those not fed an early neonatal food during this period ($P < 0.05$). Early neonatal feeding practices should be addressed when scaling-up exclusive breastfeeding in South Asia. Maternal education, antenatal care, and support during labor and delivery may help reduce ENF and promote exclusive breastfeeding. J. Nutr. 143: 1161–1167, 2013.

Introduction

Infants derive many potential health benefits from breastfeeding, including reducing the risk of infection (1–3), undernutrition (4), and mortality (5–8). Despite the clear benefits and active promotion of exclusive breastfeeding, adherence remains low in many developing countries, including Bangladesh, where it is estimated that fewer than 40% of infants younger than 6 mo are exclusively breastfed (9–11).

Prelacteal feeding (PF), defined as "any fluid or feed given before breastfeeding starts" (12), may have an important impact on the timing of breastfeeding initiation (13) and maintenance of exclusive breastfeeding (14). PF has been shown to be associated with delayed initiation of breastfeeding (15), which, in turn, may be associated with increased risk of poor health outcomes for infants, including infection and mortality (6,7).

In most retrospective studies, it is difficult to assess whether a food given to a newborn early in life is truly "prelacteal." Survey timing and recall bias as well as varying definitions of exclusive breastfeeding can result in different estimations of the prevalence of PF within similar environments (16–18). Estimates of PF prevalence in Bangladesh vary widely, with recent studies reporting rates of 25% (19) and 90% (20). We had the opportunity from 2001 to 2007 to study women in a large cohort (21) and the frequency with which those women reported offering foods other than breast milk to their infants in the first 3 d of life. In this analysis, we refer to these foods as "early neonatal foods" rather than prelacteal foods, because we were unable to determine with sufficient precision whether their feeding preceded the initiation of breastfeeding. The objective of this analysis was to ascertain whether significant differences existed between women whose infants received early neonatal foods and those who did not, by demographic, health, and economic characteristics.

[1] This trial was conducted by the Center for Human Nutrition, Department of International Health, Bloomberg School of Public Health, Johns Hopkins University, under Global Research Activity Cooperative Agreement GHS-A-00-03-00019-00 between Johns Hopkins University and the Office of Health, Infectious Diseases and Nutrition; the US Agency for International Development (Washington, DC); and Bill and Melinda Gates Foundation (Seattle, WA) Grant 614 (Global Control of Micronutrient Deficiency). Additional support was provided by Sight and Life (Basel, Switzerland), the Sight and Life Research Institute (Baltimore, MD), Nutrilite Health Institute (Nutrilite Division, Access Business Group, LLC, Buena Park, CA), the Canadian International Development Agency, and the National Integrated Population and Health Program of the Ministry of Health and Family Welfare of the Government of the People's Republic of Bangladesh.
[2] Author disclosures: M. E. Sundaram, A. B. Labrique, S. Mehra, H. Ali, A. A. Shamim, R. D. W. Klemm, K. P. West Jr, and P. Christian, no conflicts of interest.
[3] The parent trial, JiVitA-1, from which this data is derived was registered with clinicaltrials.gov as GHS-A-00-03-00019-0.
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Methods

Subjects and study design. We conducted an analysis of data collected within the context of the JiVitA-1 Trial in rural Gaibandha, Bangladesh (21–23), a double-masked, cluster-randomized, placebo-controlled community trial testing the effects of a weekly supplement of an RDA of either vitamin A or β-carotene on maternal mortality. The details of this trial were published elsewhere (21–24).

Information about socioeconomic status, characteristics surrounding the birth environment, breastfeeding practices of the mother, child gender, and other demographic characteristics was obtained from closed-ended questions in structured interviews conducted when the pregnancy was first identified and at 3 mo postpartum. The final analyses excluded pregnancies yielding multiple births and infants who died before 12 wk postpartum. To reduce the risk of recall bias in responses, we also limited the analysis to interviews conducted within ±28 d of the scheduled 3-mo postpartum visit (**Fig. 1**).

Statistical methods. The association among early neonatal feeding (ENF) and maternal or infant characteristics, time to initiation of breastfeeding, and other birth variables was tested using chi-square analyses for categorical variables. We defined "exclusive breastfeeding" to start after d 3 of life in order to make comparisons of breastfeeding and exclusive breastfeeding between ENF-fed and non-ENF–fed groups. $P < 0.05$ was considered significant for differences in demographic characteristics between groups. The 3 micronutrient supplementation arms of the randomized controlled trial (vitamin A, β-carotene, and placebo) were combined in the analysis, as chi-square analyses revealed no significant differences between these groups with regard to socioeconomic status, maternal education, literacy, age, gravidity, perception of child size at birth, and most other variables. Wealth quintiles were determined using a comprehensive living standards index that reflected several key socioeconomic factors such as literacy, occupation, and amount of land owned (25). Chi-square analyses were used to compare ENF practices across months and years of the study.

We used a multiple logistic regression model to test whether different maternal and infant characteristics were associated with ENF status. To determine inclusion of covariates in the final model, single logistic regressions were conducted for each of the possible variables. Variables that were significantly related to ENF status in a single logistic regression model ($P < 0.05$) or otherwise scientifically important were included in the final model. Backward stepwise selection was also conducted and the "selected" model was compared with the model with manually selected covariates; variables that did not remain significant in the selected model and did not describe basic demographic characteristics such as maternal age or child gender were eliminated from the final model. Trends over time were examined using a binary variable describing participation in either the first 3 or last 3 y of the study. The final model included variables determined to have a significant relationship to ENF ($P < 0.05$) or determined to have an important theoretical relationship with ENF; the "adjusted" model included variables describing maternal age, literacy, education, socioeconomic status, and child gender and size as well as the ability of the infant to suckle at birth, the location of birth and birth assistant present (if any), and participation in a microcredit program. None of the variables included in the final model had variance inflation factors >2 or tolerances <0.1, indicating no observed multicollinearity among variables in the model. Stata 11 (StataCorp) was used for all statistical analysis.

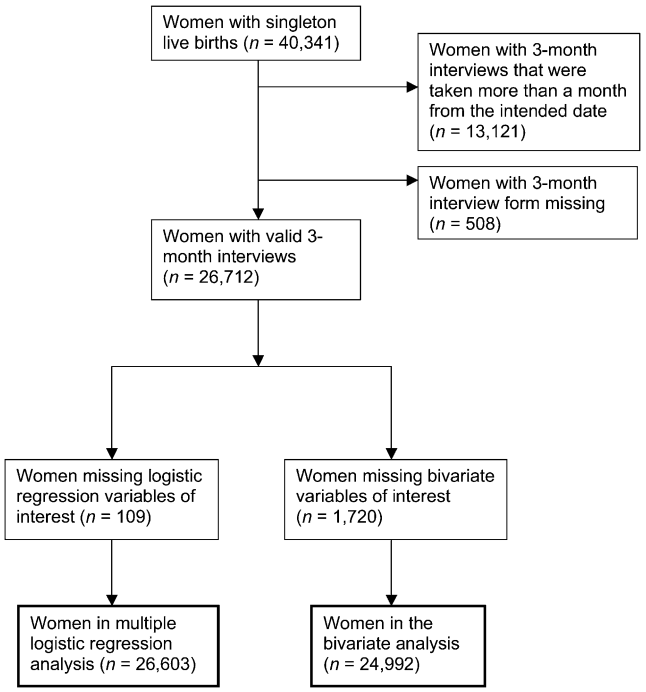

FIGURE 1 CONSORT diagram of study participants included in the analysis.

Ethical clearance. The protocol for the JiVitA-1 trial was reviewed and approved by both the institutional review board at the Bloomberg School of Public Health at Johns Hopkins University and the Bangladesh Medical Research Council, an autonomous body under the Ministry of Health and Family Welfare, Government of Bangladesh.

Results

Maternal and child demographic characteristics. A total of 24,992 women were included in the final analysis. Among participants in the bivariate analysis, most reported their child had received an early neonatal food. In bivariate analyses, ENF was associated with younger maternal age, lower socioeconomic status, illiteracy, primigravidity, smaller child size, and lack of participation in a microcredit program, although the differences in ENF prevalence according to child size, microcredit program participation, and maternal literacy were small (**Table 1**). Child gender was not significantly associated with ENF. Maternal primigravidity, but not child size or maternal literacy, remained associated with ENF in a multivariate logistic regression model (**Table 2**).

ENF according to exclusive breastfeeding, suckling behavior, and other health-seeking behaviors. Most women who did not give their infant ENF in the first 3 d of life reported exclusively breastfeeding their child through the time of the 3-mo postpartum interview (conducted within 28 d of the 3-mo postpartum date). In contrast, a small portion of women who provided an early neonatal food reported exclusively breastfeeding their infants up to this postnatal age (Table 1).

Mothers' perceptions of infants' ability to suckle normally at birth greatly decreased the odds of an infant being fed an ENF. Of the women who did not initiate breastfeeding until after 72 h postpartum, a very small proportion did not feed ENF. Infants were less likely to receive ENF if their mothers gave birth at a clinic or hospital compared with giving birth at home. Having received any antenatal care was also associated with protecting an infant from being fed ENF. Finally, women participating in a local microcredit program were less likely to feed their infants ENF than women not participating in the program (Table 2).

Variability in ENF frequency and type. Infants were given several kinds of early neonatal foods. The most common ENF was animal milk (a category that includes cow, goat, sheep, and buffalo milk), followed by honey (**Fig. 2**).

TABLE 1 ENF practices and demographic characteristics of women and children[1]

Characteristic	No food fed in first 3 d (n = 2624)		Any food fed in first 3 d (n = 22,368)		Total (n = 24,992)	
	n	%	n	%	n	%
Maternal						
Age, y						
≤19	895	34.1*	9211	41.2	10,106	40.4
20–29	1410	53.7	10,708	47.9	12,118	48.5
>29	319	12.2	2449	10.9	2768	11.1
Passed class 9 in school						
Yes	703	26.8*	4100	18.3	4803	19.2
No	1921	73.2	18,268	81.7	20,189	80.8
Literate						
Yes	1357	51.7*	10,490	46.9	11,847	47.4
No	1267	48.3	11,878	53.1	13,145	52.6
Gravidity						
Multigravid	1756	66.9*	13,842	61.9	15,598	62.4
Primigravid	868	33.1	8526	38.1	9394	37.6
Wealth quintile						
1	395	15.1*	3933	17.6	4328	17.3
2	495	18.9	4455	19.9	4950	19.8
3	514	19.6	4691	21.0	5205	20.8
4	510	19.4	4734	21.2	5244	21.0
5	710	27.1	4555	20.4	5265	21.1
Participation in a BRAC microcredit program	282	10.7*	2047	9.2	2329	9.3
Timeframe of interview						
First 3 y of study	1100	41.9*	11,854	53.0	12,954	51.8
Last 3 y of study	1524	58.1	10,514	47.0	12,038	48.2
Child						
Female child gender	1296	49.4	11,123	49.7	12,419	49.7
Mother's perception of child size at birth						
Small	559	21.3*	5408	24.2	5967	23.9
Medium	948	36.1	8388	37.5	9336	37.4
Large	1117	42.6	8572	38.3	9689	38.8
Exclusive breastfeeding from 3 d postpartum until interview	1848	70.4*	4196	18.8	6044	24.2
Health-seeking characteristics						
Birth location						
At home	2146	81.8*	21,293	95.2	23,439	93.8
At a family welfare visitor's house	74	2.8	200	0.9	274	1.1
Clinic/hospital	384	14.6	790	3.5	1174	4.7
En route, other, or don't know	20	0.8	85	0.4	105	0.4
Assistant present at birth						
No one present	37	1.4*	351	1.6	388	1.6
Neighbor/relative	826	31.5	9238	41.3	10,064	40.3
Traditional birth attendant	963	36.7	8825	39.5	9788	39.2
Health care professional	787	30.0	3923	17.6	4710	18.9
Other	11	0.4	31	0.1	42	0.2
Number of antenatal care visits received						
None	1688	64.3*	16,876	75.5	18,564	74.3
1–3 visits	776	29.6	4835	21.6	5611	22.5
≥4 visits	160	6.1	657	2.9	817	3.3

[1] *Denotes a significant difference in a chi-square analysis, $P < 0.05$. BRAC, Bangladesh Rural Advancement Committee; ENF, early neonatal feeding.

More than 10% of women reported giving their newborns "drops," which consisted of a wide range of items (Fig. 2). Usually sold commercially in small-volume plastic or glass vials, subsequent market studies found drops to include homeopathic supplements such as *Arnica montana*, homeopathic arsenic, and *Atropa belladonna* as well as broad-spectrum antibiotics, concentrated vitamin supplements, and purportedly sterile solutions of sucrose, glucose, dextrose, or saline.

Socioeconomic status was related to the type of early neonatal food fed to an infant. Infants of mothers in the highest wealth quintile tended to be more likely to be fed formula (13.8%) (P = 0.09) and were more likely to be fed drops (13.4%) ($P < 0.001$) than infants of women in the lowest wealth quintile (12.6 and 9.4%, respectively). Infants of women in the lowest wealth quintile, by comparison, were more likely to be fed animal milk (48.0%) and sweetened water (38.3%) than infants of women in

TABLE 2 Odds of ENF based on demographic characteristics of women and children and maternal behaviors[1]

	Feeding ENF (unadjusted)	Feeding ENF (adjusted)		
	OR (95% CI)	OR (95% CI)	*n*	%
Maternal characteristic				
Age, y				
≤19 (ref.)	1.0 (ref.)	1.0 (ref.)	10,849	40.6
20–29	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	12,869	48.2
>29	1.0 (0.8, 1.2)	1.0 (0.8, 1.1)	2994	11.2
Passed class 9 in school	0.8 (0.7, 0.9)*	0.8 (0.7, 0.9)*	5135	19.2
Literate	1.0 (0.9, 1.1)	1.0 (0.9, 1.2)	12,597	47.2
Primigravidity	1.4 (1.3, 1.6)*	1.4 (1.3, 1.6)*	10,130	37.9
Wealth quintile				
1 (ref.)	1.0 (ref.)	1.0 (ref.)	4632	17.3
2	1.0 (0.9, 1.1)	1.0 (0.8, 1.1)	5288	19.8
3	1.1 (0.9, 1.2)	1.0 (0.9, 1.2)	5575	20.9
4	1.2 (1.0, 1.4)	1.1 (1.0, 1.3)	5611	21.0
5	1.0 (0.9, 1.2)	1.0 (0.9, 1.2)	5605	21.0
Perception of child size at birth				
Small (ref.)	1.0 (ref.)	1.0 (ref.)	6395	24.1
Medium	1.0 (0.9, 1.2)	1.0 (0.9, 1.2)	9903	37.2
Large	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	10,294	38.7
Male child gender	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	13,480	50.5
Behaviors				
Normal suckling after birth	0.1 (0.1, 0.1)*	0.1 (0.1, 0.1)*	18,454	69.3
Birth location				
At home (ref.)	1.0 (ref.)	1.0 (ref.)	24,962	93.5
Family welfare visitor's house	0.4 (0.3, 0.5)*	0.4 (0.3, 0.5)*	294	1.1
Clinic/hospital	0.3 (0.2, 0.3)*	0.3 (0.2, 0.3)*	1319	4.9
En route, other, or don't know	0.5 (0.3, 0.8)*	0.5 (0.3, 0.8)*	118	0.4
Assistant present at birth				
None	1.0 (ref.)	1.0 (ref.)	407	1.5
Neighbor/relative	1.2 (0.9, 1.7)	1.2 (0.8, 1.7)	10,589	39.7
Traditional birth attendant	1.1 (0.8, 1.6)	1.0 (0.7, 1.5)	10,499	39.3
Health professional	1.1 (0.7, 1.5)	0.9 (0.6, 1.4)	5147	19.3
Other	0.5 (0.2, 1.2)	0.5 (0.2, 1.1)	46	0.2
Number of antenatal care visits				
None	1.0 (ref.)	1.0 (ref.)	19,834	74.3
1–3	0.8 (0.7, 0.9)*	0.8 (0.7, 0.9)*	5982	22.4
≥4	0.8 (0.7, 1.0)*	0.8 (0.7, 1.0)	896	3.4
Participation in BRAC microcredit program	0.8 (0.7, 1.0)*	0.9 (0.8, 1.0)	2500	9.4

[1] Controlled for trends over time and pregnancy wantedness. *Factor significantly affects the odds of early neonatal feeding compared to its reference group, $P < 0.05$. BRAC, Bangladesh Rural Advancement Committee; ENF, early neonatal food.

the highest wealth quintile (43.2 and 35.6%, respectively) ($P < 0.05$). Wealth quintile was related to maternal education, which was also independently related to early neonatal food preference. Women who had completed ≥9 y of school were more likely to feed their newborns "drops" (13.4%) than women with less education (11.6%) ($P < 0.01$) in a univariate analysis. These more highly educated women were also less likely than those less educated to feed their newborns animal milk (41.3 vs. 48.3%), honey (33.1 vs. 37.4%), and sweetened water (34.4 vs. 38.7%) ($P < 0.05$), although the differences between these groups were generally small.

Trends over time in ENF practices. Our data revealed significant trends by month of study with regard to ENF behaviors. Over the course of 6 study years, there was a gradual decrease in ENF prevalence (**Fig. 3**). Our data also revealed a significant increase in feeding commercial "drops" during the course of the study (Fig. 3).

Discussion

Early neonatal feeding is common in northwest rural Bangladesh; nearly 90% of study participants reported their infant received a food other than breast milk within the first 3 d of life. This figure is consistent with other reports of PF in rural Bangladesh (20).

The practice of feeding ENF in this analysis was associated with younger maternal age, primigravidity, and lower socioeconomic status. Higher maternal education, literacy and socioeconomic status were associated with an increased risk of feeding drops to newborns. Some of these differences were small but detectable due to the large sample size of the study.

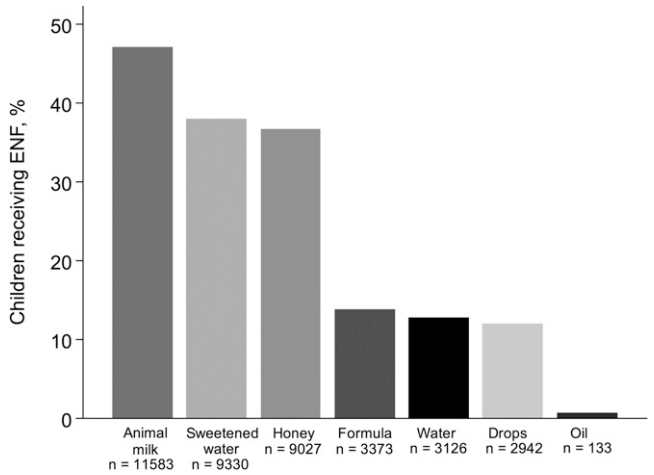

FIGURE 2 Frequency of early neonatal food fed by type. The frequencies shown are nonexclusive, meaning that it was possible for one woman to feed multiple types of foods. ENF, early neonatal food.

However, studies in India (26) and Bangladesh (27) as well as Uganda (28) have found that decreased maternal literacy and education are related to an increased practice of PF. The counterintuitive relationship between higher education and the increased practice of ENF feeding seen in our study with drops could reflect an increased ability to pay for expensive or commercial ENFs; this phenomenon has been reported elsewhere (29).

We found that women participating in a microcredit program were slightly less likely to feed ENF. The Bangladesh Rural Advancement Committee was the only microcredit program of several programs that was found to be significantly related to the odds of feeding ENF; a variable combining all possible microcredit programs was also not found to be significantly related to the odds of feeding ENF. Several microcredit programs operating in the study area counsel women about breastfeeding practices, which may have favorably affected early infant feeding practices. It is also possible that women participating in such a microcredit program are better able to make decisions regarding breastfeeding practices independently of other family or sociocultural constraints. Due to the small difference in ENF prevalence, however, it is possible that this association may not be scientifically meaningful.

Mothers who fed early neonatal foods were more likely to report difficulty in establishing normal suckling after birth than mothers not giving ENF. It is possible that the mother's perception of difficulty suckling leads to more rapid use of ENFs to nourish a newborn (30). Other studies have suggested that ENF may be initiated, because the mother perceives her breast milk to be insufficient (17,31) and wishes to provide some food to the infant to "tide over" until breast milk is available. It is also possible that ENF affects suckling through a "vicious cycle," where difficulty suckling leads to feeding ENF or PF, which in turn leads to reduced suckling desire and behavior (15,32).

Exclusive breastfeeding was associated with avoiding ENF during the first 3 d of life. It is possible that ENF is originally fed because of a perceived inability of the infant to suckle; however, our data suggest that exclusive breastfeeding from 3 d to 3 mo postpartum is significantly related to not feeding ENF. It is likely that ENF is part of a pattern of continued early complementary feeding rather than an isolated behavior.

Of the several different types of food reportedly fed to newborn infants, animal milk was the most common type in this rural Bangladeshi setting; honey and sweetened water were also common choices. The preference of certain types of foods over others may reflect cultural preferences. For example, feeding honey or sweetened water may reflect a belief that the first thing a child eats ought to be something sweet (33). Early neonatal food selection may also depend on household income and level of food security, as seen elsewhere in rural Bangladesh (34).

Our data revealed a small but significant decrease in ENF behavior, though with a seeming paradoxical rise in the use of drops, during the 6-y time course of our study. This finding suggests a need to better understand the roles of drops in protecting infant health as perceived by mothers, their actual health consequences, and the challenges that their use poses to programs seeking to promote exclusive breastfeeding in rural South Asia.

Limitations. A few important limitations to this analysis should be noted: first, this analysis excludes a large group of women who received the 3-mo postpartum interview more than ±28 d from the 3-mo postpartum date. The excluded women were younger, lower in socioeconomic status, and less likely to be assisted by a healthcare professional at birth; a smaller proportion were literate (data not shown). Excluding this large group was done to reduce the danger of recall bias and ensure that the time of interview and thus interpretation of results was comparable across all participants included in the analysis. Three-month recall data have been reported to be subject to bias in reporting breastfeeding behaviors (35). Because the time of recall in our study was 3 mo,

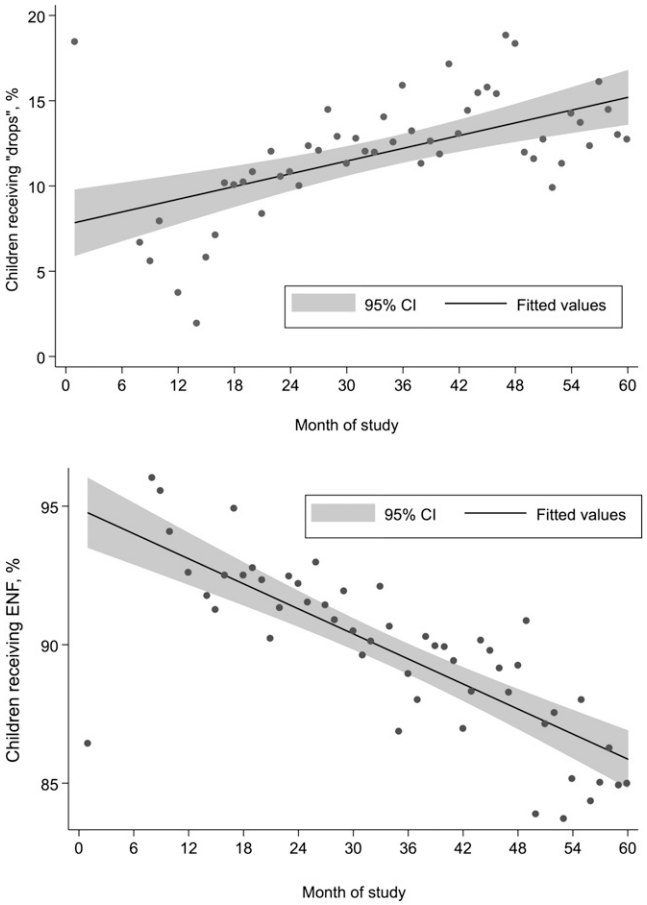

FIGURE 3 Probability of drop feeding prevalence and early neonatal food reported according to month of the study, derived from logistic regression models. ENF, early neonatal food.

this bias should be taken into account when interpreting the findings. It is possible, e.g., that the women were not as accurate at recalling precisely what time breastfeeding was initiated or specifically which food was fed, if a food was fed. Including these women in the analysis did not change the direction or substantially change the magnitude of any of the associations we found.

Also, our study has adopted the term "early neonatal food," which includes, but is not exclusive to, prelacteal foods. Therefore, our study results may not be directly comparable with other studies of strictly defined, PF practices. However, the term also includes all complementary feeding practices within the first 3 d of life, which may be seen as advantageous in understanding neonatal feeding behavior.

Finally, this study is powered to detect even minute differences in ENF prevalence according to different demographic or healthcare-seeking groups. Therefore, it is important to note that a significant difference in ENF prevalence among groups may not reflect a large difference in prevalence.

In conclusion, in adjusted models, ENF in northwestern rural Bangladesh is associated with primigravidity, a low level of rural wealth, and less maternal education. Practices associated with avoidance of these foods in the days shortly after birth include birthing in a hospital or clinic, receiving antenatal care and, in our local setting, participation in a microcredit program. Importantly, providing early neonatal foods other than breast milk in the first 3 d of life may prevent mothers from exclusively breastfeeding their infants through 3 mo of age. Overcoming barriers to exclusive breastfeeding is likely to require a thorough understanding of local neonatal feeding practices. Intervention and strategies may need to consider emerging market forces and commercial product lines that are not only sold as breast milk substitutes, but also items used as prelacteal feeds.

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