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Determinants Of Exclusive-Breastfeeding Practices And Their Association With Respiratory Illness Among Children Between 6-24 Months Of Age In North-24-Parganas

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ABSTRACT:

Background: Childhood respiratory illnesses are one of the major causes of infant mortality and morbidity worldwide. This study aims to evaluate the determinants of exclusive-breastfeeding practices and also to observe the association between childhood respiratory-infections with those determinants.

Subjects and Methods: This cross-sectional study was conducted by using simple random sampling method among 1226 children in north-24-parganas.

Results: Asthma prevalence was significantly higher in non exclusively-breastfed (NEBF) than in exclusively-breastfed (EBF) children. Exclusive-breastfeeding was inversely related to mother's education and household-wealth. Families of EBF children maintain better hygiene habits. Use of proper drinking-water was significantly higher among NEBF children. Lower parity and upholding proper hygienic-practices were shown to significantly minimize the incidence of 'cold&cough' in EBF children; but lower parity, mother's higher educational-attainment and use of clean-separate containers were found to do so in NEBF children. Increased household-affluence, mothers' higher-education, and use of clean-separate containers before feeding have all been shown to significantly reduce the incidence of pneumonia in NEBF children. Asthma prevalence was significantly higher in EBF children who hadn't used protected drinking-water and in NEBF children having higher parity. Fever prevalence was significantly lower in EBF children of families having good hygienic-practices. EBF children have suffered lower risks of respiratory-infections than NEBF children. The odds-ratio was calculated to assess the risk of respiratory-infections based on socio-demographic and other factors.

Conclusion: This study infers that besides exclusive-breastfeeding, maintaining a better lifestyle with proper hygienic-practices may foster a healthy child. Adequate nutrition-education for mothers could be be beneficial.

Keywords: Exclusive-breastfeeding, respiratory infections, non exclusive-breastfeeding.

INTRODUCTION:

Childhood infection represents a formidable global burden, affecting millions of children worldwide and posing significant challenges to public health systems.[1] Infectious diseases are

considered to be the prominent cause of morbidity and hospitalization among infants and young children in developing countries. According to the Ministry of Health and Family Welfare, the infant mortality rate (per 1000 live births) and under-five mortality rate (per 1000 live births) in West Bengal was 28 and 30 respectively in 2014. As per WHO, (2012) the causes of child mortality rate were Neonatal cause (53%), pneumonia (15%), diarrhoeal disease (12%), and measles (3%).[2] Factors such as inadequate access to healthcare, poor sanitation, malnutrition, and limited vaccination coverage exacerbate the impact of these infections, disproportionately affecting vulnerable populations.[3] In the early stages of life, the practice of exclusive breastfeeding till six months has a protective role against various infectious diseases like severe lower-respiratory disease, acute otitis media, asthma, atopic disease, obesity, type-1 diabetes, sudden infant death syndrome, and gastrointestinal infections.[4]As per NFHS-5 report, prevalence of symptoms of acute respiratory infection (ARI) in the 2 weeks preceding the survey was 2.8%, while prevalence of ARI symptoms with fever was 69% in India.[5]However, it is unclear how exclusive breastfeeding habits along with other critical characteristics affect the risk of respiratory infections in early childhood.

OBJECTIVES:

There is a lack of literature, indicating factors affecting childhood infectious diseases in West Bengal as well as north-24-parganas. So, the present study aims to find out the determinants of exclusive breastfeeding practices among children and their association with childhood infectious diseases.

METHODS:

Area of the study: A cross-sectional survey was carried out in thirteen gram-panchayat of Gaighata block in the north-24-Parganas district was selected.

Study Population: 6-24 months of age children, who have completed age-appropriate immunization as per government schedule were chosen to conduct the study. Exclusion criteria: Children of unwilling mothers, mothers with HIV infection, cancer, the child with any non-communicable or other diseases, or mentally ill, and children in the absence of their mother during data collection were excluded from this study.

Sampling: A simple random sampling method was used for the selection of study participants from the existing active anganwadi centers of the selected area.

Sample size: The final sample size was determined by selecting 15% of the total population of the age group of the selected area.[6] From the data of the CDPO (child development project officer) of Gaighata block, the total population was 8353. Finally, from April 2022 to May 2023 a total of 1226 children were assessed.

Data collection: Data were collected by face-to-face interview technique using a structured and pretested questionnaire. The questionnaire was prepared in the English language first and then translated into the local language 'Bengali'. After collecting proper consent, mothers of selected infants who were willing to participate in the study were interviewed to collect the information.

Anthropometric measurements:

The anthropometric survey was conducted at the time of the interview. Therefore weight was assessed with a salter weighing machine and standard weighing scale with 100-g precision, and

height or recumbent length was assessed with an anthropometric rod or 'infantometer' with 0.2 centimetres precision. Weight and length were entered into the WHO 'Anthro' software to calculate weight-for-age, height-for-age, and weight-for-height z-scores.[7,8]

Other Measurements:

Socio-demographic parameters, birth weight of children along with hygienic practices during complementary feeding were recorded. For the determination of exclusive breastfeeding status, participants were asked, whether (a) the infant was still being breastfed, (b) the duration and frequency of breastfeeding (c) whether they had been given any water, liquids, milk, solids, or powdered milk to their infant in the previous day. Participants were then asked if they were breastfeeding their infant. Participants were asked if their child "had cold&cough, diarrhoea, dysentery recently?" The mother was asked, "Presently if their child had ever been hospitalized for pneumonia or had ever faced asthma or breathing issues use an inhaler?" Maternal response to the question "Did your child have high body temperature in the past two weeks?" was used to define the presence of fever with dichotomous yes and no responses. Mothers were also asked, "if their child had suffered from any kind of ear infection and dermatitis or any skin disease or rashes?" Pallor at both anatomical sites of the eyes was clinically observed for the identification of anaemia in children. Responses to this item were coded as 1 or 0 to represent the presence or absence of any diseases.

Definitions:

EBF refers to infants, who receive only breast-milk, and neither drink any liquids or water nor solids are given for the first 6 months of life except oral rehydration solution (ORS), or drops/syrups of vitamins, minerals, or medicines (WHO).[7] **NEBF** designates the infant who receives formula milk or any other animal milk (like cow milk, goat milk, etc) or any liquids like water or any other semi-solid/solid foods during the first six months of life.

Statistical analysis:

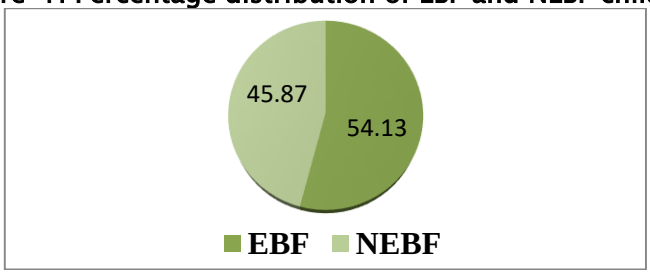
SPSS 23.0 (Statistical Package for the Social Sciences) for statistical analysis. Descriptive statistics and frequencies were evaluated. A chi-square test and multivariate logistic regression analysis were performed between various determinants and the occurrence of infectious diseases. An odds ratio with 95% confidence interval was calculated. p-value <0.05 was accepted as being statistically significant.

Ethical issues:

Ethical approval was sought from the West Bengal State University Institutional Ethics Committee (IEC) (Approval no. WBSU/IEC/30/06) for Research on Human Subjects before the survey was conducted.

RESULT & DISCUSSION:

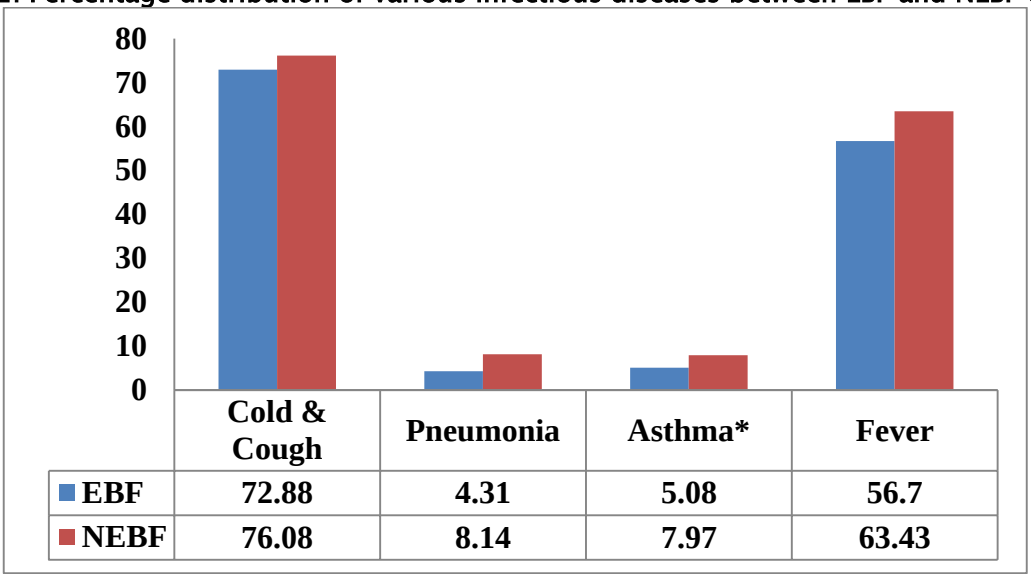
Figure-1: Percentage distribution of EBF and NEBF children



Out of 1226 children who visited ICDS centers in Gaighata block, between April 2021 and May 2022 of the thirteen-gram panchayat, 649 (54.13%) were EBF and 577(45.87%) were NEBF. (Figure-1)

According to NFHS-5 (2019-2021) the prevalence of exclusively breastfed children in India, was 63.7%, which is quite greater than this study, but in West Bengal, this percentage is 53.3% which is almost closer to this study's findings.[9]

Figure-2: Percentage distribution of various infectious diseases between EBF and NEBF children



	Cold & Cough	Pneumonia	Asthma*	Fever
EBF	72.88	4.31	5.08	56.7
NEBF	76.08	8.14	7.97	63.43

p<0.05* (chi-square test)

Figure-2 represents that the prevalence of asthma was significantly higher in NEBF than in EBF children.Similar findings were observed in a study of North Bengal, where there is a significantly smaller number of asthma patients (59.58%) who were exclusively breastfed in contrast to the control group (non-asthma) (74.47%).[10]Immunomodulatory constituents and anti-inflammatory agents in breast-milk are important for the prevention of childhood asthma. Human milk oligosaccharides (HMOs) present in breast-milk can affect the turnover of airway epithelial cells and the formation of glycocalyx mucus, and interact with immune cells and pathogens to protect against asthma. [11]

Table-1: Percentage distribution of EBF and NEBF children according to social, demographic, hygienic and anthropometric characteristics of the mothers and children.

Characteristics	Exclusive breastfeeding practices		χ2-value	p-value
	Yes (%)	No (%)		
Mother's age				
15-20 years	117 (18.02)	87 (15.07)		
20-25 years	235 (36.2)	211 (36.56)	2.34	0.67
25-30 years	198 (30.5)	192 (33.27)		
30-35 years	83 (12.78)	75 (12.99)		
>35 years	16 (2.46)	12 (2.07)		
Mother's nutritional status in 1st trimester				
Undernourished	116 (17.87)	92 (15.94)		
Normal	250 (38.52)	232 (40.2)	0.895	0.639
Overweight/Obese	283 (43.6)	253 (43.84)		
Mother's education				
Below-8 standard	104 (16.02)	77 (13.34)		
8-10th standard	339 (52.23)	349 (60.48)	0.01	**0.00***
10-12th standard	95 (14.63)	0 (0)		
>12th standard	111 (17.10)	151 (26.16)		
Parity				
Primipara	362 (55.57)	339 (58.75)	1.67	0.43
Multipara	256 (39.44)	217 (37.6)		
Grand-multipara	31 (4.77)	21 (3.63)		
Child's nutritional status				
Undernourished	38 (5.85)	23 (3.98)		
Normal	447 (68.87)	426 (73.83)	4.716	0.095
Over-nourished	164 (25.26)	126 (21.83)		
Low birth weight				
Yes	155 (23.88)	125 (19.26)	0.854	0.376
No	494 (76.11)	452 (78.33)		
Household wealth				
Poor	285 (43.91)	93 (16.11)	0.13	**0.00***
Middle	222 (34.2)	206 (35.7)		
High	142 (21.87)	278 (48.18)		
Use of clean and separate containers for feeding				
Yes			6.10	**0.04***
No	503 (77.5)	441 (76.42)		
	146 (22.49)	136 (23.57)		
Use of washing hands before feeding				
Yes	509 (78.42)	446 (77.29)	6.17	**0.04***
No	140 (21.57)	131 (22.7)		

p<0.05* (chi-square test)

Participants were stratified by exclusive breastfeeding status. The percentage distribution of the study sample is presented in table-1. The prevalence of NEBF children is significantly greater than that of EBF children in higher educated mothers (>12th standard), better household wealth families, families where mothers do not use clean and separate containers, and families where mothers do not properly wash their hands before feeding.A similar finding was observed in an

Indonesian study, where there was a significant relationship between monthly household expenditures and maternal educational status with exclusive breastfeeding among under two years of age children.[12,13] Having greater opportunities for employment and inadequate maternity leave among educated mothers could drop their contact with their infant and will lead to compromised exclusive breastfeeding till 6 months of age. The economic scarcity of affording non-human milk for their infants might be one of the positive causes of the exclusive breastfeeding practice more among poor wealth index families than the richest ones.[14]But, practices of using protected drinking water were significantly higher in NEBF children, than EBF children. An analogous result was also observed in Pakistan, where the use of improved drinking water was higher among NEBF children than EBF children.[15]Majority of EBF children belongingto the lower-income families and lack of awareness about healthy lifestyle in poor families may be one of the reasonsfor lesser usage of protected drinking water among EBF children.

Table-2: Prevalence of infectious disease by selected social, demographic, hygienic and anthropometric factors among EBF children (n=649)

Characteristics	Name of diseases			
	Cold & cough	Pneumonia	Asthma	Fever
Mother's age				
15-20 years	87 (74.35)	4 (3.41)	2 (1.7)	68 (58.11)
20-25 years	169 (71.91)	13 (5.53)	13 (5.53)	139 (59.14)
25-30years	147 (74.24)	7 (3.53)	11 (5.55)	108 (54.54)
30-35 years	57 (68.67)	3 (3.61)	5 (6.02)	45 (54.21)
>35 years	9 (56.25)	0	0	6
χ2-value	15.49	11.74	7.27	21.63
(p-value)	(0.97)	(0.92)	(0.508)	(0.601)
Mother's nutritional status				
Undernourished	88 (75.86)	3 (2.58)	4 (3.44)	65 (56.03)
Normal	180 (72)	10 (4)	10 (4)	140 (56)
Overweight/Obese	201(71.02)	14 (4.94)	17 (6)	162 (57.24)
χ2-value	17.09	10.51	3.5	13.32
(p-value)	(0.25)	(0.39)	(0.478)	(0.346)
Mother's education				
<8th standard	54 (64.28)	5 (5.95)	5 (5.95)	75 (89.28)
8-10th standard	267 (78.76)	17 (5.01)	17 (5.01)	212 (62.53)
10-12th standard	81 (70.43)	4 (3.47)	5 (4.32)	55 (47.82)
>12th standard	27 (24.32)	1 (0.9)	4 (3.6)	25 (22.52)
χ2-value	29.03	7.37	6.25	16.91
(p-value)	(0.113)	(0.94)	(0.395)	(0.52)
Parity				
Primipara	249 (68.78)	14 (3.86)	14 (3.86)	200 (55.24)
Multipara	193 (75.39)	12 (4.68)	14 (5.46)	149 (58.2)
Grand-multipara	26 (83.87)	1 (3.22)	31 (100)	18 (58.06)
χ2-value	**24.82**	3.85	3.38	10.36
(p-value)	**(0.03*)**	(0.95)	(0.49)	(0.58)
Child's nutritional status				
Undernourished	26 (68.42)	1 (2.63)	2 (5.26)	24 (63.15)
Normal	333 (74.49)	15 (3.35)	18 (4.02)	252 (56.37)
Over-nourished	110 (67.07)	11 (6.7)	11 (6.7)	91 (55.48)
χ2-value	16.23	14.38	3.67	6.99

(p-value)	(0.29)	(0.156)	(0.45)	(0.85)
Low birth weight(LBW)				
Yes	114 (73.54)	6 (3.87)	10 (6.45)	92 (59.35)
No	355 (67.81)	21 (4.25)	21 (4.25)	275 (55.66)
χ2-value	0.16	7.72	1.62	1.72
(p-value)	(0.68)	(0.17)	(0.443)	(0.94)
Household-wealth				
Poor	94 (32.98)	5 (1.75)	5 (1.75)	75 (26.31)
Middle	194 (87.38)	18 (8.1)	21 (9.45)	137 (61.71)
High	81 (57.04)	4 (2.81)	5 (3.52)	55 (38.73)
χ2-value	21.43	3.92	4.6	16.55
(p-value)	(0.09)	(0.95)	(0.331)	(0.167)
Use of protected drinking water				
Yes	97 (23.42)	17 (4.1)	26 (6.28)	218 (52.65)
No	60 (25.53)	10 (4.25)	24 (10.21)	149 (63.4)
χ2-value	**43.03**	2.52	**28.38**	**23.53**
(p-value)	**(0.00*)**	(0.991)	**(0.00*)**	**(.023*)**
Use of clean and separate containers for feeding				
Yes				
No	355 (70.57)	21 (4.17)	26 (5.16)	277 (55.06)
	114 (78.08)	6 (4.1)	5 (3.42)	90 (61.64)
χ2-value	**19.69**	5.19	1.10	14.9
(p-value)	**(0.006*)**	(0.39)	(0.602)	**(0.021*)**
Use of proper hand washing before feeding				
Yes	360 (70.72)	17 (3.33)	27 (5.3)	278 (54.61)
No	109 (77.85)	10 (7.14)	4 (2.85)	89 (63.57)
χ2-value	**18.3**	10.38	1.57	**17.76**
(p-value)	**(0.01*)**	(0.065)	(0.45)	**(0.007*)**

p<0.05* (chi-square test)

The prevalence of infectious diseases of exclusively breastfed children was characterized in Table 2. **'Cold&cough'** was significantly higher among the children ofmultiparous and grand-multiparous mothers than the children of primiparous mothers, also among the children who were fed 'protected drinking water' and also among the mothers who use 'clean and separate containers' and practice 'proper hand washing' before feeding their babies.**Asthma** was significantly higher in the children who were not fed 'protected drinking water' than those who were fed. The percentage of children having **fever** was significantly higher in the children who were not fed 'protected drinking water', also those families where mothers do not use 'clean and separate container', do not wash hands properly before feeding their babies. No significant association was found for pneumonia in EBF children.

Table-3: Prevalence of infectious disease by selected social, demographic, hygienic and anthropometric factors among NEBF children (n=577)

Characteristics	**Name of diseases**			
	Cold & cough	**Pneumonia**	**Asthma**	**Fever**
Mother's age				
15-20 years	65 (74.71)	7 (8.04)	3 (3.44)	55 (63.21)
20-25 years	152 (72.03)	18 (8.53)	14 (6.63)	131 (62.08)
25-30years	157 (81.77)	14 (7.29)	19 (9.89)	121 (63.02)

30–35 years	55 (73.33)	6 (8)	8 (10.66)	56 (74.66)
>35 years	7 (58.33)	0	0	4 (33.33)
χ2-value	6.4	0.904	5.53	11.22
(p-value)	(0.17)	(0.92)	(0.23)	(0.18)
Mother's nutritional status				
Undernourished	67 (72.82)	7 (7.6)	9 (9.78)	57 (61.95)
Normal	170 (73.27)	21 (9.05)	16 (6.89)	141 (60.77)
Overweight/Obese	202 (87.06)	17 (7.32)	21 (9.05)	170 (73.27)
χ2-value	3.5	0.921	0.81	3.9
(p-value)	(0.17)	(0.63)	(0.66)	(0.41)
Mother's education				
<8th standard	60 (77.92)	13 (16.88)	6 (7.79)	50 (64.93)
8–10th standard	268 (76.79)	24 (6.87)	29 (8.3)	222 (63.61)
10–12th standard	0	0	0	0
>12th standard	91 (60.26)	8 (5.29)	11 (7.28)	96 (63.57)
χ2-value	**6.71**	**10.56**	0.155	0.71
(p-value)	**(0.03*)**	**(0.005*)**	(0.92)	(0.95)
Parity				
Primipara	240 (70.79)	29 (8.55)	19 (5.6)	212 (62.53)
Multipara	179 (82.48)	14 (6.45)	25 (11.52)	146 (67.28)
Grand-multipara	15 (71.42)	1 (4.76)	2 (9.52)	9 (42.85)
χ2-value	**7.73**	1.05	**6.36**	5.92
(p-value)	**(0.02*)**	(0.59)	**(0.04*)**	(0.205)
Child's nutritional status				
Undernourished	16 (69.56)	2 (8.69)	3 (13.04)	14 (60.86)
Normal	322 (75.58)	34 (7.98)	29 (6.8)	269 (63.14)
Over-nourished	99 (78.57)	9 (7.14)	14 (11.11)	84 (66.67)
χ2-value	1.01	0.12	3.27	0.98
(p-value)	(0.6)	(0.94)	(0.19)	(0.91)
Low birth weight (LBW)				
Yes	96 (76.8)	10 (8)	8 (6.4)	85 (68)
No	343 (75.88)	35 (7.74)	38 (8.4)	283 (62.61)
χ2-value	0.45	0.009	5.38	4.72
(p-value)	(0.9)	(1.00)	(0.57)	(0.09)
Household-wealth				
Poor	65 (69.89)	14 (15.05)	9 (9.67)	60 (64.51)
Middle	157 (76.21)	16 (7.76)	16 (7.76)	132 (64.07)
High	217 (78.05)	15 (5.39)	21 (7.55)	176 (63.3)
χ2-value	2.55	**9.04**	0.44	1.85
(p-value)	(0.27)	**(0.01*)**	(8.00)	(0.76)
Use of protected drinking water				
Yes	312 (76.84)	28 (6.89)	34 (8.37)	252 (62.06)
No	126 (73.68)	17 (9.94)	12 (7.01)	115 (67.25)
χ2-value	0.56	1.58	0.29	3.79
(p-value)	(0.45)	(0.23)	(0.73)	(0.15)
Use of clean and separate containers for feeding				
Yes	328 (74.31)	29 (6.57)	37 (8.39)	278 (63.03)
No	111 (81.61)	16 (11.76)	9 (6.61)	90 (66.17)
χ2-value	**4.22**	**4.13**	0.38	1.14

(p-value)	**(0.04*)**	**(0.04*)**	(0.71)	(0.56)
Use of proper hand washing before feeding				
Yes				
No	334 (74.88)	30 (6.72)	38 (8.52)	282 (63.22)
	105 (80.15)	15 (11.45)	8 (6.1)	86 (65.64)
χ2-value	2.46	3.36	0.72	0.87
(p-value)	(1.12)	(0.09)	(0.46)	(0.64)

p<0.05* (chi-square test)

The prevalence of infectious diseases of non-exclusively breastfed children was characterized in Table-3. **'Cold&cough'** was significantly higher among the children of the lower educated, multiparous and grand-multiparous mothers than the children of higher educated and primiparous mothers respectively, also those families, where the child's mothers do not use 'clean and separate container' before feeding their babies than who use.**Pneumonia** was significantly higher among the children of multiparous and grand-multiparous mothers and children of poor household wealth families than the children of primiparous mothers and higher household wealth families respectively, also among the children of those families, where their mothers do not use 'clean and separate containers' before feeding than who use. **Asthma** was significantly higher among the children of multiparous and grand-multiparous mothers than primiparous mothers. No significant association was found for fever in NEBF children. NEBF children have been suffering from various diseases relatively more than EBF children. Breast milk has several ***important immunological properties*** which defend against various types of infections in children.[16]**Leukocytes** are thought to mediate active immunity and develop immunocompetence in the infant by phagocytosis, secretion of cytokines and immunoglobulins, and antigen presentation, in addition to protecting the mammary gland from infection.[17,18,19]**Lactoferrin** works together with lysozyme to exert an antibacterial effect by degrading the outer walls of bacteria.[17]**Nucleotides** have beneficial effects on mucosal immunity in animal models and may enable macrophage activation via immunomodulatory factor production.[17]**HMO (human milk oligosaccharides)** acts as decoy receptors at epithelial binding sites to prevent pathogen colonization and actively modulate gut microbiota, conferring protection against infectious diseases by acting as prebiotics.[17] Maternal milk is the major source of **epidermal growth factor (EGF)** and heparin-binding EGF-like growth factor, both of which are crucial in gut epithelial regeneration and repair.[19]

Table-4: Logistic regression analysis of environmental and socio-demographic factors of infectious diseases among EBF children

Characteristics	Name of diseases			
	Cold & cough	Pneumonia	Asthma	Fever
	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)
Mother's age				
15-20years	0.44 (0.1-1.83)	**4.21* (1.28-1.38)**	2.4(0.24-23.51)	2.84 (0.7-11.45)
20-25 years	0.53 (0.13-2.12)	**5.96* (0.27-1.71)**	2.15 (0.24-18.94)	2.16 (0.55-8.44)
25-30years	0.45 (0.11-1.83)	**8.48* (2.58-2.79)**	2.31 (0.25-20.66)	1.62 (0.41-6.4)
30-35 years	0.53 (0.12-2.26)	1.55 (0.55-1.57)	2.32(0.22-24.31)	3.31(0.8-13.71)
>35 years	Ref	Ref	Ref	Ref
Mother's nutritional status				
Undernourished	0.84 (0.48-1.48)	1.42 (0.37-5.49)	1.11 (0.33-3.69)	1.08 (0.66-1.76)

Normal	Ref	Ref	Ref	Ref
Overweight/Obese	1.09(0.71-1.65)	0.89 (0.37-2.12)	0.66 (0.29-1.5)	0.94 (0.64-1.37)
Mother's education				
<8th standard				
8-10th standard	0.43 (0.19-0.97)	0.35 (0.03-3.32)	3.12 (0.77-12.63)	1.85 (0.54-2.56)
10-12th standard	**0.46* (0.22-0.96)**	0.31 (0.03-2.53)	2.62 (0.81-8.45)	1.25 (0.61-2.53)
>12th standard	**2.57* (0.1-0.61)**	0.29 (0.03-2.86)	2.52 (0.61-10.3)	1.66 (0.75-3.67)
	Ref	Ref	Ref	Ref
Parity				
Primipara	Ref	Ref	Ref	Ref
Multipara	0.7 (0.47-1.05)	0.77 (0.33-1.76)	0.76 (0.35-1.66)	1.03 (0.72-1.47)
Grand-multipara	**0.24* (0.06-0.87)**	1.47 (0.14-15.37)	0.4 (0.9-1.7)	1.1 (0.47-2.54)
Child's nutritional status				
Undernourished	1.7 (0.75-3.85)	1.75 (0.21-14.41)	0.68 (0.14-3.12)	0.64 (0.29-1.38)
Normal	Ref	Ref	Ref	Ref
Over-nourished	1.46 (0.94-2.26)	0.64 (0.27-1.5)	0.61 (0.27-1.36)	0.93 (0.62-1.39)
Low birth weight(LBW)				
Yes	0.993 (0.63-1.55)	0.838 (0.32-2.19)	1.59 (0.72-3.51)	1.151 (0.77-1.71)
No	Ref	Ref	Ref	Ref
Household-wealth				
Poor	1.68 (0.85-3.33)	1.22 (0.3-4.9)	1.24 (0.34-4.53)	0.71 (0.4-1.26)
Middle	1.98 (1.11-3.52)	1.19 (0.37-3.78)	0.91 (0.33-2.55)	0.73 (0.46-1.18)
High	Ref	Ref	Ref	Ref
Use of protected drinking water				
Yes	Ref	Ref	Ref	Ref
No	1.06 (0.71-1.6)	0.91 (0.39-2.13)	**3.34* (1.24-8.98)**	**1.60* (0.42-0.86)**
Use of clean and separate containers for feeding				
Yes				
No	Ref	Ref	Ref	Ref
	0.66(0.4-1.08)	0.82(0.31-1.18)	1.72(0.63-4.69)	0.84(0.55-1.27)
Use of proper hand washing before feeding				
Yes	Ref	Ref	Ref	Ref
No	0.61(0.36-1.01)	**0.33*(0.14-0.8)**	2.55(0.83-7.78)	0.79(0.51-1.2)

p<0.05* (logistic regression test)

Table-4 presents the results of the multivariate logistic regression analysis for EBF children. **Mother's age**: Children of mothers belonging to 15-20, 20-25, and 25-30 years of age had significantly 4.21 (95%CI=1.28, 1.38), 5.96 (95%CI=0.27, 1.71), 8.48 (95%CI=2.58, 2.79) increased odds of having pneumonia respectively, than children of mothers belonging to >35 years of age. **Mother's education**: Children of mothers belonging to 8-10th and 10-12th standard had significantly 0.46 (95%CI=0.22, 0.96) and 2.57 (95%CI=0.1, 0.61) increased odds of having 'cold&cough' respectively than children of highly educated (>12th standard) mothers. **Parity:** Children of the mothers with grand-multipara had significantly 0.24 (95%CI=0.06, 0.87) increased

odds of having 'cold&cough' than children of the mothers with primipara. **Use of protected drinking water:** Children of the mothers who do not use protected drinking water had significantly 3.34 (95%CI=1.24, 8.98) and 1.60 (95%CI=0.42, 0.86) increased odds of having asthma and fever respectively than children of the mothers who use. **Use of clean and separate containers for feeding:** Children of the mothers who did not use clean and separate containers had significantly 0.63 (95%CI=0.41, 0.96) increased odds of having diarrhoea than children of the mothers who used. **Use of proper hand washing before feeding:** Children of mothers who do not wash their hands properly before feeding had significantly 0.33 (95%CI=0.14, 0.8) increased odds of having pneumonia than children of mothers who wash their hands properly before feeding.

Table-5: Logistic regression analysis of environmental and socio-demographic factors of infectious diseases among NEBF children

Characteristics	Name of diseases			
	Cold & cough	Pneumonia	Asthma	Fever
	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)	Odds Ratio (OR) (95%CI for OR)
Mother's age				
15-20 years	3.02 (0.31-28.86)	**8.36* (2.48-2.81)**	**8.48* (2.12-3.38)**	0.54 (0.11-2.59)
20-25 years	3.28 (0.35-30.21)	**8.22* (0.29-2.30)**	**4.41* (1.72-1.12)**	0.53 (0.11-2.41)
25-30years	1.87 (0.2-17.41)	**8.52* (0.29-2.46)**	**2.88* (1.17-7.1)**	0.58 (0.12-2.65)
30-35 years	4.07 (0.42-39.47)	**1.15* (0.11-1.15)**	**2.65* (0.26-2.65)**	0.27 (0.05-1.36)
>35 years	Ref	Ref	Ref	Ref
Mother's nutritional status				
Undernourished	1.1 (0.6-2.00)	1.27 (0.49-3.26)	0.7 (0.29-1.68)	**6.09* (3.5-10.43)**
Normal	Ref	Ref	Ref	Ref
Overweight/Obese	0.77 (0.48-1.22)	1.41 (0.7-2.85)	0.82 (0.41-1.64)	7.63 (0.73-9.8)
Mother's education				
<8th standard	1.77 (0.89-3.51)	**0.3* (0.11-0.82)**	1.06 (0.36-3.09)	0.85 (0.45-1.6)
8-10th standard	1.17 (0.7-1.94)	0.79 (0.33-1.87)	0.86 (0.41-1.78)	**8.97* (.58-1.37)**
10-12th standard	-	-	-	-
>12th standard	Ref	Ref	Ref	Ref
Parity				
Primipara	Ref	Ref	Ref	Ref
Multipara	**0.59* (0.37-0.93)**	1.33 (0.65-2.71)	0.45 (0.23-0.85)	1.09 (0.1-1.15)
Grand-multipara	0.73 (0.25-2.14)	0.66 (0.13-3.25)	0.62 (0.13-2.99)	0.96 (0.37-2.48)
Child's nutritional status				
Undernourished	1.4 (0.51-3.8)	1.06 (0.22-5.1)	0.48 (0.13-1.75)	7.86 (0.38-2.00)
Normal	Ref	Ref	Ref	Ref
Over-nourished	0.87 (0.52-1.47)	1.21 (0.54-2.71)	0.57 (0.29-1.13)	**8.26* (0.52-1.29)**
Low birth weight (LBW)				
Yes	1.03 (0.62-1.73)	1.00 (0.46-2.17)	1.3 (0.58-2.91)	**1.55* (0.98-2.44)**
No	Ref	Ref	Ref	Ref
Household-wealth				
Poor				

Middle	1.27 (0.7-2.28)	**0.32* (0.14-0.74)**	0.85 (0.36-2.00)	0.95 (0.55-1.63)
High	1.06 (0.66-1.69)	0.68 (0.31-1.46)	1.00 (0.5-1.99)	6.39 (0.63-6.51)
	Ref	Ref	Ref	Ref
Use of protected drinking water				
Yes	Ref	Ref	Ref	Ref
No	0.89 (0.55-1.43)	1.32 (0.66-2.62)	0.8 (0.4-1.6)	1.35 (0.89-2.06)
Use of clean and separate containers for feeding				
Yes	Ref	Ref	Ref	Ref
No	**1.82* (1.04-3.2)**	**2.61* (1.25-5.44)**	0.75 (0.33-1.71)	0.96 (0.6-1.52)
Use of proper hand washing before feeding				
Yes	Ref	Ref	Ref	Ref
No	1.67 (0.96-2.93)	**2.14* (1.02-4.48)**	0.7 (0.3-1.61)	0.93 (0.59-1.48)

p<0.05* (logistic regression test)

Table-5 presents the results of the multivariate logistic regression analysis for NEBF children. **Mother's age**: Children of mothers belonging to 15-20, 20-25, 25-30, and 30-35 years of age had significantly 8.36 (95%CI=2.48, 2.81), 8.22 (95%CI=0.29, 2.3), 8.52 (95%CI=0.29, 2.46), and 1.15 (95%CI=0.11, 1.15) increased odds of having pneumonia; 8.48 (95%CI=2.12, 3.38), 4.41 (95%CI=1.72, 1.12), 2.88 (95%CI=1.17, 7.1), and 2.65 (95%CI=0.26, 2.65) increased odds of having asthma; than children of mothers belonging to >35 years of age. **Mother's nutritional status**: Undernourished mothers had significantly 6.09 (95%CI=3.5, 10.43) increased odds of having fever than mothers having normal nutritional status. **Mother's education**: Children of mothers belonging to below 8th standard and 8-10th had significantly 0.3 (95%CI=0.11, 0.82) and 8.97 (95%CI=0.58, 1.37) increased odds of having pneumonia and fever than children of highly educated (>12th standard) mothers. **Parity**: Children of the mothers with multipara had significantly 0.59 (95%CI=0.37, 0.93) increased odds of having 'cold&cough' than children of mothers with primipara. **Child's nutritional status**: Over-nourished children had significantly 8.26 (95%CI=0.52, 1.29) increased odds of having a fever than normal children. **Low birth weight (LBW)**: Children who were born with LBW had significantly 1.55 (95%CI=0.98, 2.44) increased odds of having fever than children who were born with normal weight. **Household wealth**: Children of the family having poor household wealth had significantly 0.32 (95%CI=0.14, 0.74) increased odds of having pneumonia than children of the family having higher household wealth. **Use of clean and separate containers for feeding**: Children of the mothers who did not use clean and separate containers had significantly 1.82 (95%CI=1.04, 3.2), 2.61 (95%CI=1.25, 5.44) increased odds of having 'cold&cough' and pneumonia, than children of mothers who used. **Use of proper hand washing before feeding**: Children of mothers who do not wash their hands properly before feeding had significantly 2.14 (95%CI=1.02, 4.48) increased odds of having pneumonia, than children of mothers who wash their hands properly before feeding.

An increased risk of childhood infectious diseases was found among the children of younger mothers. In some previous studies, evidence showed an ambiguous relationship between maternal age and childhood infectious diseases. Young maternal age may be associated with LBW and preterm delivery.[20,21] It can be assumed that younger mothers may have lower educational

knowledge and are inexperienced for dealing with difficulty in caring for their children. The nutritional status of mothers before and during pregnancy is very important for a healthy pregnancy outcome. Low maternal body-mass index is associated with intrauterine growth restriction.[22] Maternal under-nutrition contributes to the nutritional decline during the first year of life by triggering infectious diseases like prolonged diarrhoea and also by altering intestinal barrier function at 12 months of age.[23]Among 0-2-year-old Danish children, the risk of hospitalized children for infectious disease was increased in families of mothers with a low level of education along with low-income groups.[24] Educated mothers as well as, families with higher income may have better help-seeking behaviour when a child is ill and also may have better personal hygiene and sanitation practices as they may be more likely to comply with follow-up immunization doses and may achieve better nutrition of the child to reduce the occurrences of infectious diseases.[25]It was observed in a study that, higher parity was associated with an increased risk of losing babies. Birth weight as well as the growth and development of young children are affected by their mothers' past nutritional histories and their well-being during pregnancy. Higher parity is known to deplete maternal nutrition and influence the child's survival.[26]A large number of studies in animals exhibit the adverse effects of protein deficiency on immunity and these effects have been confirmed in various human settings. Malnutrition along with protein deficiency diminishes immune responses and increases susceptibility to infection because immune defences are dependent upon cell replication and the production of proteins with biological activities.[27]The household wealth index (an indicator of socioeconomic status) is also another important determinant of child morbidity. Household wealth index is significantly related to childhood cough (like, children in the poorest wealth quintile are at higher risk than those in the poor quintile and poor quintile are worse than those in the middle quintile, and so on).[28] The risk of infectious disease illness among those in the poorest wealth quintile may be attributable to greater exposure to infectious agents.[29] This finding may be explained by the fact that children of economically poor families are likely to live in poor environmental conditions like poor sanitation, and also are engaged in poor hygienic practices, which might increase their exposure to infectious agents. Additionally, it is documented that poor families often have more children and live in more crowded houses; both environmental conditions are conducive for the transmission of infectious agents.[30] Moreover, economically poor people may not be able to afford nutritious food which can lead to poor nutritional status and inadequate nutrition, and this condition suppresses the ability of the immune system to fight against infections.[31]It is important to note that no matter how nutritious or deficient the complementary food is, if contaminated, it is hazardous to the young child with an underdeveloped immune system.[32] Several studies showed a direct association between food hygiene practices and childhood infection among children. The explanation behind these findings may be like this: weaning foods for young children prepared under unhygienic conditions are frequently contaminated with pathogens which can be an important risk factor for the transmission of infections through viruses, bacteria, or other pathogens.[33]From the above study, it is clear that EBF children have suffered less number of infections than NEBF children. Immunological properties of breast milk might be the reason for this type of finding. Breast milk supports passive immunity and has a specific trophic effect on the thymus to promote thymic growth by transferring the immunological or trophic factors through the placenta to the foetus.[34]Additionally, it has been discovered that breastfed babies have a higher concentration of healthy bacteria in their gut microbiome, particularly Bifidocacteria and Lactobacilli. This may have implications for producing further antimicrobial compounds, reduction of intestinal permeability, the competition with harmful bacteria for nutrients and binding sites, and the maturation and stimulation of both local and systemic immune responses.[35]But still, infections in EBF children

were a great concern. Maternal ignorance about healthy nutritional practices, extended breastfeeding, and inappropriate age-specific weaning practices also might influence the chances of infections in early childhood.[36]

CONCLUSION:

This study found that exclusive breastfeeding practices were associated with the mother's education and other hygienic practices while feeding the children. Younger mothers and those with poor nutritional status are more likely susceptible to infections due to various factors, including compromised immune systems and inadequate caregiving practices. Higher levels of maternal education are associated with improved economic outcomes and reduced childhood infectious diseases, and also they often have better access to healthcare, knowledge of preventive measures, and resources to provide for their children's well-being. This leads to lower rates of childhood infections and associated economic burdens, including healthcare costs and lost productivity. For the variety of reasons including limited resources, reduced maternal attention per child, and increased exposure to infectious agents within the household, higher parity is associated with an increased risk of childhood infections.LBW children are more likely to have infections because of weakened immune function and physiological vulnerabilities. Furthermore, the lack of exclusive breastfeeding practices along with poor nutritional status increases this risk by weakening the immune system and impairing the body's ability to fight off infections. Maintaining proper hygiene with a clean feeding environment, washing hands before preparing or handling food, and sterilizing feeding equipment significantly lowers the risk of contamination and transmission of pathogens to the children. Family planning strategies that consider the impact of parity on childhood health outcomes, promoting maternal health, including proper nutrition and age-appropriate childbirth and also hygienic feeding practices are essential in lowering childhood infection rates and improving overall child well-being. Interventions aimed at improving childhood nutrition, especially for low birth weight infants, are crucial for reducing the incidence and severity of childhood infections.

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