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Original Article

Comparison Between Exclusively and Non-Exclusively Breastfed Infants for the Development of Acute Respiratory Infections and Diarrhea

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ABSTRACT

Objective: To compare the incidence of acute respiratory infections (ARI) and diarrhea in exclusively breastfed infants versus those not exclusively breastfed from the second to the sixth month of life.

Study Design: Prospective observational study.

Place and Duration of Study: Pediatrics Department of Combined Military Hospital, Abbottabad, Pakistan from Jul 2024 to Jan 2025.

Methodology: Infants were divided into Group-A (n=260), who were exclusively breastfed and Group-B (n=260), who were non-exclusively breastfed. Infants were followed up for feeding habits and incidence of ARI and diarrhea from the 60th till the 180th day of life. Primary variables studied were the incidence of ARI and diarrhea during the duration of the study protocol. Odds ratio was calculated for the same.

Results: Incidence of ARI was seen in 72(27.7%) infants in Group-A versus 133(51.2%) infants in Group-B (p<0.001). Incidence of diarrhea was seen in 69(26.5%) patients in Group-A versus 154(59.2%) infants in Group-B (p<0.001). The odds of developing ARI were 2.73 times higher than those who were exclusively breastfed, and the odds of developing diarrhea was 4.02 times greater than those non-exclusively breastfed.

Conclusion: We conclude that exclusive breast feeding from the second to the sixth moth of life results in decreased incidence of ARI and diarrhea in infants and also results in decreased number of episodes of both conditions seen in these infants.

Keywords: Acute Respiratory Infection, Breastfeeding, Diarrhea, Infant.

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INTRODUCTION

Breastfeeding the newborn is the most important step in ensuring adequate nutrition by the mother.[1] According to WHO and UNICEF guidelines, babies should be breastfed to at least 6 months of age as the primary source of nutrition.[2] Mother's milk has been proven to provide all growth and immune requirements to the newborn.[3] After 6 months, semi-solid and solid nutritive additives can be included in the diet, along with continued breastfeeding to 2 years of age.[4]

Breast milk not only contains nutritive factors but anti-microbial as well as immune factors for the baby.[5] Its defensive role, especially during the first six months of life has been widely reported, and studies support its protective role in preventing respiratory infections, diarrhea, and failure to thrive, as it contains anti-bodies and protective immune factors against a variety of bacteria documented to cause gastric and respiratory infections.[6-8]

The morbidity and mortality associated with respiratory infections and diarrhea during the first months of life is very high especially in the developing countries.[9] According to global consensus, 1 in 9 deaths in infants are due to diarrheal illnesses and the mortality associated with ARI among infants was 5.02 deaths/1000 live births.[10]

This study was carried out in our demographic setup since respiratory infections and diarrhea form the major bulk of infants received at our setup and result in considerable morbidity and mortality.[10] We compared the effect of exclusively breastfeeding on the development of acute respiratory infections (ARI) and diarrhea from the second to the sixth month of life.

METHODOLOGY

This prospective observational study was carried out at the Department of Pediatrics, Combined Military Hospital Abbottabad, Pakistan from Jul 2024 to Jan 2025, after approval from the Ethical Review Board (vide letter no. CMH-Atd-ETH-160-Paeds-24, dated 05 Jun 2024).

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Inclusion Criteria: Infants of either gender between the age of 60 to 180 days, being exclusively and non-exclusively breastfed without any other supplementary nutrition of solids, semi-solids, or liquids, who were born at term with weight within percentiles for age with minimum weight at birth >2500 grams were included.

Exclusion Criteria: Infants with major cardiac or respiratory disease, immune disease, congenital anomalies at birth, those who remained admitted for birth associated infections, those with a history of NG feed after birth, birth associated sepsis, those who were shifted to formula or became critical and required NG feed during the study, and infants whose feeding modality was changed during the study protocol were excluded.

Sample size was calculated using the WHO calculator keeping the anticipated population proportion of exclusively breastfed infants in our demographic as 56.2% and those not exclusively breastfed as 43.8%.[11] This came to be 252 for each group. We included a total of 260 patients in each of the two groups making the total study size of 520 patients according to the inclusion criteria furnished.

Non-probability consecutive sampling was used to collect data, and informed consent was taken from parents/guardians. Infants were divided into two groups, with Group-A (n=260) being exclusively breastfed and Group-B (n=260) being non-exclusively breastfed (Figure-1). All infants born in the hospital were assessed by an independent team of pediatricians at their 45th day of visit to the hospital for routine examination and vaccination. A detailed history was taken from the mothers regarding the feeding habits and after consent to be included in the study, the infants were placed in the appropriate groups according to their feeding habits. The mothers were given a questionnaire in the language that they understood and those who did not know how to read were given pictorial representation of when to contact and visit the hospital for ARI and diarrhea. A routine visit was planned every 15th day till the 180-day limit of the study, and mothers were advised to recall feeding habits, episodes of diarrhea and ARI in both groups. Infants with episodes of ARI and diarrhea requiring admission were also noted. The diagnosis of ARI and diarrhea was confirmed using standard WHO definition and protocol by a consultant pediatrician unaware of the study protocol after the patients presented to the hospital.[12,13] Mothers were asked to keep a count by ticking the occurrence of ARI and diarrhea on forms given at the start of the study. Detail history was taken after each episode and endorsed on patients' data record sheets. The final outcome was analyzed in both groups.

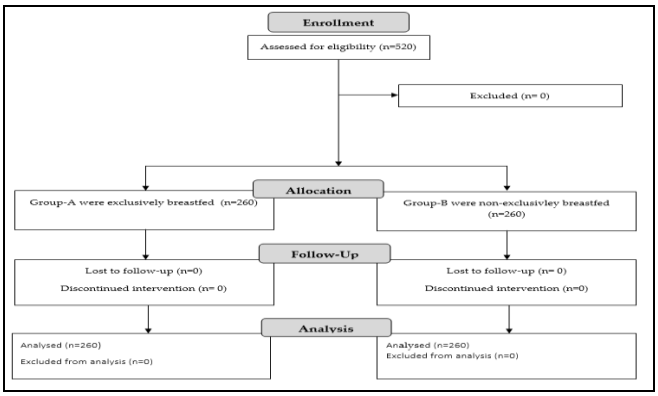

Figure: Patient Flow Diagram (n=520)

Data was analyzed using Statistical Package for Social Sciences 26. Primary variables studied were the incidence of ARI and diarrhea. Demographic data including mean age and weight were expressed as Mean±SD and compared using the independent samples t-test. Qualitative data was expressed as frequency and percentage and compared using the Chi-square test. Odds ratio was calculated to compare rate of occurrence of ARI and diarrhea across groups. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 520 patients were analyzed in the final study protocol divided into Group-A (exclusively breastfed, n=260) and Group-B (not exclusively breastfed, n=260). Mean age of patients at the start of the study in Group-A was 61.50±1.39 days versus 61.53±1.41 days in Group-B (p=0.803). Mean weight was 3132.88±210.50 grams in Group-A versus 3132.46±211.57 grams in Group-B (p=0.982). Gender distribution revealed 164(63.1%) males and 96 (36.9%) females in Group-A versus 163(62.7%) males and 97 (37.3%) females in Group-B (Table-I).

When observing primary variables under study, frequency of ARI was seen in 72(27.7%) infants in Group-A versus 133 (51.2%) infants in Group-B (p<0.001). Incidence of diarrhea was seen in 69(26.5%) patients in Group-A versus 154(59.2%) infants in Group-B (p<0.001). Infants with no episodes of ARI were 188 (72.3%) in Group-A versus 127(48.8%) in Group-B (p<0.001), while those with more than one

episode of ARI were 41 (15.8%) in Group-A versus 71(27.3%) in Group-B (p=0.001). Similarly, infants with no episodes of diarrhea constituted 191(73.5%) infants in Group-A versus 106(40.8%) infants in Group-B (p<0.001). More than one episode of diarrhea was seen in 46(17.7%) subjects in Group-A versus 87(33.5%) subjects in Group-B (p<0.001), as seen in Table-II. The odds of developing ARI were 2.73 times higher than those who were exclusively breastfed, and the odds of developing diarrhea was 4.02 times greater than those non-exclusively breastfed (Table-II).

Table-I: Age and Height Characteristics Across Groups (n=520)

Variable	Group-A (n=260) Mean ± SD	Group-B (n=260) Mean ± SD	*p*-value
Mean age (days)	61.50±1.39	61.53±1.41	0.803
Mean weight (grams)	3132.88±210.50	3132.46±211.57	0.982
Gender	n (%)	n (%)	
Male	164 (63.1%)	163 (62.7%)	-
Female	96 (36.9%)	97 (37.3%)	-

Table-II: Association of Primary Variables Across Groups (n=520)

VARIABLE	GROUP-A (n=260) n (%)	GROUP-B (n=260) n (%)	*p*-vale	Odds Ratio (95% CI)
Acute Respiratory Infection	72 (27.7%)	133 (51.2%)	<0.001	2.734
Diarrhea	69 (26.5%)	154 (59.2%)	<0.001	4.022
No Acute Respiratory Infection	188 (72.3%)	127 (48.8%)	<0.001	-
More than one episode of Acute Respiratory Infection	41 (15.8%)	71 (27.3%)	0.001	-
No Diarrhea	191 (73.5%)	106 (40.8%)	<0.001	-
More than one episode of Diarrhea	46 (17.7%)	87 (33.5%)	<0.001	-

**CI: Confidence Interval*

DISCUSSION

The study concluded that infants who are exclusively breast-fed in the second to sixth month of life have a lower incidence of both ARI and diarrhea than non-exclusively breast-fed infants. The findings also show that the number of episodes of both diarrhea and respiratory infections is significantly less in the exclusively breast-fed group. Pakistan ranks as one of the top countries in Southeast Asia where diarrheal diseases and respiratory infections result in the highest mortality in infants less than one years of age.[14] While many of the environmental factors including access to clean water, proper sanitation, hygiene of the mother and baby remain mediocre at best despite major efforts, maternal and infant related causes need to be addressed as well to decrease the overall morbidity and mortality in these patients.[15]

There has been no formula which has paralleled the superiority of mother's milk in terms of its components and benefits. It is rich in nutrients, sugar, vitamins, proteins as well as pro-biotics, immune factors, and micronutrients. It confers immunity to the newborn in the form of antibodies as well as biomarkers. It is recommended by the WHO and UNICEF that breast milk contains all necessary nutrition during the first six months of life and can be the sole nutritive source for the infant.[16] Recommended to be continued to at least two years combined with other dietary sources for effective nutrition of the baby. It has been reported in various studies that mother's milk in developing countries in poor in iron, vitamin D, vitamin K and potassium. This is attributed to nutritional deficiencies in the mother and consecutive pregnancies with short inter-pregnancy intervals resulting in less than optimum nutrients in mother's milk. For newborns of these mothers, formula maybe advised to cover the deficiencies of the breastmilk as an alternative or as an adjunct to breast milk.[17] So, for these two different dietary regimes, we aimed to find whether formula provided any disadvantages in terms of incidence of ARI and diarrhea in these infants. The study included healthy term infants added to the study at the 60th day of life, with a male pre-dominance. There was a statistically significant difference in the incidence of ARI as well as diarrhea in patients who not exclusively breastfed. This is in line with studies done both locally and internationally.[15-17] Not only was the incidence of ARI and diarrhea seen in more than 50% of infants in the non-exclusive breastfed group, the incidence of having multiple episodes was also increased the same group. The odds ratio of developing ARI was twice as much as that of the exclusively breastfed group whereas the chances of incidence of diarrhea was increased as much as four times in the non-exclusive breastfed infant group.[18]

In a study carried out by Gonga *et al.*, the incidence of both ARI as well as diarrhea was reduced in exclusively breastfed infants between the ages of 2-12 months. The study also concluded that early breastfeeding was associated with decreased episodes of diarrhea especially in rural areas with poor sanitation levels.[19] In another study, done by Khairunnisa *et al.*, exclusive breastfeeding was associated with decreased incidence of diarrhea in children less than 5 years of age which is in line with the findings of our study, where both the incidence and the number of episodes of diarrhea were

significantly less in children who were exclusively breastfed.[20] In a national study done by Ibrahim *et al*., the authors found that even though the incidence of diarrhea and acute respiratory infections is less in exclusively breastfed infants, serum zinc levels also play an important role and even with exclusive breastfeeding, the incidence especially of diarrhea increases in infants with low serum zinc levels and this has to be taken into account in patients with recurrent diarrheal and respiratory episodes.[21] Based on the study and findings of national and international literature, the authors recommends that exclusively breastfeeding is superior to non-exclusive breastfeeding in decreasing the chances of developing ARI and diarrhea in the second to sixth month if life for infants.

LIMITATIONS OF STUDY

The limitations are that this was a single-center only study, and that infants were not followed-up until 2 years of age for a greater scope of study.

CONCLUSION

The study concludes that exclusive breast feeding from the second to the sixth moth of life results in decreased incidence of ARI and diarrhea in infants and also results in decreased number of episodes of both conditions seen in these infants.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FZ & AI: Data acquisition, data analysis, critical review, approval of the final version to be published.

MF & SA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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