

Feeding Modes and their Association with Diarrheal Diseases and Acute Respiratory Infections in Infants upto 6 months of age: A Cross-sectional Study

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ABSTRACT

Background: Diarrheal & respiratory diseases are very common among infants, especially in the developing countries and are influenced by multiple factors. They constitute the most common cause of morbidity and mortality in children. Feeding modes of infants have long been considered to influence such infectious diseases.

Aim: To find different feeding modes, and whether these feeding modes have an impact on the prevalence of diarrhea & acute respiratory infections in infants upto 6 months of age.

Methods: Cross-sectional study was conducted in Pediatrics OPD & Vaccination Center of Jinnah Hospital Lahore, Pakistan. 200 mother-infant pairs were chosen. Data was collected according to a structured questionnaire. Information regarding feeding mode (exclusive breastfeeding, partial breast feeding or top fed), history of diarrhea or respiratory infection during the previous 1 month was gathered. Prevalence of different feeding modes was calculated in terms of percentages. Data was analyzed using SPSS version 21 and presented in the form of frequency tables and graphs. Associations between feeding modes and history of diarrheal and respiratory infections were established using Chi – square test taking 0.05 as standard p – value.

Results: Majority of the infants in our sample was being exclusively breastfed (46%) & prevalence of diarrhea & respiratory infections was least in the same group. A significant association for diarrhea was obtained

Conclusion: It can be concluded from this study that feeding mode has a definite impact on infectious diseases in infants upto 6 months of age and exclusive breast feeding is the most effective way of preventing these infections.

Key words: Exclusive breast feeding Partial breast feeding Diarrhea Top feed ARTI: Acute respiratory infection

INTRODUCTION

Diarrheal and acute respiratory tract infections are the leading cause of morbidity and mortality in children under five years of age¹. Such diseases are influenced by a variety of factors both modifiable and non-modifiable. The most important modifiable factor is breastfeeding and it has been indicated that the immunity of a child can be enhanced by breast milk which contains anti-viral and anti-bacterial substances². Further investigations suggest that there is a 5-times greater risk for bottle fed children to be hospitalized as compared to breast fed children³. Studies reveal that bottle-fed children had a 6-fold higher incidence of dying in the first 2 months from infectious diseases². A research carried out in eight countries revealed the relative risk for diarrheal diseases in breast fed children of 0-2 month's age to be 1.00 while it was 3.43 in those receiving artificial milk⁴. Similarly, relative risk for acute upper RTI in infants of 0-5 month's age was 1.00 in exclusively breast-fed children while it was 4.14 in children receiving artificial milk⁴. Formula milk and other complementary contaminated food make children, susceptible to agents causing gastrointestinal distress which may also be caused by dirty and turbid water used to prepare milk⁵. According to the WHO, the ideal time period for exclusive breast feeding for an infant is 6 months. [6] Also, WHO has proposed that ideal breastfeeding practice involves provision of milk to the baby in the first few hours, giving colostrum and the absence of any pre-lacteal feeding⁷. A research shows that breast feeding has been effective in providing protection against infant mortality especially due to diarrhea and decreases the incidence of hospitalization of children⁸. It has been estimated that exclusive breast feeding and further provision of breast milk to children up to 1 year is estimated to decrease the child death toll by 1.3 million. In Asia

and Africa, the practice of exclusive breast feeding is only about 40% which is far below the ideal level². The purpose of our research is to establish a connection between diarrheal diseases and acute RTIs with breast feeding practice so that awareness can be created among the mothers.

METHODOLOGY

We conducted a cross sectional study at Pediatrics OPD & Vaccination Center of Jinnah Hospital from 25th April, 2018 till 12th May, 2018 on infants up to 6 months of age who came to Pediatrics OPD for regular check-up or routine vaccination. Pediatrics OPD & vaccination center. Informed consent was verbally taken either from the mother or the father of each child. Data was collected from the mother of each infant according to a structured questionnaire. Data was entered into questionnaires by the researchers themselves. Each mother-child pair was interviewed only once. Vital information collected from each pair included: feeding pattern of infant, H/O diarrhea or acute respiratory infection (ARTI) in the previous month, pre-lacteal feeding & administration of colostrum at the time of birth. Other covariates included were: child's gender, birth weight & vaccination status. Educational status of the mother, socioeconomic condition of the family, sanitation & source of drinking water of the household. If the mothers were unsure about the birth weight of the infant, an estimation of the size of baby at the time of birth was used as indication to the birth weight. Children upto 6 months of age admitted in the hospital, suffering from diarrhea or RTI due to a congenital or acquired anatomical or functional abnormality or having an auto-immune disorder. H/O diarrhea or ARTI older than 1 month were excluded from the study. Exclusively Breast Fed infants were defined as the ones who had only been given breast milk (with or without pre-lacteal feeding) since the time of birth². Infants who were being given breast milk along with water, sugar water, honey or other non-milk liquids were defined as Predominantly Breast Fed.[5] However, due to the small sample size, the predominantly breast fed infants were

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also included in the category of exclusively breast fed infants. The data collected analyzed by SPSS version 21. Percentages of exclusively, partially & non-breast fed infants were determined & illustrated in the form of a pie chart. A comparison of prevalence of diarrheal diseases & ARTIs with respect to different feeding modes was made by cross-tabulating the frequencies & this was depicted in the form of bar graphs. Chi square test was employed for determining the p-values which were compared to the standard (0.05). Only those results were considered to be statistically significant whose p-value was less than 0.05.

RESULTS

In the sample population, 92 children (46.0%) were being exclusively breastfed, 73 (36.5%) were partially breastfed and 35 infants (17.5%) were not breastfed at all (Fig.1).

Out of the 92 infants being exclusively breastfed, 43.5% had a positive H/O diarrhea (Figure 2) & 43.5% had a positive H/O ARTI (Figure 3) in the previous one month, thus accounting for 36.4% of all the diarrheal cases & 42.1% of all the cases of ARTI in our sample. 73 infants received mixed feed. Out of which 60.3% had a positive H/O diarrhea (Figure 2) 50.7% had a history of ARTI (Figure 3) in the previous one month, accounting for 40.0% of all the cases of diarrhea &

38.9% of all the RTI cases (Table 1). The non-breast-fed category comprised of 35 infants. 74.3% had a history positive for diarrhea (Fig. 2) and 51.4% had a history positive for ARTI (Fig. 3) in the last month, thus accounting for 23.6% of all the diarrheal cases & 18.9% of all the cases of ARTI (Table 1).

Chi square test was applied with a standard p value: $p \leq 0.05$. After cross tabulation of observed feeding patterns with diarrheal cases, the p value was obtained was **0.04**, this being less than the standard p value, a significant association was established between feeding modes & diarrheal diseases. The percentage of infants suffering from diarrhea in the exclusively breastfed group was far less than that in the partially breastfed & non-breast fed groups. Similarly, the percentage of infants in the partially breastfed group suffering from diarrhea was less than that in the non-breast fed group. As the calculated value of p was less than 0.05, we can conclude that diarrhea was least prevalent in the exclusively breast fed group.

Similarly, feeding patterns were also cross tabulated with RTI cases. Chi square test was applied and the value of p was found out to be 0.574 (Table 1). The calculated p value had no significant association between feeding modes & ARTIs was established. The mean birth weight in this study was 2.15kg & a statistically significant association was found between birth weight & prevalence of diarrhea

Fig. 1: Percentages of different feeding modes in the study sample

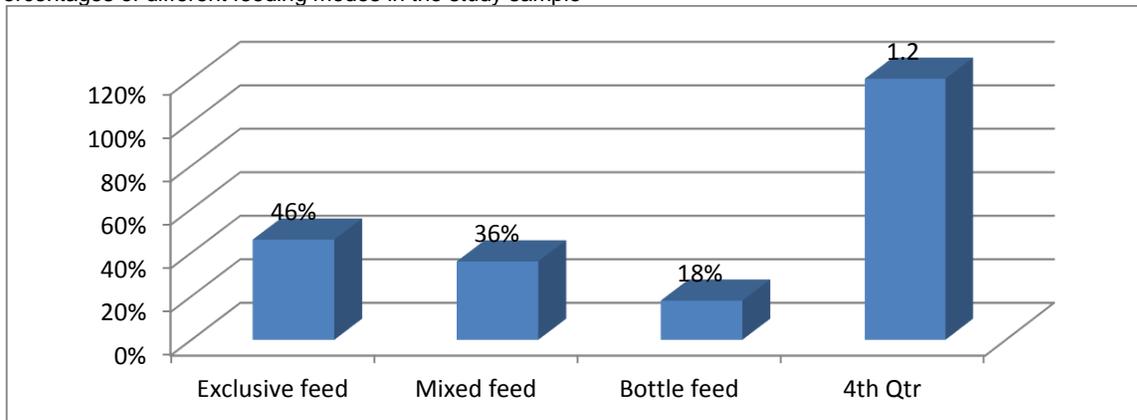


Fig. 2: Percentages of infants who had a positive history of Diarrhea in previous 1month w.r.t feeding modes

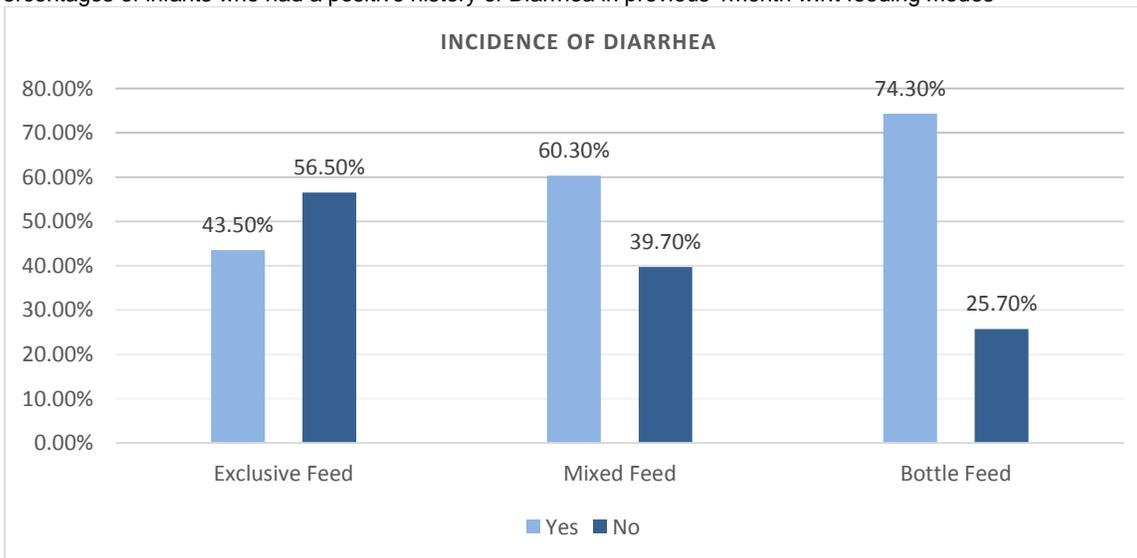


Table-1: The following frequency table shows the prevalence of diarrhea and ARTIs in each feeding group

Feeding Modes	History of Diarrhea		Significance	History of ARTIs		Significance
	Yes	No		Yes	No	
Exclusive Breastfeed	40(43.5%)	52(56.5%)	X ² = 11.015 P= 0.004	40(43.5%)	52(56.5%)	X ² = 1.110 P= 0.574
Mixed Feed	44(60.3%)	29(39.7%)		37(50.7%)	36(39.3%)	
Bottle Feed	26(74.3%)	9(25.7%)		18(51.4%)	17(52.5%)	
Total	110(55%)	90(45%)		95(47.5%)	105(52.5%)	

DISCUSSION

In our study sample, the most prevalent feeding mode was exclusive breast feeding (45%). Results indicate a protective effect of exclusive breast feeding against diarrheal diseases in infants upto 6 months of age^{1,2,4,5,10,12}. The significance of this finding can be highlighted by a cluster randomized controlled trial which was carried out in India. 8 communities were randomly chosen. Counselling regarding the importance of exclusive breast feeding during the first 6 months of life was carried out in some, while the rest of the communities were used as control with no intervention. The results of this study revealed the rate of exclusive breast feeding to be 79% in the intervention group & 49% in the control group after a period of 3 months. Also the 7 day prevalence of diarrheal diseases was very much reduced in the intervention group. [2] The results of our study revealed that only 43.5% of infants in the exclusively fed group & 74.3% infants in the non-breast fed group developed diarrhea. A similar observation was made in a study carried out in Qatar which revealed that risk of diarrhea in children who were given formula was 48.7% as compared to the exclusively breastfed group. So was the case for partially breastfed children (37.3%)¹¹. Another study carried out in Northeast Ethiopia also confirmed that prevalence of diarrhea was strikingly high in the first 6 months of life & the risk was even higher for the infants who were not exclusively breast fed during this time¹².

The greater prevalence of diarrhea in the partially breastfed & non-breast-fed groups could be due to 2 factors: (i) contaminated infant formula or complementary foods (ii) decreased availability of protective agents present in breast milk for the child. Food borne infections are a major cause of diarrhea in infants. A child's immune system develops & starts to function properly by 6-9 months of age. During this time period, the infant is entirely dependent upon the immunity imparted by his diet. The evidence is well documented in several studies. A study in Nigeria revealed that risk of diarrhea was far greater in infants who were given complementary foods between 2 to 6 months of age⁹. Use of contaminated water to prepare infant formula in places where people don't have access to clean drinking water & live in unsanitary conditions, causes contamination of the infants' feed resulting in frequent episodes of diarrhea¹³. Apart from contaminated water, children may be exposed to infected formula, infected bottles & teats resulting in an 80% increased risk of diarrhea in the formula-fed infants¹⁴. It has been well documented that breast milk is the best kind of milk & best source of nutrition for children, especially upto 6 months of age. Breast milk supplies the right amount of fat, protein and carbohydrate, vitamins, minerals & enzymes needed for digestion along with vital hormones required for proper growth & normal functioning of the baby^{12,14}. Human breast milk also contains certain growth factors that are responsible for gastrointestinal epithelial regeneration thus leading to a quick recovery after an infection. [4] Not only does breast milk prevent infection by preventing exposure to contaminated food sources, it also contains immunogenic & anti-infective agents that protect the infant against pathogens¹². Recently, these agents have been identified to be immunoglobulins &

lactoferrin. Breast milk and colostrum contain an appreciable amount of the secretory antibody, IgA which acts by preventing bacterial & viral attachment to the gastrointestinal mucosa. Further protection is provided by lactoferrin which acts as a microbicidal agent^{14,15}. Hence it is recommended to continue to exclusively breast feed a child during period of illness because infant formula increases the child's susceptibility to diarrhea & death by causing withdrawal of the maternal antibodies & directly introducing pathogens¹⁶.

The results of this study were unable to establish a significant association between RTIs and breast feeding. Some other studies have shown exclusive breast feeding to reduce the incidence & prevalence of diarrhea but have failed to establish such a connection with ARTIs. Either the difference in RTI prevalence in such studies is non-significant or else the reduction in RTI prevalence was less than that of diarrhea^{5,17}. However, other more recent studies have shown a reduction in the incidence, prevalence, morbidity & mortality due to RTIs similar to diarrhea in exclusively and/or predominantly breastfed children^{1,2,5,6,10,18}. In fact, recent studies have shown that breast milk of HIV positive women also incurs the same degree of immunity against RTIs caused by *Streptococcus pneumoniae* & *Haemophilus influenzae* because it contains pathogen specific IgG & IgA in amounts equal to breast milk of an HIV negative woman¹⁹.

Other than the feeding mode, several factors influence the presence of disease in children such as birth weight, vaccination status, pre-lacteal feeding, colostrum administration, knowledge & education of mother, socioeconomic status, sanitary condition & source of drinking water. Pakistan is a developing country where literacy rates are not very high & poverty prevails. Due to poor nutrition, a large proportion of infants are underweight. This was also seen in our study where the mean birth weight was found to be 2.15kg. As most mothers do not have basic education, they fail to have a sound knowledge regarding the benefits of breastfeeding. Similarly, a large proportion of mothers have no clue about the effect of colostrum & they deprive their babies of this important feed due false beliefs such as 'colostrum causes diarrhea.' Majority of the people in Pakistan are Muslims & its common practice among Muslims to give honey or sweet water to newborns, before their first milk-feed. Thus the practice of pre-lacteal feeding is very common in Pakistan, as was revealed in our study where 80.5% of the infants were given pre-lacteal feed. A high prevalence of poverty means people cannot afford clean water for drinking purpose. It also means that the sanitary conditions are poor & fecal contamination of water is common, leading to water borne infections.

In this study, a significant association was found between birth weight & disease prevalence⁵. This has also been confirmed by other studies. The prevalence of diarrhea & RTIs in our sample was higher in the infants born to mothers not having a formal education. The results of our study also revealed that infectious diseases were more common in infants living in households having improper sanitation. Similar was the case for infants who had received pre-lacteal feed^{9,11,12}. Although a definite difference in the percentage prevalence was found for the aforementioned factors, the differences were

not statistically significant for any factor other than birth weight. The study was unable to establish a significant association between colostrum administration & infectious diseases. But other studies have made clear the role of colostrum as a source of passive immunity for the neonate¹⁴.

The results of this study and the above discussion clearly show the importance of exclusive breast feeding in infants upto 6 months of age. However, if we strictly adhere to the definition of exclusive breast feeding given by WHO (i.e. the one without pre-lacteal feeding), it would be seen that actually a very small percentage of children are truly breast fed for any period of time. This emphasizes the need of maternal counselling regarding the importance of exclusive breast feeding & its role in the prevention of infectious diseases, especially during the first 6 months of life. Such awareness can be generated through the use of mass media & interpersonal counselling, both of which have been proven to show a positive impact on feeding practices in the past²⁰.

CONCLUSION

It is concluded that breast feeding has an important influence on the prevalence of infectious diseases in infants upto 6 months of age. Exclusive breast feeding imparts a greater degree of protection against infection than does partial breast feeding. Other factors such as birth weight also play a role in diarrheal and respiratory diseases.

REFERENCES

- Duijts L, Jaddoe VWV, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk of infectious diseases in infancy. *Pediatrics*. 2010;126(1):18-25
- Mihrshahi S, Ichikawa N, Shuaib M, Oddy W, Ampon R et al. Prevalence of exclusive breast feeding in Bangladesh and its association with diarrhea and acute respiratory infection: results of the multiple indicator cluster survey 2003. *Journal of Health, Population and Nutrition*. 2007;25(2):195-204
- Haider R, Islam A, Hamadani J, Amin NJ, Kabir I et al. Breast-feeding counselling in a diarrhoeal hospital. *Bulletin of the World Health Organization*. 1996;74(2):173-9
- Brown KH, Black RE, de Romana GL, de Kenashiro HC. Infant-Feeding Practices and their Relationship with Diarrheal and Other Diseases in Huascar (Lima), Peru. *Pediatrics*. 1989;83(1): 31-40
- Arifeen SE, Black RE, Antelman G, Baqui A, Caulfield L et al. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics*. 2001;108(4):67-74.
- Quigley MA, Kelly YJ, Sacker A. Breastfeeding and Hospitalization for Diarrheal and Respiratory Infection in the United Kingdom Millennium Cohort Study. *Pediatrics*. 2007;119(4): 837-42
- Patil CL, Turab A, Ambikapathi R, Nesamvuni C, Chandyo RK et al. Early interruption of exclusive breastfeeding: results from the eight-country MAL-ED study. *Journal of Health Population and Nutrition* 2015;34:10
- Lamberti LM, Walker CLF, Noiman A, Victora C, Black RE. Breastfeeding and the risk for diarrhea morbidity and mortality. *BMC Public Health*. 2011;11(3):15
- Dairo MD, Ibrahim TF, Salawu AT. Prevalence and determinants of Diarrhea among infants in selected primary health centers in Kaduna north local government area, Nigeria. *The Pan African Medical Journal*. 2017;28:109
- Alarcon ML, Villalpando S, Fajardo A. Breast feeding lowers the Frequency and Duration of Acute Respiratory Infection and Diarrhea in Infants under 6 months of age. *Community and International Nutrition*. 1997;127:436-43
- Bener A, Ehlayel MS, Abdulrahman HM. Exclusive breast feeding and Prevention of Diarrheal diseases. *Rev. Bras. Saude Mtern. Infant., Recife*. A study in Qatar. 2011;11(1):83.
- Gizaw Z, Wondwoson W, Bitew BD. Child feeding practices and Diarrheal disease among Children less than two years of age of the Nomadic people in Hadaleala District, Afar Region, Northeast Ethiopia. *International Breastfeeding Journal*. 2017;12:24
- Nguyen TV, Van PL, Huy CL, Gia KN, Weintraub A. Etiology and Epidemiology of Diarrhea in children in Hanoi, Vietnam. *International Journal of Infectious Diseases*. 2006;10:298-308
- Begum MUH, et al. Breast feeding versus Formula feeding and Diarrheal Diseases in Infants and Children- A Review. *Journal of Bangladesh College of Physicians and Surgeons*. 2014;32(1):26-30
- Dieterich CM, Felice JP, O'Sullivan E, Rasmussen KM. Breast Feeding and Health Outcomes for the Mother-Infant Dyad. *Pediatr Clin North Am*. 2013;60(1):31-48
- Bani IA, Saeed AAW, Othman AAMA. Diarrhea and Child Feeding practices in Saudi Arabia. *Public Health Nutrition*. 2002;5(6):727-31
- Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CDV. Protective Effect off Breast feeding against Infection. *Br Med J*. 1990;300:11-6
- Bahl R, Frost C, Kirkwood BR, Edmond K, Martines J, et al. Infant Feeding Patterns and risks of Death and Hospitalization in the First Half of Infancy: multicenter cohort study. *Bulletin of the World Health Organization*. 2005;83:418-26
- Shapiro RL, Lockman S, Kim S, Smeaton L, Rahkola JT, et al. Infant Morbidity, Mortality and Breast Milk Immunologic Profiles among Breastfeeding HIV-Infected and HIV-Uninfected women in Botswana. *The Journal of Infectious Diseases*. 2007;196:562-9
- Nguyen PH, Kim SS, Nguyen TT, Hajeobhoy N, Tran LM et al. Exposure to Mass Media and Interpersonal Counseling has Additive Effects on Exclusive Breastfeeding and its psychosocial determinants among Vietnamese mothers. *Maternal & Child Nutrition*. 2016;12(4):713-25.