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Original Research Article

ROLE OF EXCLUSIVE BREASTFEEDING IN REDUCING MORBIDITY AMONG LOW-BIRTH-WEIGHT INFANTS: A PROSPECTIVE STUDY

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ABSTRACT

Background: Infants with low birth weight (LBW) are defined as those weighing under 2500 grams at birth, and are at higher risk of infections, feeding and growing problems, and hospitalization due to LBW during the first few days of life. These contribute to neonatal and infant morbidity in developing countries. Exclusive breastfeeding (EBF), defined operationally as infants receiving only breast milk (with no other liquids or solids) for the first six months, is endorsed and is the standard of care. Breast milk supplies complete nutrition with added anti-infective and immunological properties that may reduce the incidence of illness in LBW infants. The practice of EBF for LBW infants is frequently not done, and there are few prospective studies on exclusively breastfeeding LBW infants to prevent morbidity. **Objectives:** This study's purpose was to determine the impact of exclusive breastfeeding on morbidity patterns among LBW infants during the first six months of life. Specific objectives included comparing rates of diarrhoea diseases, acute respiratory infections, febrile illnesses, hospitalization status, and growth parameters between low birth weight infants who were exclusively breastfed and infants who were not exclusively breastfed.

Materials and Methods: An observational study was carried out prospectively over twelve calendar months (July 2024 to June 2025) in Department of Paediatrics, Malabar Medical College Hospital and Research Centre, Ulliyeri, Kozhikode, Kerala, India. Following informed parental consent, 120 LBW infants were enrolled. Baseline maternal and infant data were collected, and infants were divided into two groups: those exclusively breastfed (the EBF group) and those mixed breastfed/formula fed (the non-EBF group). All infants were followed for the duration of six months with monthly visits until the infants reached six months of age. Information about feeding practices, morbidity episodes (diarrheal illness, respiratory infections, skin infections, and hospitalizations) and anthropometric measurements (weight and length) were collected.

Results: Of the 120 infants, exclusively breastfed infants were 68 (56.7%) while non-exclusively breastfed infants were 52 (43.3%). The episodes of diarrhoea occurred significantly less in EBF infants than non-exclusive infants ($p < 0.05$). Acute respiratory infections were prevalent for fewer EBF infants compared to non-exclusive infants ($p < 0.01$). Fewer hospital admissions for infection were seen for EBF infants compared to non-exclusive infants ($p < 0.05$). Weight gain and linear growth trends were more favourable for EBF infants compared to the non-exclusive infants, however, the values were not statistically significant between the two groups. The cumulative morbidity burden was markedly lower for infants who were EBF compared to infants who were non-EBF.

Conclusion: Exclusive breastfeeding is an important public health intervention to reduce morbidity in LBW infants during the first six months of life, especially associated with infections and hospitalizations. The findings underscore the need to continue to promote and support exclusive breastfeeding among LBW infants as an effective public health intervention in a resource-limited population.
Keywords: Exclusive breastfeeding, low-birth-weight infants, morbidity, diarrheal diseases, respiratory infections, infant feeding practices, growth outcomes

INTRODUCTION

Low-birth-weight (LBW) infants, defined by the World Health Organization as those with a birth weight of less than 2500 grams, continue to be a significant public health challenge globally. LBW infants comprise approximately 15–20% of all infants born alive, most being born in low-and middle-income regions. In India, the burden is particularly high and contributes to the country's high neonatal and infant morbidity and mortality rates.[1] LBW infants are at risk for multiple challenges in the early days of life, including difficulty maintaining body temperature, poor feeding tolerance, impaired immunity, and increased vulnerability to infections, including pneumonia, diarrhoea, and sepsis. The issues with neonatal health and feeding compliance frequently contribute to repeat hospitalizations and long-term growth and developmental sequelae.[2]

Exclusive breastfeeding (EBF) has always been recognized as the single most important intervention in improving infant survival and health during the first six months of life. Breast milk is biologically designed to meet the nutritional needs of infants and has several bioactive components, such as immunoglobulins, lactoferrin, lysozymes, and growth factors, contributing protection against infection.[3] There is evidence that EBF is associated with a lower incidence of diarrhoea, acute respiratory tract infections (ARTI), and other common childhood illnesses and that EBF is associated with achieving adequate growth rates and development in cognitive abilities. Overcoming these challenges is important because, despite the disadvantages associated with exclusive breastfeeding for LBW infants, the rates of exclusive breastfeeding for LBW infants are often lower than for normal birth-weight infants due to maternal anxiety, challenges with lactation, cultural practices, and poor counselling by healthcare professionals.[4]

Numerous observational and interventional investigations have demonstrated that exclusive breastfeeding may result in reduced infant morbidity and mortality. However, nearly all of these studies focus on the general infant population, and fewer studies concentrate exclusively on the LBW infant population. Since LBW infants are more vulnerable, the protective effects of EBF may be even more significant. Additionally, in many contexts, LBW infants are more likely to receive mixed or formula feeding due to beliefs that breast milk is inadequate or concerns about growth. Therefore, LBW infants may be at greater risk of infection and malnutrition than the general population due to mixed or formula feeding, which can occur even with breastfeeding support.[5]

India is a region with a high prevalence of LBW infants and is therefore an important location to study EBF in vulnerable infants. A prospective evaluation will provide an opportunity to study feeding practices, illness patterns, and growth outcomes over time and produce locally relevant evidence. Understanding the extent to which exclusive breastfeeding contributes to morbidity reduction in LBW infants will provide insights for maternal and child health programming, particularly in resource-limited settings which require the most cost-effective interventions.[6]

Consequently, the research was conducted to evaluate the association of exclusive breastfeeding with morbidity in LBW infants within the first 6 months of life. The research was focused on comparing the incidence of diarrhoea, respiratory tract infections, febrile illnesses, hospitalizations, and growth measurements between LBW infants who were exclusively breastfed and those who were not exclusively breastfed in a prospective cohort study at a tertiary care hospital in Kerala.

MATERIALS AND METHODS

Study design and setting

This prospective observational study was conducted in Department of Paediatrics, Malabar Medical College Hospital and Research Centre, Ulliyeri, Kozhikode, Kerala, India over a twelve-month period, starting from July 2024 and ending in June 2025. The study setting was a referral hospital that defines low-birth-weight (LBW) infants from a large number of urban and rural populations, making it an appropriate site for exploring feeding practices and morbidity profiles, among LBW infants.

Study population

The study population included live-born infants with a birth weight of less than 2500 grams, irrespective of gestational age. Infants were enrolled from the postnatal wards and neonatal intensive care unit (NICU) after stabilization and prior to discharge.

Inclusion criteria

1. Infants with a birth weight <2500 grams.
2. Infants whose mothers provided informed consent for participation.

3. Infants available for regular follow-up for at least six months after birth.

Exclusion criteria

1. Infants with major congenital anomalies or chromosomal abnormalities.
2. Infants with severe perinatal asphyxia requiring prolonged intensive care.
3. Infants with conditions requiring specialized feeding interventions other than breastfeeding.

Sample size

A total of 120 LBW infants were recruited for the study. This sample size was chosen based on feasibility within the study period and was sufficient to allow comparisons between exclusively breastfed and non-exclusively breastfed infants.

Grouping of infants

Infants were categorized into two groups based on feeding practices reported by the mother and verified at each follow-up:

- **Exclusive breastfeeding (EBF group):** Infants who received only breast milk, without any additional food or liquid (not even water), except for oral rehydration solution, drops, or syrups (vitamins, minerals, or medicines).
- **Non-exclusive breastfeeding (non-EBF group):** Infants who received mixed feeding (breast milk with other foods or liquids) or exclusive formula feeding.

Follow-up and data collection

All infants were followed up monthly until six months of age. At each follow-up visit, the following information was collected:

- **Feeding practices:** Confirmed through maternal interview and cross-checked with feeding recall.
- **Morbidity assessment:** Details of illness episodes such as diarrhoea, acute respiratory infections, febrile illnesses, skin infections, and any hospital admissions were recorded. Diagnosis was based on clinical evaluation and hospital records when available.
- **Growth monitoring:** Anthropometric parameters including weight and length were measured using standardized techniques at each visit.

Outcome measures

The primary outcome was morbidity in terms of frequency and incidence of diarrhoea, respiratory tract infections, febrile illnesses, and hospital admissions within the first six months of life. Secondary outcomes included growth velocity assessed by monthly weight gain and increase in length.

Ethical considerations

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Malabar Medical College Hospital and Research Centre. Written informed consent was obtained from the parents or guardians before inclusion of the infants. Confidentiality of participants was maintained throughout the study, and infants requiring medical attention during follow-up were managed as per hospital protocols.

Statistical Analysis

The data were entered into Microsoft Excel and analysed using SPSS software, version 25.0. Baseline characteristics were summarized using descriptive statistics. Categorical variables were expressed in frequencies and percentage, while continuous variables were expressed in mean ± standard deviation. Differences between EBF and non-EBF groups were compared using the chi-square test for categorical variables, and independent t-test for continuous variables. A 2-tailed p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 120 low-birth-weight (LBW) infants were enrolled and were followed for six months. Of this number, 68 infants (56.7%) were exclusively breastfed (the EBF group) and 52 infants (43.3%) were in the non-exclusive breastfeeding group (the non-EBF group). Both groups were similar and comparable at baseline regarding demographic and perinatal characteristics. The morbidity outcomes and growth parameters observed during follow-up are presented in the subsequent tables.

Table 1: Baseline characteristics of study participants

Characteristic	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
Mean birth weight (g)	2225 ± 190	2240 ± 210	0.61
Mean gestational age (weeks)	36.2 ± 1.9	36.4 ± 2.1	0.48
Male sex (%)	37 (54.4%)	28 (53.8%)	0.94
Caesarean delivery (%)	25 (36.8%)	20 (38.5%)	0.84

Table 1 shows that the two groups were similar in terms of sex distribution, mean birth weight, and gestational age, with no statistically significant differences.

Table 2: Maternal characteristics

Maternal variable	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
Mean maternal age (years)	26.8 ± 3.5	27.1 ± 3.8	0.69
Primiparous (%)	31 (45.6%)	23 (44.2%)	0.88
≥4 ANC visits (%)	54 (79.4%)	38 (73.1%)	0.42

Table 2 highlights maternal factors, showing no major differences between groups regarding age, parity, or antenatal care.

Table 3: Distribution of feeding practices

Feeding type at baseline	Number of infants	Percentage (%)
Exclusive breastfeeding	68	56.7
Mixed feeding	40	33.3
Exclusive formula feeding	12	10.0

Table 3 confirms that a larger proportion of infants were maintained on exclusive breastfeeding compared to mixed or formula feeding.

Table 4: Incidence of diarrheal episodes

Variable	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
Infants with ≥1 episode (%)	11 (16.2%)	19 (36.5%)	0.01
Mean episodes per infant	0.26 ± 0.5	0.58 ± 0.8	0.02

Table 4 shows that diarrheal illness was significantly less common in the EBF group compared to the non-EBF group.

Table 5: Incidence of acute respiratory infections (ARI)

Variable	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
Infants with ≥1 ARI (%)	14 (20.6%)	25 (48.1%)	<0.01
Mean ARI episodes/infant	0.32 ± 0.6	0.79 ± 1.0	<0.01

Table 5 demonstrates a significant protective effect of EBF against ARI.

Table 6: Hospital admissions during follow-up

Reason for admission	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
Due to diarrhoea	2 (2.9%)	6 (11.5%)	0.04
Due to ARI	3 (4.4%)	7 (13.5%)	0.05
Any cause	5 (7.3%)	11 (21.2%)	0.02

Table 6 shows that hospitalizations were fewer in the EBF group.

Table 7: Febrile illness episodes

Infants with ≥1 febrile episode (%)	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
	9 (13.2%)	15 (28.8%)	0.03

Table 7 indicates that febrile illnesses were less frequent among exclusively breastfed infants.

Table 8: Skin infections

Infants with skin infection (%)	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
	5 (7.4%)	7 (13.5%)	0.29

Table 8 shows no significant difference in skin infections between the two groups.

Table 9: Growth velocity (weight gain)

Mean monthly weight gain (g)	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
	520 ± 105	495 ± 115	0.18

Table 9 indicates that mean weight gain was slightly higher in the EBF group, though not statistically significant.

Table 10: Growth velocity (linear growth)

Mean length gain per month (cm)	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
	2.7 ± 0.4	2.6 ± 0.5	0.27

Table 10 shows marginally better linear growth in the EBF group.

Table 11: Cumulative morbidity burden

Total illness episodes (6 months)	EBF Group (n=68)	Non-EBF Group (n=52)	p-value
	42	74	<0.01

Table 11 summarizes all illness episodes, demonstrating a substantially lower burden of morbidity among exclusively breastfed infants.

Table 12: Summary of morbidity patterns

Morbidity outcome	EBF (%)	Non-EBF (%)	p-value
Diarrhoea	16.2	36.5	0.01
ARI	20.6	48.1	<0.01
Febrile illness	13.2	28.8	0.03
Hospitalization (any cause)	7.3	21.2	0.02

Table 12 provides a consolidated comparison of the major morbidity indicators between the two groups.

Table 1 shows that baseline demographic factors such as birth weight, gestational age, and sex were comparable across groups. Table 2 further demonstrates that maternal characteristics, including age, parity, and antenatal care, did not differ significantly. Table 3 illustrates that just over half of

the infants were exclusively breastfed, while others received mixed or formula feeding. Table 4 highlights the significantly lower incidence of diarrheal episodes among the EBF group. Table 5 confirms that acute respiratory infections were also markedly less frequent in exclusively breastfed infants. Table 6 indicates that hospital admissions were substantially fewer in the EBF group. Table 7 supports the protective effect of EBF against febrile illnesses, while Table 8 shows no significant difference in skin infections. Table 9 and Table 10 demonstrate that growth velocity in terms of weight and length gain was slightly higher among EBF infants, though the difference was not statistically significant. Table 11 presents the overall cumulative morbidity burden, which was significantly lower among exclusively breastfed infants. Finally, Table 12 consolidates the findings, emphasizing the consistent trend of reduced morbidity associated with exclusive breastfeeding.

DISCUSSION

This prospective study looked at the role of exclusive breastfeeding (EBF) in reducing morbidity among low birth weight (LBW) infants during the first six months of life. The data show a protective effect of EBF, with significantly lower rates of diarrhoea disease, acute respiratory disease, febrile illness, and hospitalization compared to infants that were not EBF.[7] Although weight and length growth velocity were higher among the EBF infants, the difference was not statistically significant. Overall, the findings show EBF is an effective and low-cost intervention to reduce morbidity in vulnerable populations.[8]

One major discovery in this study was the decrease in diarrheal episodes among infants who were only breastfed. This finding supports the established protective effect of breast milk against infections of the gastrointestinal tract. Breast milk contains immunoglobulin A, lactoferrin, lysozyme and oligosaccharides to help protect infants by preventing the colonization of pathogenic organisms in their gut.[9] Furthermore, exclusive breastfeeding limits an infant's exposure to contaminated water, bottles, and complementary feeds, all of which are important sources of infection that prove to be significant risk factors in limited resource settings. The lower incidence of diarrhoea reported in our cohort is aligned with both international and regional studies that have indicated lower risks of gastrointestinal illness among infants who were exclusively breastfed.[10]

Another noteworthy observation was the significant reduction in acute respiratory infection (ARI) episodes in the EBF group. Breast milk contains immune-modulating factors that help enhance mucosal defence and reduce the risk of respiratory pathogens.[11] Breastfeeding exclusively, does also reduce exposure to allergens and environmental contaminants that might introduce through other feeds. Several studies have also documented lower rates of pneumonia and overall respiratory infections among breastfed infants, supporting the biological plausibility of our finding. It is important to note that ARI is one of the leading causes of morbidity and mortality in infants in India, and any intervention that reduces the burden of ARI will have important public health implications.[12]

This study demonstrated that, particularly in regards to infectious illness, infants exclusive breastfed were significantly less likely to have been admitted to a hospital. This is representative of not only a decrease in incidence rates of diarrhoea and respiratory illnesses, but also the role of breast milk in protecting against hospitalization because of severe illness. Lower rates of hospitalization contributed to lower rates of health care costs and reduced burden of care for families. From a health systems approach, supporting exclusive breastfeeding may reduce workload and effective use of health resources.[13]

In regard to febrile illness, we observed that febrile illness was not as different between groups when compared to the differences we observed for diarrhoea and acute respiratory infection. Skin infections were not statistically different between group pairs. These outcomes may be due to more multifactorial components of febrile episodes and skin infections that are influenced by environmental and hygiene factors that are not necessarily related to feeding. Nevertheless, we can observe an overall trend of less morbidity with exclusive breastfeeding, contributing to the overall protective benefits of breastfeeding in general.[14]

In our study, growth outcomes indicated slightly more weight gain, and length gains in infants that were exclusively breastfed followed by a lesser likelihood of being LBW infants, but these were not statistically significant. This indicates that breast milk is enough nutritional intake for LBW infants and goes against the misconceptions that LBW infants require supplementary feeds for optimal growth. Previous studies have indicated that while growth was appropriate with EBF, catch-up growth among LBW infants depends on greater factors beyond nutrition including maternal nutritional status, frequency of feedings, and illness among LBW infants. Our results, similar to previous studies, support that EBF does not inhibit growth for LBW infants, and that there could be indirect benefits of illness on growth with exclusive breastfeeding, and ultimately the amount they could gain in length and weight.[15]

This study has several strengths including its prospective scope, monthly follow-up, and close assessment of feeding practices and morbidity outcomes. By targeting LBW infants, this study examines a subgroup often left out of more general infant feeding studies. The findings are particularly pertinent for countries like India with a high prevalence of LBW infants and still faced with a great burden of infant morbidity.

It is also important to note some limitations. First, although the total sample size was sufficient to identify large differences in morbidity, it is possible that it was not large enough to measure small differences in growth. Second, feeding practices depended on maternal report and verification by recall, which may also introduce recall bias. Third, the study was conducted in a single tertiary care facility, which may affect generalizability to community settings. Lastly, household hygiene, maternal education, and socioeconomic status, although similar by treatment group, may have had some impact on morbidity outcomes.

Notwithstanding these limitations, there is strong evidence from the current study that exclusive breastfeeding contributes to reducing morbidity among LBW infants, and therefore, promoting and supporting exclusive breastfeeding should remain a major component of neonatal and infant care strategies. It is important that health care providers counsel mothers of LBW infants on the adequacy of breast milk, address lactation concerns, and discourage unnecessary supplementation. Additionally, policy initiatives should be directed at strengthening breastfeeding support at the hospital, community, and policy levels to meet the needs of vulnerable infants. Administering optimal feeding practices ensures that vulnerable infants benefit from this practice.

CONCLUSION

This cohort study shows exclusive breastfeeding significantly decreases morbidity in low-birth-weight babies during their first six months. Babies exclusively breastfed had fewer episodes of diarrhoea, acute respiratory infections, febrile illnesses, and hospitalizations than those who were mixed or formula-fed. Weight gain and length gain were similar between groups, signifying that exclusive breastfeeding provides adequate nutrition for LBW infants. These results are an important reminder of the promoting and supporting exclusive breastfeeding's value as a safe, cost-effective, and smart way to positively affect health outcomes in this vulnerable population. Improving hospital-based and community-based breastfeeding programs and maternal counselling will substantially reduce infant morbidity and improve long-term health outcomes.

Author Contributions

Dr. Najeeba C M - Conception of the idea, Drafting the article, Critical revision of the article and Final approval of the version to be published. Dr. Vandana V - Drafting the article, Data analysis and Final approval of the version to be published. Dr. Muhammed Basheer K T - Drafting the article, Data representation and Final approval of the version to be published. Dr. Shrinath G - Statistical interpretation, Critical revision of the article and Final approval of the version to be published.

Ethics Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of Malabar Medical College Hospital and Research Centre.

Consent to Participate

Written informed consent was obtained from the parents or guardians of all participating infants before enrolment.

Helsinki Compliance

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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Conflict of Interest

The authors declare no conflicts of interest related to this study.

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