Al Ameen J Med Sci 2025;18(4):285-291 ● US National Library of Medicine enlisted journal ● ISSN 0974-1143

ORIGINAL ARTICLE CODEN: AAJMBG

The protective effects of exclusive breastfeeding on infant health

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Received: 11th April 2025; ***Accepted:*** 25th July 2025; ***Published:*** 01st October 2025

Abstract: *Background:* Exclusive breastfeeding (EBF) for six months is recommended by the World Health Organization (WHO) due to its protective effects against infections. However, despite its benefits, EBF rates decline significantly over time, particularly in low- and middle-income settings. This study aimed to evaluate the prevalence of EBF and its association with illness incidence among infants in Kashmir. *Methods:* A prospective observational study was conducted at G B Panth Children Hospital, Srinagar from March 2018 to March 2019, enrolling 900 healthy, full-term neonates. Feeding practices and illness incidences were recorded at regular intervals up to six months. The association between EBF and illness rates was analyzed using statistical methods, including logistic regression. *Results:* EBF rates declined from 100% at birth to 47% at six months. Infants who were exclusively breastfed throughout six months had significantly lower illness incidence (32.5%) compared to non-EBF infants (49%). The illness rate per infant was lower in the EBF group (0.46) than in the non-EBF group (0.61, P = 0.012). Respiratory infections were the most common illness. Logistic regression confirmed that EBF significantly reduced illness risk, particularly beyond 10 weeks of age. *Conclusion:* Our findings reinforce the protective role of EBF in reducing infant illness, independent of confounders. The sharp decline in EBF rates after four months underscores the need for sustained breastfeeding support. Targeted interventions are essential to promote and maintain EBF, ensuring better infant health outcomes in resource-limited settings.

Keywords: Exclusive breastfeeding, Infant illness, Infection risk, Breastfeeding prevalence.

Introduction

Exclusive breastfeeding (EBF) until six months of age is recognized by the World Health Organization (WHO) as the ideal method of infant feeding, ensuring sufficient nutrition while protecting against respiratory infections and diarrheal diseases [1-5]. However, despite these well-documented benefits, various factors at multiple levels – political, socio-economic, cultural, and individual – can negatively impact breastfeeding practices, affecting both mother and baby [6]. According to analyses of the National Family Health Survey (NFHS) data, the proportion of infants exclusively breastfed for six months rose from 31.3% in NFHS-4 (2015-16) to 43% in NFHS-5 (2019-21) [7].

This improvement is encouraging; however, it also indicates that more than half of Indian infants are still not receiving exclusive breastfeeding for the recommended duration. Regional variations exist within the country. For instance, states like Chhattisgarh (71%), Haryana (69.5%), and Jharkhand (61.7%) reported higher EBF rates, while states such as Meghalaya (23%), Manipur (24.5%), West Bengal (25.4%), and Uttarakhand (25.5%) had lower rates [8]. Factors influencing EBF practices include maternal education, employment status, place of delivery, and antenatal care visits. Studies have found that employed mothers and those with lower education levels are less likely to practice EBF. Additionally, mothers who delivered at public health facilities and had multiple antenatal visits were more likely to exclusively breastfeed their infants [9].

The MAL-ED (Etiology, Risk Factors, and Interactions of Enteric Infections and Malnutrition and the Consequences for Child Health and Development) study, conducted

across multiple countries in Africa, South Asia, and South America, reported that in six out of eight sites, EBF prevalence in the first month of life was below 60%, while partial breastfeeding exceeded 20% [10]. Factors linked to early cessation of EBF include prelacteal feeding, discarding colostrum, and first-time motherhood. A mixed-methods study conducted in a rural coastal Kenyan community among 50 first-time mothers and their advisers highlighted numerous breastfeeding challenges in the first month of life [11].

In India, adolescent mothers under 20 years of age have been observed to have shorter durations of exclusive breastfeeding (EBF) compared to older mothers. According to the National Family Health Survey (NFHS-5), a significant proportion of adolescent mothers initiate breastfeeding but often discontinue EBF earlier due to factors such as lack of awareness, social stigma, and inadequate support systems. While adolescent childbearing remains a concern - with 7.9% of women aged 15-19 already mothers or pregnant at the time of the survey-there is limited published data specifically addressing EBF practices among first-time adolescent mothers in various regions of India, particularly in rural and underserved areas [12-13].

Breast milk is considered a newborn's first natural food and immunization, playing a crucial role in child health and survival. It meets all nutritional requirements in early infancy while significantly reducing morbidity and mortality from childhood infections, including pneumonia, diarrhea, otitis media, and urinary tract infections. WHO recommends that all newborns worldwide be exclusively breastfed for the first six months (without any additional liquids or solids, except for vitamins, minerals, or medicines), followed by the introduction of complementary foods while continuing breastfeeding up to two years or beyond [14].

WHO's endorsement of EBF is supported by strong empirical evidence of its protective effects against illnesses. In low- and middle-income countries, primary care physicians play a vital role in providing comprehensive care to mothers and infants, including nutritional assessment, anticipatory guidance, and infection management [9]. Suboptimal breastfeeding practices, including non-exclusive breastfeeding, contribute to 11.6% of deaths in children under five [14]. Increasing EBF rates could potentially prevent 823,000 child deaths annually [15]. Despite global awareness, EBF prevalence remains below optimal levels. WHO global data from 2016 indicate that only 40% of infants are exclusively breastfed at six months [16].

Similarly, the National Family Health Survey (NFHS-4) from 2015–16 reports EBF rates in India and Tamil Nadu at 54.9% and 48.3%, respectively [17]. Variations in infection rates and illness incidences between EBF and non-EBF infants may be attributed to breast milk's protective effects, as well as other factors influencing early complementary feeding. The timing of complementary feeding initiation is shaped by local knowledge, attitudes toward breastfeeding, the infant's gender and birth order, and the mother's age and socio-economic status [18]. EBF rates exhibit significant inter- and intra-regional differences, with previous studies in our region reporting notably low EBF prevalence [19-20].

Aims and Objectives:

- To evaluate the current prevalence of exclusive breastfeeding (EBF) among full-term, healthy infants.
- To compare the incidence of illnesses between EBF and non-EBF infants and identify the factors influencing breastfeeding practices in our setting.

Material and Methods

This present prospective observational study was conducted in the Postgraduate Department of Paediatrics and Neonatology, GB Pant Children Hospital, an associated hospital of Government Medical College, Srinagar Kashmir. Newborns were identified in postnatal wards and followed up in the Department of Paediatrics.

Healthy, full-term neonates with birth weights above 2.5 kg were eligible if their parents consented to participate and intended to complete immunizations at the clinic until six months of age. Exclusion criteria included neonates with congenital anomalies,

significant medical conditions, preterm birth, low birth weight, or mothers with breastfeeding contraindications. Written informed consent was obtained from all mothers. Infants were examined by a doctor at enrollment, and exclusive breastfeeding (EBF) was reinforced. Follow-ups occurred at 6, 10, 14, 18, 22, and 26 weeks during immunization visits or via telephone. Feeding practices and illness incidence were recorded using structured diary cards maintained by mothers, documenting feeding frequency, illness types, symptoms, and severity.

Data collection was conducted by a doctor and trained social workers, with periodic validation by a pediatrician blinded to feeding status.

Illnesses were classified and graded based on standard operational definitions [21-31], covering respiratory infections (common cold, pneumonia, bronchiolitis), gastrointestinal conditions (vomiting, diarrhea), urinary tract infections, seizures, urticaria, and sepsis. EBF was defined per WHO guidelines [14].

Based on the 2015–16 National Family Health Survey data, with an estimated 48.3% EBF prevalence in Tamil Nadu [17], a sample size of 800 infants was calculated (95% CI, 5% precision). 900 mother-infant dyads were recruited. Data were entered using Microsoft Excel and analyzed in Statistical Package for Social Sciences (SPSS Ver. 22). Descriptive statistics were presented as mean (SD). Proportion tests compared illness incidence between EBF and non-EBF groups, and Penalized Logistic Regression was used to assess risk factors. Statistical significance was set at $P< 0.05$.

Results

A total of 900 infants were included in the study. The male-to-female ratio was 1.3:1. First-order births accounted for 60%, and 65.8% of infants were delivered vaginally. Pre-lacteal feeding was reported in 15% of cases, mainly with formula milk, while all infants received colostrum. The mean maternal age was 27.2 years (range: 19–38 years). Most mothers were part of joint families (68%) and belonged to the middle-income group (65.3%). Despite 78.7% of mothers having attained college-level education, 87.8% were homemakers (Table 1).

Table-1: Baseline Characteristics of Study Population (N = 900)

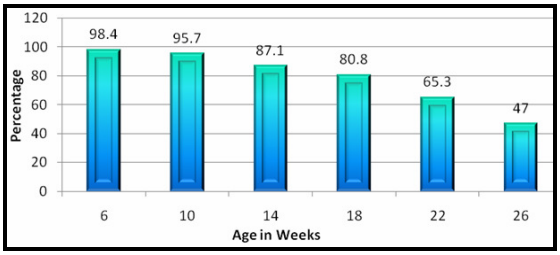
Characteristic	Value
Male: Female Ratio	1.3:1
First Order Births	60%
Normal Delivery	65.80%
Formula Feeding	15%
Received Colostrum	100%
Mean Maternal Age	27.2 years (Range: 19–38)
Joint Families	68%
Middle Income Group	65.30%
College-Educated Mothers	78.70%
Homemaker Mothers	87.80%

The feeding practices were assessed at clinic visits (6, 10, 14, and 26 weeks) and via phone calls (18 and 22 weeks). Introduction of formula milk or formula began as early as six weeks. At 6, 10, 14, 18, and 22 weeks, the percentage of exclusively breastfed (EBF) infants was 98.4%, 95.7%, 87.1%, 80.8%, and 65.3%, respectively. By 26 weeks, only 47% remained exclusively breastfed. Among the 424 infants exclusively breastfed throughout six months, 138 (32.5%) reported illnesses. In contrast, 476 infants who were not exclusively breastfed for the full duration had a higher illness incidence of 49% (233 cases). A total of 371 infants (138 EBF, 233 non-EBF) reported 484 illness episodes, with 194 cases in the EBF group and 290 in the non-EBF group (Table 2, Figure 1).

Table-2: Exclusive Breastfeeding Rates Over Time

Age (Weeks)	EBF (%)
6	98.40%
10	95.70%
14	87.10%
18	80.80%
22	65.30%
26	47%

Fig-1: Exclusive Breastfeeding Rates Over Time



The illness rate per infant was 0.46 (194/424) in the EBF group, significantly lower than 0.61 (290/476) in the non-EBF group ($P = 0.012$). The most frequently reported illnesses were respiratory (82.6%), followed by gastrointestinal (11.6%) (Table 3).

Table-3: Most Common Illnesses Among Study Infants

Illness Type	Total Cases (N = 484)	Percentage (%)
Respiratory Infections	400	82.60%
Gastrointestinal Issues	56	11.60%
Urinary Tract Infections (UTI)	12	2.50%
Sepsis	8	1.70%
Severe Pneumonia	3	0.60%
Unprovoked Seizures	3	0.60%

Among the 371 infants with reported illnesses, 36 required hospitalization for severe conditions (12 UTI, 10 bronchiolitis, 3 severe pneumonia, 8 sepsis, 3 unprovoked seizures). However, there was no significant association between hospitalization rates and feeding status. Due to dynamic shifts in feeding patterns, illness incidence was analyzed at successive time points. Of the 484 illnesses recorded across 0–6, 6–10, 10–14, 14–18, 18–22, and 22–26 weeks, 316 cases occurred in infants who were exclusively breastfed up to the time of assessment, while 168 cases were in those who had transitioned to non-EBF status. The incidence of illness was significantly lower in EBF infants at 10–14, 14–18, 18–22, and 22–26 weeks ($P = 0.011$, 0.035, 0.022, and 0.047, respectively (Figure 2 and Table 4).

Fig-2: Illness Incidence among EBF vs. Non-EBF Infants

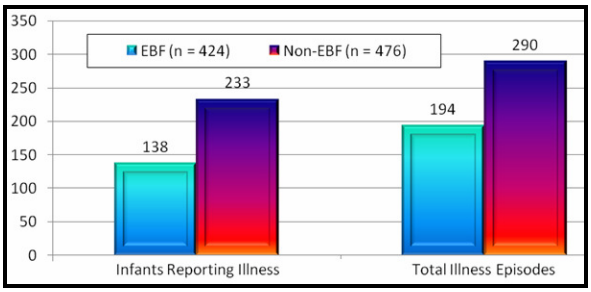


Table-4: Illness Incidence Among EBF vs. Non-EBF Infants (N = 900)

Feeding Group	Infants Reporting Illness (N, %)	Total Illness Episodes (N)	Illness Rate per Infant
EBF (n = 424)	138 (32.5%)	194	0.46
Non-EBF (n = 476)	233 (49%)	290	0.61
Total (N = 900)	371 (41.2%)	484	—

Logistic regression analysis (LRA) was performed to assess the impact of potential confounders, including maternal education and occupation, family type, socio-economic status, mode of delivery, birth order, gender, and pre-lacteal feeding. At 10–14 and 18–22 weeks, infants who were exclusively breastfed had significantly lower odds of illness, with ORs of 0.25 (CI 0.11–0.60) and 0.48 (CI 0.26–0.88), respectively. Additionally, at 14–18 and 22–26 weeks, the upper confidence intervals slightly exceeded 1, with ORs of 0.54 (CI 0.26–1.10) and 0.56 (CI 0.29–1.05), respectively. A marked reduction in infection rates among exclusively breastfed infants beyond 10 weeks of age. Furthermore, at 14–18 weeks, significantly lower odds of infection were observed in infants with lower birth order [first-born OR 0.30 (CI 0.11–0.83), second-born OR 0.31 (CI 0.10–0.92)] and in those from middle-income families [OR 0.47 (CI 0.24–0.96), Table 5].

Table-5: Logistic Regression Analysis – Risk of Illness Based on Feeding Type

Time Period (Weeks)	Odds Ratio (OR) for Illness in EBF Infants	Confidence Interval (CI 95%)	P-Value
10–14	0.25	(0.11–0.60)	0.011
14–18	0.54	(0.26–1.10)	0.035
18–22	0.48	(0.26–0.88)	0.022
22–26	0.56	(0.29–1.05)	0.047

Discussion

In our prospective study, EBF rates declined from 100% at birth to 47% at 6 months of age. High EBF rates reported in the initial period

gradually declined to about 80.8% at 18 weeks, followed by precipitous drops to 65.3% and 47% at 22 and 26 weeks, respectively. These trends closely mirror those seen in a study by Penugonda AJ et al [32], where EBF rates declined to 80% at 18 weeks, 65% at 22 weeks, and 47% at 26 weeks. Nevertheless, the EBF prevalence of 47% at 6 months in our hospital-based prospective study remains substantially higher than the prevalence of 11.4% and 1.1% at 6 months [19-20] and 63.7% at 3 months [19] and 22.1% at 4 months [20] reported in earlier community-based prospective studies from the Vellore region.

Our findings are comparable to those from a South Indian study by Joseph N et al.,(41.7%) [33] but much lower than the 62% reported from North India by Chudasama RK et al.,[34] Although 78.7% of the mothers in our study were college graduates, only 12.2% were employed. This may have enabled a majority of them to continue exclusive breastfeeding until six months of age. However, despite high maternal education levels, periodic motivation at each immunization visit, and adequate social support, the EBF rates registered a steep decline, especially after four months, similar to previous studies.

During the entire six-month period, significantly fewer EBF infants [138/424 (32.5%)] reported illnesses compared to non-EBF infants [233/476 (49%)]. This is consistent with findings from the 450-patient study, where 69/212 (32%) EBF infants and 116/238 (49%) non-EBF infants had illnesses. The number of illnesses per infant was also significantly lower in EBF (0.46) compared to non-EBF (0.61), aligning closely with the previous study's rates (0.45 vs. 0.60). Respiratory infections remained the most commonly reported illnesses (82.6%), followed by gastrointestinal infections (11.6%), similar to the earlier study.

Moreover, illness incidences were significantly lower at 10–14, 14–18, 18–22, and 22–26 weeks among EBF infants, as confirmed by logistic regression analysis (LRA). At 10–14 weeks and 18–22 weeks, the odds ratios (ORs) were 0.27 (CI 0.12–0.64) and 0.50 (CI 0.27–0.90), respectively, in favor of EBF, independent of potential confounders. A similar trend was reported in a Nigerian study by Onayade A et al.,[35] which found significantly lower illnesses per infant in EBF (0.1) versus those exclusively breastfed until four months (1.4). Our findings are also consistent with a study in rural West Bengal, India by Panda S et al.,[36] which reported an increased risk of diarrhea in non-EBF infants.

The multicentric multinational MAL-ED study by Richard SA et al.,[37] which included Vellore, India, found a significantly reduced risk of diarrhea at 0–2 months and 3–5 months and of ALRI at 3–5 months in EBF infants. A study in the Maldives by Raheem RA et al.,[38]showed a significantly reduced risk of ARTIs in predominantly breastfed infants at 3 and 6 months and a lower risk of diarrhea even in partially breastfed infants at 6 months. A Bangladeshi study by Mihrshahi Set al.,[39]also reported a significantly lower seven-day prevalence of diarrhea in EBF infants than in non-EBF infants. A study conducted in urban Kerala by Kuriakose Set al.,[40] reported that the relative risk of developing ARTI in non-EBF infants was 2.46, with an odds ratio of 3.863 for ARTI during the 61st to 180th day of life.

Strengths and Limitations: Our study has several strengths. It was a prospective study in which illnesses were recorded at regular and monthly intervals, reducing recall bias. We used a structured questionnaire that included feeding patterns and illness severity, which was reviewed at every visit by a physician. Additionally, we not only compared illness incidences between EBF and non-EBF groups across all time intervals but also used LRA to analyze the impact of several potential confounders.

Conclusion

Our study reinforces the protective effect of exclusive breastfeeding in reducing illness incidence during the first six months of life, independent of potential confounders. Despite high initial EBF rates, a sharp decline was observed after four months, highlighting the need for sustained breastfeeding support. Given the substantial health benefits, targeted interventions are essential to promote and sustain exclusive breastfeeding, ensuring better infant health outcomes in low- and middle-income settings.

Financial Support and sponsorship: Nil **Conflicts of interest:** There are no conflicts of interest.

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Cite this article as: Asif A and Sana A. The protective effects of exclusive breastfeeding on infant health. *Al Ameen J Med Sci* 2025; 18(4): 285-291.

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