



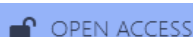
Original Article

A Comparative Study of Exclusive Breastfeeding Practices, Infant Growth Patterns, and Morbidity During the First Six Months of Life

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ABSTRACT

Background; Exclusive breastfeeding (EBF) is universally recommended as the optimal feeding practice for infants during the first six months of life due to its well-established nutritional, immunological, and developmental benefits. Despite global recommendations, the prevalence of EBF remains suboptimal, and early introduction of formula or complementary feeding continues to contribute to increased infant morbidity and impaired growth. This study aimed to compare exclusive breastfeeding practices, infant growth patterns, and morbidity during the first six months of life among exclusively breastfed and non-exclusively breastfed infants.

Materials and Methods; This prospective comparative observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of one year (April 2025 to March 2026). A total of 60 healthy mother–infant pairs were enrolled and followed from birth until six months of age. Participants were divided into two groups: exclusively breastfed infants (n=30) and non-exclusively breastfed infants (n=30). Baseline maternal and neonatal characteristics, breastfeeding practices, anthropometric measurements (weight, length, and head circumference), and morbidity episodes were recorded during scheduled follow-up visits. Statistical analysis was performed using SPSS version 26.0, with a p-value <0.05 considered statistically significant.

Results; Baseline maternal and neonatal characteristics were comparable between the two groups. Early initiation of breastfeeding (86.7% vs. 56.7%, p=0.011), colostrum feeding (96.7% vs. 80.0%, p=0.045), and on-demand breastfeeding (90.0% vs. 63.3%, p=0.016) were significantly more common among exclusively breastfeeding mothers. Exclusively breastfed infants demonstrated significantly greater weight gain throughout follow-up and had higher mean weight (7.18±0.69 kg vs. 6.47±0.74 kg, p<0.001), length (66.4±2.4 cm vs. 64.8±2.6 cm, p=0.014), and head circumference (42.6±1.3 cm vs. 41.8±1.5 cm, p=0.031) at six months. The incidence of acute respiratory infections (26.7% vs. 56.7%, p=0.019), diarrhea (20.0% vs. 50.0%, p=0.015), and hospitalizations (6.7% vs. 26.7%, p=0.038) was significantly lower among exclusively breastfed infants. Perceived inadequate breast milk was the most common reason for early discontinuation of exclusive breastfeeding (33.3%).

Conclusion; Exclusive breastfeeding during the first six months of life was associated with significantly better growth outcomes, reduced infectious morbidity, and fewer hospitalizations compared with non-exclusive breastfeeding. The findings support continued promotion of exclusive breastfeeding through early breastfeeding initiation, maternal counseling, and community-based education to improve infant health outcomes.

Keywords: Exclusive breastfeeding, infant growth, morbidity, respiratory infection, diarrhea, anthropometry, infant nutrition, breastfeeding practices.

INTRODUCTION

Exclusive breastfeeding (EBF) is recognized as the optimal method of infant feeding during the first six months of life and is one of the most effective interventions for improving child survival, growth, and development. The World Health Organization (WHO) recommends that infants should receive only breast milk during the first six months, without any additional food or liquids except oral rehydration solution, vitamins, minerals, or prescribed medicines, followed by continued breastfeeding along with appropriate complementary feeding up to two years of age or beyond.[1]

Breast milk provides complete nutrition, essential fatty acids, immunoglobulins, growth factors, enzymes, and antimicrobial substances that promote healthy physical growth while protecting infants against infectious diseases. Secretory immunoglobulin A (IgA), lactoferrin, lysozyme, oligosaccharides, cytokines, and leukocytes contribute significantly to immune protection by reducing gastrointestinal and respiratory infections during infancy.[2,3]

Globally, despite strong recommendations, the prevalence of exclusive breastfeeding remains suboptimal. According to UNICEF and WHO, only about 48% of infants younger than six months are exclusively breastfed worldwide. In India, the National Family Health Survey-5 (NFHS-5) reported that approximately 64% of infants below six months receive exclusive breastfeeding, although considerable regional variations continue to exist.[4,5]

Adequate nutrition during early infancy is crucial because the first six months represent a period of rapid physical growth and brain development. Breastfed infants generally demonstrate appropriate weight gain, linear growth, improved cognitive development, and lower rates of obesity later in life. Conversely, early introduction of formula feeding or complementary foods may increase the risk of infections, malnutrition, allergies, and metabolic disorders.[6,7]

Several studies have demonstrated that exclusive breastfeeding significantly reduces morbidity due to acute respiratory infections, diarrheal diseases, otitis media, and hospitalization during infancy. These protective effects are particularly important in developing countries where infectious diseases remain major contributors to infant morbidity and mortality.[8,9]

Successful breastfeeding is influenced by multiple maternal and socioeconomic factors including maternal education, early initiation of breastfeeding, antenatal counseling, family support, employment status, parity, and institutional delivery practices. Identification of barriers to exclusive breastfeeding is essential for developing effective public health interventions aimed at improving breastfeeding practices.[10]

Although numerous studies have evaluated breastfeeding practices, relatively limited prospective comparative data are available from southern India assessing the simultaneous relationship between exclusive breastfeeding, infant growth, and morbidity during the first six months of life. Therefore, the present prospective comparative observational study was undertaken at ESIC Medical College and Hospital, Kalaburagi, Karnataka, to compare exclusive breastfeeding practices, infant growth patterns, and morbidity among exclusively breastfed and non-exclusively breastfed infants during the first six months of life.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of one year from April 2025 to March 2026. The study was designed to compare exclusive breastfeeding (EBF) practices, infant growth patterns, and morbidity during the first six months of life among infants who were exclusively breastfed and those who were not exclusively breastfed.

The study was conducted after obtaining approval from the Institutional Ethics Committee (IEC) of ESIC Medical College and Hospital, Kalaburagi. Written informed consent was obtained from the mothers or legal guardians before enrollment. Confidentiality of participant information was maintained throughout the study in accordance with the Declaration of Helsinki. Exclusive breastfeeding was defined according to the World Health Organization (WHO) criteria as feeding the infant only breast milk, without any additional liquids or solids except oral rehydration solution, vitamins, minerals, or medicines.

Study Population

The study included healthy mother–infant pairs attending the postnatal clinic, immunization clinic, and pediatric outpatient department of ESIC Medical College and Hospital.

Sample Size

A total of 60 mother–infant pairs were enrolled and followed prospectively from birth until completion of six months of age.

Study Groups

Participants were categorized into two groups based on infant feeding practices:

- Group A: Infants receiving exclusive breastfeeding for the first six months (n = 30)
- Group B: Infants receiving mixed feeding or formula feeding before completion of six months (n = 30)

Inclusion Criteria

Mother–infant pairs fulfilling the following criteria were included:

- Healthy singleton live-born infants
- Birth weight ≥ 2.5 kg
- Gestational age ≥ 37 weeks
- Mothers willing to participate and provide informed consent
- Infants enrolled within the first week after birth
- Availability for scheduled follow-up visits up to six months

Exclusion Criteria

Mother–infant pairs were excluded if they had:

- Preterm birth (<37 weeks)
- Low birth weight (<2.5 kg)
- Congenital anomalies or major birth defects
- Neonatal intensive care admission for more than 7 days
- Infants with chronic medical illnesses
- Mothers with serious illnesses contraindicating breastfeeding (e.g., HIV infection, chemotherapy, severe psychiatric illness)
- Incomplete follow-up data

Data Collection

Baseline maternal and neonatal information was recorded using a structured predesigned proforma.

Maternal Variables

The following maternal characteristics were documented:

- Age
- Residence (urban/rural)
- Educational status
- Occupation
- Socioeconomic status
- Parity
- Antenatal care visits
- Mode of delivery
- Pregnancy complications
- Early initiation of breastfeeding (within one hour)
- Breastfeeding counseling received
- Family support for breastfeeding

Neonatal Variables

The following neonatal details were recorded:

- Gender
- Birth weight
- Length
- Head circumference
- Gestational age
- APGAR score
- Birth order
- Immunization status

Follow-up Schedule

Mother–infant pairs were followed at:

- Birth
- 6 weeks
- 10 weeks

- 14 weeks
- 18 weeks
- 24 weeks (6 months)

At each visit, infant feeding practices, anthropometric measurements, and episodes of illness were documented.

Assessment of Exclusive Breastfeeding

Exclusive breastfeeding practices were assessed through maternal interviews using a standardized questionnaire.

The following variables were recorded:

- Initiation of breastfeeding
- Colostrum feeding
- Pre-lacteal feeds
- Frequency of breastfeeding
- Night feeding
- Duration of exclusive breastfeeding
- Introduction of water
- Introduction of formula milk
- Introduction of complementary feeds
- Breastfeeding difficulties
- Reasons for discontinuation of exclusive breastfeeding

Assessment of Infant Growth

Anthropometric measurements were performed using standardized techniques by trained healthcare personnel.

Parameters Measured

- Body weight (digital infant weighing scale)
- Length (infantometer)
- Head circumference (non-stretchable measuring tape)
- Weight gain
- Length gain

Growth was assessed according to the WHO Child Growth Standards using age-appropriate growth charts.

The following indicators were evaluated:

- Weight-for-age
- Length-for-age
- Weight-for-length
- Head circumference-for-age
- Growth velocity

Assessment of Infant Morbidity

Information regarding morbidity during the first six months was obtained during follow-up visits and verified from medical records whenever available.

Episodes of the following illnesses were recorded:

- Acute respiratory infections
- Diarrheal disease
- Fever
- Otitis media
- Skin infections
- Hospital admissions
- Antibiotic use
- Emergency department visits

For each illness, duration, severity, treatment received, and hospitalization were documented.

Outcome Measures

Primary Outcomes

- Rate of exclusive breastfeeding up to six months
- Infant weight gain
- Infant length gain
- Head circumference growth

Secondary Outcomes

- Incidence of respiratory infections
- Incidence of diarrheal episodes
- Frequency of hospitalization
- Overall morbidity during the first six months
- Factors associated with successful exclusive breastfeeding

Data Management

All collected data were entered into Microsoft Excel and cross-checked for completeness and accuracy before statistical analysis. Data validation was performed to minimize entry errors.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequency and percentage.

Comparisons between the exclusive breastfeeding and non-exclusive breastfeeding groups were performed using:

- Independent Student's *t*-test for continuous variables
- Chi-square test or Fisher's exact test for categorical variables
- Repeated measures ANOVA for comparison of growth parameters across follow-up visits
- Relative risk (RR) with 95% confidence intervals for morbidity outcomes

A p-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

Table 1. Baseline Characteristics of Study Participants

Variable	Exclusive Breastfeeding (n=30)	Non-Exclusive Breastfeeding (n=30)	p-value
Maternal age (years), Mean $\pm$ SD	25.8 $\pm$ 3.5	26.4 $\pm$ 3.9	0.542
Primiparous mothers	14 (46.7%)	16 (53.3%)	0.602
Vaginal delivery	21 (70.0%)	19 (63.3%)	0.584
Cesarean section	9 (30.0%)	11 (36.7%)	0.584
Male infants	17 (56.7%)	16 (53.3%)	0.793
Female infants	13 (43.3%)	14 (46.7%)	0.793
Birth weight (kg), Mean $\pm$ SD	3.05 $\pm$ 0.34	2.98 $\pm$ 0.36	0.451

Observation: Baseline maternal and neonatal characteristics were comparable between both groups ($p>0.05$).

Table 2. Breastfeeding Practices

Variable	Exclusive Breastfeeding (n=30)	Non-Exclusive Breastfeeding (n=30)	p-value
Breastfeeding initiated within 1 hour	26 (86.7%)	17 (56.7%)	0.011*
Colostrum given	29 (96.7%)	24 (80.0%)	0.045*
Pre-lacteal feeds given	2 (6.7%)	10 (33.3%)	0.010*
Night feeding practiced	28 (93.3%)	21 (70.0%)	0.021*
Breastfeeding on demand	27 (90.0%)	19 (63.3%)	0.016*

Observation: Early initiation, colostrum feeding, and on-demand breastfeeding were significantly more common in the EBF group.

Table 3. Monthly Weight Gain (kg)

Age	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	p-value
Birth	3.05 $\pm$ 0.34	2.98 $\pm$ 0.36	0.451
6 weeks	4.42 $\pm$ 0.41	4.19 $\pm$ 0.46	0.049*
10 weeks	5.26 $\pm$ 0.48	4.89 $\pm$ 0.51	0.008*
14 weeks	5.96 $\pm$ 0.55	5.48 $\pm$ 0.60	0.003*
18 weeks	6.52 $\pm$ 0.63	5.93 $\pm$ 0.66	0.001*
24 weeks	7.18 $\pm$ 0.69	6.47 $\pm$ 0.74	$<0.001^*$

Observation: Exclusively breastfed infants demonstrated significantly greater weight gain throughout follow-up.

Table 4. Growth Parameters at Six Months

Parameter	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	p-value
Weight (kg)	7.18 ± 0.69	6.47 ± 0.74	<0.001*
Length (cm)	66.4 ± 2.4	64.8 ± 2.6	0.014*
Head circumference (cm)	42.6 ± 1.3	41.8 ± 1.5	0.031*

Observation: Anthropometric measurements were significantly better among exclusively breastfed infants.

Table 5. Episodes of Acute Respiratory Infection During Follow-up

Number of Episodes	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	Total
None	22 (73.3%)	13 (43.3%)	35
One	6 (20.0%)	10 (33.3%)	16
Two or more	2 (6.7%)	7 (23.3%)	9

$\chi^2 = 6.91$, $p = 0.032^*$

Observation: Respiratory infections were significantly less frequent in the EBF group.

Table 6. Episodes of Diarrhea During First Six Months

Episodes	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	p-value
None	24 (80.0%)	15 (50.0%)	
One	5 (16.7%)	10 (33.3%)	
Two or more	1 (3.3%)	5 (16.7%)	0.021*

Observation: Diarrheal illness occurred significantly less frequently among exclusively breastfed infants.

Table 7. Hospitalization During First Six Months

Variable	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	p-value
Hospitalized	2 (6.7%)	8 (26.7%)	0.038*
Not hospitalized	28 (93.3%)	22 (73.3%)	

Observation: Hospital admissions were significantly lower in the exclusive breastfeeding group.

Table 8. Overall Morbidity Pattern

Morbidity	Exclusive Breastfeeding (n=30)	Non-Exclusive Breastfeeding (n=30)	p-value
Respiratory infection	8 (26.7%)	17 (56.7%)	0.019*
Diarrhea	6 (20.0%)	15 (50.0%)	0.015*
Fever	5 (16.7%)	11 (36.7%)	0.083
Skin infection	2 (6.7%)	5 (16.7%)	0.228

Observation: Respiratory and gastrointestinal illnesses were significantly reduced among exclusively breastfed infants.

Table 9. Reasons for Early Discontinuation of Exclusive Breastfeeding (n=30)

Reason	Frequency	Percentage
Perceived inadequate milk	10	33.3
Maternal employment	7	23.3
Family advice	5	16.7
Maternal illness	4	13.3
Infant feeding difficulty	2	6.7
Other reasons	2	6.7

Observation: The most common reason for discontinuing exclusive breastfeeding was perceived insufficient breast milk.

Table 10. Comparison of Overall Study Outcomes

Outcome	Exclusive Breastfeeding	Non-Exclusive Breastfeeding	p-value
Mean weight at 6 months (kg)	7.18 ± 0.69	6.47 ± 0.74	<0.001*
Respiratory infection (%)	26.7	56.7	0.019*
Diarrhea (%)	20.0	50.0	0.015*
Hospitalization (%)	6.7	26.7	0.038*
Overall normal growth (%)	93.3	76.7	0.041*

Observation: Exclusive breastfeeding was associated with significantly better growth, lower morbidity, fewer hospitalizations, and a higher proportion of infants achieving normal growth during the first six months of life.

*Statistically significant ($p < 0.05$).

DISCUSSION

The present prospective comparative study evaluated exclusive breastfeeding practices, infant growth, and morbidity among sixty mother–infant pairs followed from birth to six months. The findings demonstrate that exclusive breastfeeding was associated with significantly better growth outcomes and reduced morbidity compared with non-exclusive breastfeeding.

Baseline maternal and neonatal characteristics were comparable between both study groups, indicating that the observed differences in growth and morbidity were less likely to be influenced by demographic variations. Similar baseline comparability has been reported in previous prospective studies evaluating breastfeeding outcomes.[11]

Early initiation of breastfeeding within one hour of birth was significantly more frequent among exclusively breastfeeding mothers (86.7%) compared with the non-exclusive breastfeeding group (56.7%). Likewise, colostrum feeding and on-demand breastfeeding were significantly more common among mothers practicing exclusive breastfeeding. These findings agree with WHO recommendations emphasizing early breastfeeding initiation as a critical determinant of successful exclusive breastfeeding and improved neonatal survival.[1,12]

Infant growth parameters showed consistent superiority among exclusively breastfed infants throughout the six-month follow-up period. Weight gain was significantly greater at every scheduled visit, and infants in the exclusive breastfeeding group also demonstrated significantly higher body weight, length, and head circumference at six months. Similar findings have been reported by Victora et al. and Horta et al., who demonstrated that exclusive breastfeeding supports optimal growth during early infancy without compromising nutritional status.[6,13]

The present study also demonstrated significantly lower rates of acute respiratory infections among exclusively breastfed infants (26.7%) compared with non-exclusively breastfed infants (56.7%). Breast milk contains numerous immune-modulating components including secretory IgA, lactoferrin, cytokines, macrophages, and oligosaccharides that provide passive immunity and reduce susceptibility to respiratory pathogens. Similar reductions in respiratory infections have been documented in previous cohort studies.[8,14]

Diarrheal disease was also significantly less common among exclusively breastfed infants. Exclusive breastfeeding protects against gastrointestinal infections by preventing exposure to contaminated food and water while promoting healthy intestinal microbiota and enhancing mucosal immunity. Previous systematic reviews have consistently demonstrated a substantial reduction in diarrheal illnesses among exclusively breastfed infants, supporting the findings of the present study.[9,15]

Hospital admissions during the first six months were significantly lower among exclusively breastfed infants, reflecting the combined protective effects against infectious diseases and improved nutritional status. Fewer hospitalizations not only improve infant health outcomes but also reduce healthcare expenditure and parental stress. Similar observations have been reported by Kramer and Kakuma as well as WHO infant feeding guidelines.[7,16]

Perceived inadequate breast milk was identified as the leading reason for early discontinuation of exclusive breastfeeding, followed by maternal employment and family advice. Similar barriers have been identified in several Indian and international studies, emphasizing the need for effective breastfeeding counseling, workplace support, maternity leave policies, and family-centered education programs.[10,17]

Overall, the present study reinforces the well-established benefits of exclusive breastfeeding in promoting healthy infant growth while substantially reducing infectious morbidity during the first six months of life. Strengthening breastfeeding promotion through antenatal counseling, Baby-Friendly Hospital Initiative (BFHI) practices, early initiation of breastfeeding, and community-based support programs may significantly improve exclusive breastfeeding rates and contribute toward achieving national and global child health goals.

One limitation of the present study was the relatively small sample size and its single-center design, which may limit generalizability. Furthermore, follow-up was restricted to the first six months of life, and long-term developmental outcomes were not assessed. Larger multicenter longitudinal studies are recommended to further evaluate the long-term impact of exclusive breastfeeding on child growth, neurodevelopment, and metabolic health.

CONCLUSION

Exclusive breastfeeding during the first six months of life was associated with significantly better infant growth, lower morbidity, and fewer hospitalizations compared with non-exclusive breastfeeding. Early initiation and appropriate breastfeeding practices contributed to successful exclusive breastfeeding. These findings highlight the importance of promoting exclusive breastfeeding through effective maternal counselling and supportive healthcare interventions to improve infant health outcomes.

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