Comparison of incidence of acute respiratory infection in exclusively breastfed infants and not exclusively breastfed infants from 61 to 180 days of age: A prospective cohort study

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Abstract

Introduction: Acute respiratory tract infection (ARTI) is an important cause of morbidity and mortality among infants. Exclusive breastfeeding can considerably decrease the incidence as well as mortality due to ARTI. Aims and Objectives: To evaluate the effectiveness of exclusive breast feeding for the first six months of life in preventing acute respiratory tract infection in infants 61-180 days of age. To compare the incidence of acute respiratory tract infection in exclusively breastfed infants (61-180 days of age) and not exclusively breastfed infants. Material and Methods: A prospective cohort study was done among term babies with > 2500g birth weight born in Lourdes hospital during the period from 1st June 2012 to 31st May 2013. Based on feeding habits babies were classified into two groups. Infants were followed up from 61st day to 180th day of life to assess feeding habits and episodes of ARTI. Discussion and conclusion: 232 episodes of ARTI were recorded during the study of which 165 episodes were recorded in not exclusively breastfed infants. Incidence of ARTI was 2.04 in the exclusively breastfed infants group and 5.02 in the other group. Relative risk of developing ARTI in not exclusively breastfed infants was found to be 2.46. Odds ratio of having ARTI due to lack of exclusive breast feeding during the 61st to 180th day of life was 3.863. Data from this study confirmed the protective effect of exclusive breastfeeding against ARTI during the 61st to 180th day of life.

Keywords: Acute respiratory tract infection, arti, exclusive breastfeeding, infant health
maternity units set a powerful example for new mothers. BFHI is an effort by UNICEF and the WHO to ensure that all maternities whether free-standing or in a hospital, become centers of breastfeeding support.

**Role of primary care physician/family physician**
A family physician is best equipped to counsel the mother and other family members regarding the importance of EBF as he/she is the first contact doctor. Besides, the family physician understands the sociocultural aspects of breastfeeding in a particular community and can effectively intervene to improve the practices regarding breastfeeding. This will help in reducing the infant mortality and morbidity in our country thereby reducing the burden on healthcare systems and creating a healthy future generation.

**Review of literature**
EBF is the perfect way to provide the best food for a baby's first 6 months of life, benefiting children the world over. According to the WHO and the American Academy of Pediatrics, breastfeeding for at least 6 months can decrease worldwide infant mortality due to diarrhea, respiratory illness, and other infectious diseases. According to UNICEF breastfed children have at least six times greater chance of survival in the early months than non-breastfed children. Breastfeeding drastically reduces deaths from acute respiratory infection (ARI) and diarrhea, two major child killers, as well as from other infectious diseases.

A study published in the Journal of Frontiers in Pediatrics in the year 2019, confirmed that breastfeeding remains a mainstay of prevention for numerous diseases and its protective role increases with duration.

A study conducted in Ethiopia using the 2011 and 2016 Ethiopian Demographic and Health Surveys showed that termination of EBF before 6 months was associated with increased occurrence of diarrhea, fever, and ARI. It was also linked with increased occurrence of childhood wasting and underweight.

Another study published in the journal of biomedcentral (BMC) public health in 2017, using the Bangladesh demographic and health survey data showed that the lack of EBF increased the odds of diarrhea, fever, and ARI. Among the babies aged 6 months or less 27.37% of diarrhea, 13.24% of fever, and 8.94% of ARI could have been prevented if EBF was not discontinued.

Statistics reveal that in the Indian State of Uttar Pradesh 70,000 babies can be saved annually simply by ensuring that all babies are exclusively breastfed for 6 months followed by complementary feed till the age of two. For a state like UP, which has the highest infant mortality rate of 25% in the country, breastfeeding can not only prove to be a big lifesaver but also a great face saver too.

The Millennium Cohort Study was a nationally representative longitudinal study that included 18819 infants who were born in the United Kingdom. The study was focused on the effects of breastfeeding in the term, singleton infants who did not have major problems at birth. About 12% of infants had at least one hospital admission during the first 8 months after birth. The most common cause of hospital admission was lower respiratory tract infection (LRTI) (3.2%). Compared with infants who were not breastfed, exclusively breastfed infants had a large and statistically significant reduction in risk for hospitalization for diarrhea (adjusted Odds Ratio [OR]: 0.37; 95% CI: 0.18–0.78) and LRTI (adjusted OR: 0.66; 95% CI: 0.47–0.92).

**Aims and Objectives**
- To evaluate the effectiveness of EBF for the first 6 months of life in preventing ARI in infants 61–180 days of age.
- To compare the incidence of ARI in exclusively breastfed infants (61–180 days of age) and not exclusively breastfed infants.

**Material and Methods**

**Inclusion criteria**
- Singleton full-term, healthy, weighed >2500 g at birth and were born at Lourdes Hospital during the period from 1st June 2012 to 31st May 2013.
- Babies of 61–180 days of age are included in the study.
- Mother's consent to participate in the study.

**Exclusion criteria**
- Patients with immunodeficiency disorders.
- Patients with low birth weight.
- Patients with developmental anomalies of heart and respiratory system.
- Patients with chromosomal anomalies.
- Those who moved out of the neighborhood.
- Those (mothers of infants) who are not willing to participate.
- Infants whose feeding habit is changed during the study period are excluded from the study.

**Study design**
This was a unicentric, observational, prospective, and cohort study. Infants were followed up for 120 days (from day 61st day to 180th day). Babies were classified into two groups, based on the feeding habits for the previous 15 days.

Number of infants in each group for follow-up was calculated by using the formula

\[ n > \frac{Z^2PQ}{d^2} \]

where Z is the confidence coefficient at 95% = 1.96

P is the incidence rate in the population. According to the National Family Health Survey 3, in the age group of 0–6 months, 56.2% of infants are exclusively breastfed in Kerala.
Kuriakose, et al.: Comparison of incidence of acute respiratory infection in exclusively breastfed infants and not exclusively breastfed infants from 61 to 180 days of age: A prospective cohort study

\[ Q = 1 - P \text{ i.e. } 43.8\% \]

\[ D = \text{difference between the estimated value and the true value, it is taken as } 9.8\% \]

And the sample size was worked out to be 100 (98.46).

At around 45 days of age, when the infants are brought to the hospital for routine vaccination, mothers will be asked to complete a questionnaire concerning data about infants’ birth. Once a mother who met the selection criteria agreed to participate in the study, appointments are made for her to attend the hospital. Infants are examined and the mothers are interviewed at the hospital or home every 15 days. The first visit is arranged on 61st day. Mothers missing hospital appointments are visited at home. At each home visit, infant feeding status will be assessed using 24-h recall. They are also advised to bring their infants to the hospital at any time when ill. Mothers are asked to check the questionnaire on symptoms such as runny nose, cough, hoarse cry, respiratory distress, and fever. The final diagnosis of acute respiratory infection will be done by a pediatrician who is blinded to the study design according to the preestablished WHO definitions after reviewing medical records. All cases of ARI are included in the study. Personnel related to the study do not prescribe medicines or treat infants.

All babies who are born in Lourdes Hospital in the period from 1st June 2012 to 31st May 2013 will be approached for the study, and those who met the selection criteria will be included and will be followed up for 120 days. Babies are continued to get enrolled in the study until both study groups have 100 infants who completed 120 days of follow-up.

Statistical analysis will be performed using SPSS software version 15.0. Several episodes of ARI in each group (exclusively breastfed and not exclusively breastfed) was calculated. Simple proportions were done for all the relevant variables studied also they were graphically represented. Effectiveness of EBF in preventing ARI in infants from 61 to 180 days of age was calculated using the Chi-square test. Incidence of ARI in “EBF infants” and “Not exclusively breastfed infants” was calculated. OR and relative risk of developing ARI in not exclusively breastfed infants were also calculated.

Ethical considerations

Ethical clearance for this study was obtained from the institutional ethics committee. Informed written consent was obtained from all the mothers of infants who were followed up and each mother, whose children were included in the study, had the right to leave the study at any time. The investigator provided counseling to participants in case of need or upon request.

Limitations of the study

The study had a fixed sample size in each group and hence many infants had to be excluded from the study. Due to limitations in time and resources the severity and duration of each episode of respiratory infections were not assessed. Subgroups in the “not exclusively breastfed infants group” were considered as one.

The sex of the infant is not considered in the comparison of ARI. Moreover, the income of the family, environmental conditions, seasonal variations, living conditions like-type of flooring and roofing, the area available per head, and the presence of domestic animals were not considered in the study. The study also did not consider the presence of siblings, which has been taken into account in many similar studies in the past.

Data from the study

A total of 546 infants were followed during the entire study period lasting from 1st June 2012 to 31st May 2013 after applying the inclusion and exclusion criteria. During follow-up, 35 infants moved out of the location. Hence, they were excluded from the study. Around 213 infants changed the feeding practice during follow-up study; i.e. exclusively breastfed infants at the beginning of the study were shifted either to completely formula feeds or to partially breastfeeding. The study continued until both study groups reached 100 infants in each group. Babies were selected on the firstborn, first preference basis.

Data analysis

Total no of babies followed for 120 days:

After excluding dropouts and babies who changed their feeding habits during the study period, a total of 200 infants were followed for 4 months each (from 61st day of life to 180th day of life). 100 infants in “the exclusively breastfed infants” group and 100 infants in the “not exclusively breastfed infants” group.

No of episodes of ARI in exclusively breastfed infants:

The total no of episodes of ARI among exclusively breastfed infants was 67.

No of episodes of ARI in not exclusive breastfed infants:

The total no of episodes of ARI among exclusively breastfed infants was 165.

Graph 1. Distribution pattern of ARI among infant groups

Distribution pattern of ARI

Total no. of episodes of ARI = 232

Graph 2. No of episodes of ARI per child in each group

Episodes of ARI/child

X-axis: Infant groups Y-axis: Episodes of ARI

Graph 3. Incidence of ARI in each group (Episodes of ARI/infant/year)
Incidence of ARI

X-axis: Infant groups

Y-axis: Incidence of ARI/infant/year

The relative risk of developing ARI in not exclusively breastfed infants

The relative risk of developing ARI in not exclusively breastfed infants =

\[
\frac{\text{Incidence of ARI among not exclusively breastfed infants}}{\text{Incidence of ARI among exclusively breastfed infants}}
\]

The relative risk of developing ARI in not exclusively breastfed infants was calculated as 2.46

Graph 1: Distribution pattern of ARI among infant groups Distribution pattern of ARI Total no. of episodes of ARI = 232

Graph 3: Incidence of ARI in each group (Episodes of ARI/infant/year) Incidence of ARI X-axis: Infant groups Y-axis: Incidence of ARI/infant/year

Graph 4: The pattern of ARI among infant-groups

X-axis: 1: Exclusively breastfed infants

2: Not exclusively breastfed infants

Y-axis: No. of infants

Infants who never had an episode of ARI

Graph 5: Infants who never had an episode of ARI

X-axis: No of infants

Y-axis: Infant groups

Exclusively breastfed infants: 44, Not exclusively breastfed infants: 17

Graph 2: No of episodes of ARI per child in each group Episodes of ARI/child X-axis: Infant groups Y-axis: Episodes of ARI
Infants who had at least one episode of ARI

Graph 6: Infants who had at least one episode of ARI

X-axis: No of infants Y-axis: Infant groups
(1) Exclusively breastfed infants: 56 (2) Not exclusively breastfed infants: 83

Odds ratio

Table 1: 2 × 2 table for calculating the odds ratio of developing ARI in not exclusively breastfed infants.

|                  | Infants who had at least one episode of ARI | Infants who never had an episode of ARI |
|------------------|---------------------------------------------|----------------------------------------|
| Exclusively      | 56                                          | 44                                     |
| Not exclusively  | 83                                          | 17                                     |
| Total            | 139                                         | 61                                     |

Odds ratio = 3.8361. 95% CI = 1.9940 to 7.3803. P = 0.001

Table 2: Chi-square test

|                  | Infants who had at least one episode of ARI | Infants who never had an episode of ARI |
|------------------|---------------------------------------------|----------------------------------------|
| Exclusively      | 56                                          | 44                                     |
| Not exclusively  | 83                                          | 17                                     |

Table 2: Chi-square test

Using 2 × 2 contingency table, Chi-square value is calculated using Pearson's method and the values obtained as

Chi-square value = 17.1954
Degrees of freedom = 1
Two-tailed P value < 0.001

As evident from the Chi-square value (Chi-square value 17.1954, degrees of freedom: 1, two-tailed P value < 0.001) the two groups which compared are significantly different which means the lesser incidence of ARTI in exclusively breastfed infants group is not just an accidental finding. EBF has a significant role in preventing ARTI in infants from 61st day to 180th day of life.

Discussion

Around 200 infants were followed for 120 days. From 61st day of life to 180th day of life feeding habits and episodes of ARIs were noted. A total of 232 episodes of ARI were recorded during the study. In the exclusively breastfed infants group, 67 episodes of ARIs (28.88% of total episodes of ARI) were recorded while 165 episodes (71.12% of total episodes of ARI) were recorded not exclusively breastfed infants group. About 56 infants in the exclusively breastfed infants group had at least one episode of ARI; whereas 83 infants had at least one episode of ARI in the other group. In other words; 44 infants from the exclusively breastfed group never had an episode of ARI while only 17 infants from the “not exclusively breastfed” group never had an episode of ARI. In total, out of the 200 infants, 61 never experienced an episode of ARI, of whom 72.13% infants belonged to exclusively breastfed infants and only 27.87% of infants belonged to the not exclusively breastfed infants. This shows the effectiveness of EBF in preventing ARI in infants of 61st to 180th day of life.

Out of the 56 infants of the exclusively breastfed group, who suffered from ARI 2 infants (3.57%) had 3 or more episodes of ARI; 7 infants (12.50%) had 2 episodes and 47 infants (43.37%) had a single episode of ARI during the follow-up period. In the other group, out of the 83 infants who experienced ARI, 23 infants (27.71%) had 3 or more episodes of ARI, 36 had 2 episodes, and 24 had only one episode of ARI.
To compare the incidences of ARI among groups, the incidence of ARI (episodes of ARI/child/year) was calculated and it was found to be 2.04 in the exclusively breastfed infants group and 5.02 in the not exclusively breastfed infants group. This shows that the incidence of ARI considerably varies among groups and the incidence of ARI is much higher in the “not exclusively breastfed infants” group. The relative risk of developing ARI in not exclusively breastfed infants was calculated as 2.46. The OR of having ARI due to lack of EBF during the 61st to 180th day of life was calculated as 3.8631 [95% CI 1.9940 to 7.3803, \( P = 0.0001 \)]. Also, the statistical significance of the study is confirmed by the Chi-square test.

Conclusions and Key Messages

Breastfeeding is the cornerstone of a baby’s health. It is nonreplaceable with any other feeding patterns or any other formula. It has a positive effect on the mental, physical, and social well-being of a baby. As today's children are tomorrow’s citizens, we must be concerned about the physical and mental well-being of children, because of a healthy tomorrow.

Kerala stands at par with the western standards in many health indicators. Kerala is a role model for India in the healthcare system. The changing lifestyles and working patterns in modern Kerala have changed the feeding practices of newborns as most working women find it difficult to continue EBF until the recommended 6 months of age.

Kochi is the first baby-friendly city in Kerala, and Lourdes hospital has contributed to this initiative. Still, we find it difficult to continue EBF until 6 months of age because of the working pattern of mothers, continuing education of mothers, misconceptions about supplementary feeding, etc. Most mothers are ready for EBF, but by the end of 3–4 months, many are forced to change feeding patterns either to partial breastfeeding or to formula feeding.

ARIs are one of the issues with which babies present to the pediatric OPD. EBF not only prevents episodes of respiratory infections but also reduces the duration of the illness as well as the severity. Therefore, the number of patients requiring hospital admission can be significantly reduced by EBF.

Like the protective effect from acute respiratory tract infections, breastfeeding protects from other childhood infections as well. By reducing the disease prevalence rate breastfeeding reduces the expenses in the healthcare system. Moreover, when the baby is ill, caretakers have to be away from work, which adds to the financial burden of the family. This can also be reduced by EBF.

Recommendations

1. More cohort studies of longer durations should be carried out to find the protective effect of breast milk from other diseases as well as the overall brain development and other aspects of the mental well-being of children.
2. Mothers should be encouraged to give expressed breast milk if they have to leave the baby for a few hours. For this, mothers should be familiar with the methods for extracting and keeping breast milk hygienically and healthily.
3. To promote breastfeeding for 6 months, there should be legislation to avail maternity leave for 6 months.
4. Newer options like “work from home,” which are practiced in the western countries can be adopted in Indian setup also, whenever feasible.
5. Mothers of lower socioeconomic backgrounds are not completely aware of the health-related and other benefits of EBF. There should be more informative and educative steps from the side of government bodies as well as other private institutes in the health delivery system.
6. Mothers should be taught proper techniques of breastfeeding to avoid too frequent and continuous feeding of babies.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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