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Original Article

The Effect of Breastfeeding on the Rate of Infections in the First 2 Years of Life

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Abstract ***Purpose:*** To investigate the effect of duration of exclusive breastfeeding (EBF) and duration of breastfeeding (BF) on the rate of infections during the first 2 years of life. ***Methods:*** The study group consisted of healthy infants who admitted to the outpatient Healthy Child Clinics for their routine control. ***Results:*** In 200 healthy term infants enrolled, the mean duration of EBF and total duration of BF were 4.2±2.8 and 11.6±5.3 months, respectively. In those without any infection (42.5%), duration of EBF and total duration of BF were 5.9±0.4 and 13.4±4.6 months, respectively while in those with 1 infection (29.5%) and ≥2 infections (28%), it was 4.6±3.3 and 11.8±4.6 months and 1.3±1.9 and 8.7±5.9 months, respectively. This difference between each group was stastistically significant (p<0.001). ***Conclusions:*** Our study showed that increased duration of EBF and increased duration of BF were associated with lower infection rate in infants in the first 2 years of life.

Key words *Breastfeeding; Breastmilk; Exclusive breastfeeding; Infection*

Introduction

Every infant and child has the right to good nutrition according to the "Convention on the Rights of the Child".[1] Human milk is the gold standard for infant feeding and breastfeeding is the cornerstone of child survival, nutrition and development as well as maternal health.[2] The World Health Organization (WHO) recommends exclusive breastfeeding (EBF) for the first 6 months of life, followed by continued breastfeeding with appropriate complementary foods for up to 2 years or beyond.[3] Growing body of evidence suggests that optimal breastfeeding lowers morbidity ad mortality and that improving breastfeeding rates globally can prevent over 800 000 deaths in children under 5 years of age.[1,4,5] However, the rate of breastfeeding is not that optimal.[6] It has been reported that currently, about 40% of infants younger than 6 months of age are exclusively breastfed.[1,4]

Besides its nutritional benefits, EBF for 6 months has many health benefits such as protection against infections (gastroenteritis, respiratory tract infections, acute otitis media), improvement in neurodevelopmental outcomes with higher performance in intelligence tests, reduction in the likelihood of obesity, reduction in sudden infant death syndrome, reduction in chronic diseases such as diabetes and gastrointestinal diseases such as necrotising enterocolitis (NEC) and inflammatory bowel disease (IBD) and allergic diseases.[4,7] Chief among these is protection against infections. There are many components in human milk serving as enzymes, antimicrobial proteins/peptides, growth factors, chemokines, antioxidants, anti-

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inflammatory elements, prebiotics, probiotics that contribute to the development and regulation of both the infant's innate and adaptive immune system.[8]

The aim of our study was to investigate the effect of duration of EBF and total duration of breastfeeding (BF) on the rate of infections during the first 2 years of life.

Methods

The study group consisted of 200 healthy term singleton infants with birth weight >2500 gram who were followed up on a regular basis beginning from the 1st week of life by the well child outpatient clinics of Istanbul University, Cerrahpasa Medical Faculty, Istanbul, Turkey during February 2016-May 2017. Infants who were born preterm, who were born from a multiple pregnancy (twins or triplets) and who had health problems at birth were not included in the study. All of the enrolled infants had received their vaccinations according to the national vaccination schedule. When the enrolled infants became 2 years old, their files were reviewed retrospectively with respect to maternal characteristics (age, education, gravidity, parity and abortion history) and infant characteristics (anthropometric measures, way of delivery, duration of EBF and total duration of BF and infection history). Infections that infants had during the period from the last visit were asked to the parents or caregivers at each visit (frequency of visits was every month until 6 months of age and every 3 months thereafter until 2 years of age). Infections were listed as upper respiratory tract and chest infections, ear infections, diarrhea, urinary tract infections. Overall infection history was grouped as no infection, one infection and 2 or more infections. The study protocol was approved by the institutional ethical committee. Informed parental consent was obtained for all enrolled infants.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) for Windows 10 software (IBM Corporation, Armonk, NY) was used to evaluate the data. Categorical variables were summarised as count and percentage whereas continuous ones were summarised as mean, standard deviation, median, minimum and maximum. For testing relationships between several variables and the rate of infections, chi square test was used for categorical variables; one-way ANOVA and Post-hoc (Tukey HSD) analysis were used for numerical variables. Statistical significance was considered at $p<0.05$.

Results

Of the 200 infants enrolled, mean birth weight, length and head circumference were 3338.8±507.8 grams, 50.4±2.5 cm and 34.8±1.4 cm, respectively. The mean duration of EBF and total duration of BF were 4.2±2.8 months and 11.6±5.3 months, respectively. There was no infant who was never breastfed among the study cohort. During the study period, a total of 213 infections were recorded among the enrolled infants. Of these 213 infections, 112 (52.5%) were upper respiratory tract infections (URTI), 31 (14.5%) were lower respiratory tract infections (LRTI), 26 (12.2%) were acute gastroenteritis (AGE), 25 (11.7%) were urinary tract infections (UTI) and 19 (8.9%) were acute otitis media (AOM). Of the enrolled infants, 85 (42.5 %) had no infection history, 59 (29.5%) had one infection and 56 (28%) had ≥2 infections. Characteristics of the enrolled infants were summarised in Table 1.

There was no difference in infection rate with respect to way of delivery, gender and anthropometric measures of the infants at birth. There was also no difference in infection rate with respect to maternal educational status and other maternal characteristics such as maternal age, gravidity and parity of the mother. Comparisons of infection rate with respect to these variables were shown in Tables 2 and 3.

When we look at the relationship between infection rate and EBF duration, duration of EBF was longest among infants with no infection history while it was shortest in those with ≥2 infections. There was a statistically significant difference in duration of EBF, and posthoc analysis revealed that this significant difference was present between groups with no infection and 1 infection; no infection and 2 or more infections; 1 infection and 2 or more infections (Table 4).

Total duration of BF was also longest among infants with no infection history while it was shortest in those with ≥2 infections. There was a statistically significant difference in total duration of BF (Table 5). Posthoc analysis revealed that this significant difference was present between groups with no infection and 2 or more infections; 1 infection and 2 or more infections.

Discussion

The most important health benefit of breastfeeding is its effect on reducing infection rates.[7,9] Overwhelming evidence exists that breastfeeding protects against diarrhoea and respiratory infections.[4,9,10] Any breastfeeding is said to reduce the incidence of nonspecific gastrointestinal tract infections by 64%.[9-12] It has been reported that about half of all diarrhoea episodes and a third of respiratory infections would be avoided by breastfeeding.[4] It has also been suggested that breastfeeding provides important protection against AOM[13] and that EBF for 6 months may have a more protective effect than less breastfeeding.[14]

In a recent study from rural parts of China, it was shown that breastfeeding was strongly associated with lower rates of both diarrhoea and cough in bivariate and multivariate analyses.[15] Breastfeeding also protects against infections in high-income countries.[16] Quigly et al[17] tried to estimate

Table 1 Characteristics of infants (n:200)

Factors		Value
Gender		
Male (%)		91 (45.5)
Female (%)		109 (54.5)
Way of delivery		
Vaginal (%)		55 (27.5)
C/S (%)		145 (72.5)
Birth weight (gram)		3338.8 ±507.8
Birth length (cm)		50.4±2.5
Head circumference (cm)		34.8±1.4
Duration of EBF (months)		4.2±2.8
Total duration of BF (months)		11.6±5.3
Infection history	No	85 (42.5)
	1	59 (29.5)
	≥2	56 (28.0)

EBF: exclusive breastfeeding; BF: breastfeeding

Table 2 Infection rate with respect to maternal educational status

	No infection		1 infection		≥2 infections		X^2	p
	n	%	n	%	n	%		
Primary	18	40.9	10	22.7	16	36.4		
Middle	9	47.4	5	26.3	5	26.3	6.01	0.422
Highschool	23	34.8	23	34.8	20	30.3		
University	36	50.7	20	28.2	15	21.1		

Table 3 Infection rate with respect to maternal and infant characteristics

	No infection	1 infection	≥2 infections	p
Maternal age	32.9±12.52	32.5±5.2	33.6±4.6	0.799
Gravidity	2.1±1.36	2.1±1.3	2.2±1.2	0.957
Parity	1.7±1.1	1.6±0.8	1.7±0.8	0.652
Birth weight (gram)	3338.8±507.8	3284.5±418.9	3207.1±362.7	0.230
Birth length (cm)	50.4±2.5	50.3±2.2	50.5±2.3	0.875
Head circumference (cm)	34.8±1.4	34.8±1.5	34.4±1.3	0.164
Way of delivery (n)				
Vaginal	23	18	14	0.798
C/S	62	41	42	
Gender (n)				
Male	38	31	22	0.355
Female	47	28	34	

the risk of infection associated with the duration of exclusive breastfeeding by analysing the data on 15809 term, singleton infants from the UK Millennium Cohort Study[18] and found that there was an increased risk of chest infection and diarrhoea in infants exclusively breastfed for <4 months and this excess risk of chest infection and diarrhoea was seen even among infants who were exclusively breastfed for 4-6 months but who stopped all breastfeeding by 6 months.

In our study, we analysed the frequency of infections in relation to the duration of EBF and total duration of breastfeeding. We reviewed the overall infection history rather than grouping each infection in relation to the breastfeeding history because of the small sample size in each infection category. In accordance with the literature, we found that as the duration of EBF increased, the frequency of infections decreased. Those who had no infection history was found to be exclusively breastfed for about 6 months. In our study, even those who had been exclusively breastfed for about 4 months had an infection history. In 2012 Cochrane review,[19] the authors reported that infants who were exclusively breastfed for 6 months experienced less morbidity from gastrointestinal infection than those who were exclusively breastfed for 3 or 4 months. In the study of Duijts et al,[12] authors concluded that EBF to the age of 6 months tended to be more protective against URTI, LRTI and AGE than EBF until the age of 4 months and partially thereafter. However, the effect of breastfeeding was found to be highest in studies that compared exclusively breastfed with non-breastfed infants.[10,12]

According to the 2018 data from Turkish Population and Health Investigation series,[20] EBF rate during the first 6 months of life was reported to be 41% in Turkey while it was said to be 37% worldwide.[4] Median duration of breastfeeding was reported to be 16.7 months and the rate of breastfeeding at 1 year of age was reported as 62% in Turkey. Turkey is defined as an upper middle income country. The prevalence of breastfeeding at 1 year is lower in developed countries which is below <1% in UK, 35% and 16% in Norway and Sweden, respectively.[4,21,22] In fact, breastfeeding at 12 months was said to be widespread in low-income and lower-middle-income settings.[4] We examined the association of total duration of breastfeeding with infection frequency. In our study, mean duration of breastfeeding was about 11.6 months. Those infants who had no infection history had the longest duration of breastfeeding which was statistically significant when compared to those who had 2 or more infection history (13.4 vs 8.7 months). There was also a statistically significant difference in duration of breastfeeding between those with 1 infection and 2 infection history (11.8 vs 8.7 months). The effect of the duration of breastfeeding longer than 6 months on infection rate was not frequently investigated. Only a few studies estimated the effect of breastfeeding for 9 or 12 months.[14,23] Li et al[23] examined the associations between breastfeeding practices during infancy and various infections at 6 years of age and found that ear, throat, and sinus infections were lowest among those breastfed for ≥9 months, exclusively breastfed for ≥6 months, or breastfed for ≥6 months without formula supplementation before 6 months.

Overwhelming evidence suggests that children who are breastfed for longer periods have lower infectious morbidity and mortality.[4,12-19,23] It has been reported that human milk directly contributes to the infant's innate immunity.[8] Breast milk contains human milk oligosaccharides and glycoproteins such as lactoferrin, mucins; immune cells and stem cells, secretory IgA, toll like receptors, antimicrobial peptides, anti-inflammatory cytokines, growth factors, antioxidants. Human milk also provides prebiotics and probiotics to the gastrointestinal tract which influences the immune system.[8,24] Therefore, it can be said that human milk has the great ability to optimise infant and child health.

The main limitation of our study was that we could not look at the association of each infection such as URTI, LRTI, AOM, AGE, UTI with EBF duration or total duration

Table 4 Infection rate and duration of exclusive breastfeeding

	n	Mean (month)	SD (±)	p
No infection	85	5.9	0.4	0.0001
1 infection	59	4.6	3.3	
≥2 infections	56	1.3	1.9	
Total	200	4.2	2.8	

Table 5 Infection rate and total duration of breastfeeding

	n	Mean (month)	SD (±)	p
No infection	85	13.4	4.6	0.0001
1 infection	59	11.8	4.6	
≥2 infections	56	8.7	5.9	
Total	200	11.6	5.3	

of breastfeeding because of the small sample size in each infection category. We rather looked at the relationship between overall infection history and EBF duration and total duration of breastfeeding.

In accordance with the literature, our study also showed that increased duration of EBF and increase in total duration of BF were associated with lower infection rates in infants in the first 2 years of life. As WHO recommends, lactating mothers should be encouraged to breastfeed their infants and it is our duty to raise awareness on breastfeeding for its encouragement. Based on the growing body of evidence, suboptimal breastfeeding has been associated with considerable health impact both for the infant and the mother. Therefore, with the significant role of optimal breastfeeding in improving nutrition, maternal and child health and survival in mind; we should develop and support policies to increase optimal breastfeeding which could result in substantial public health gains.

Declaration of Interest

None

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