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Effect of breast feeding on ocular morbidity

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Background: To evaluate the effect of human milk on ocular morbidity in infants who did not breast feed during the first 6 months of life.





Material/Methods: This retrospective randomized study included 154 subjects who were first or second grade elementary school students, 66–84 month of age. These children were randomly selected from 2080 students during health screenings. All of them were born at term and were normal birth weight. The study was composed of 3 age- and sex-matched groups. Group 1 included 52 subjects who had never been breast fed. Group 2 included 42 subjects who were breast fed and also received additional food (infant formula). Group 3 included 60 subjects who were only breast fed until 6 months old (no formula) except for the first month of life. All subjects underwent a complete ophthalmic examination and any morbidity was recorded. Frequencies of ocular morbidity were compared among the groups by using the chi-squared test.

Results: We found significant refractive errors in 12 (23%) subjects in Group 1 (no breast feeding). There was no significant refractive error in Group 2 (breast feeding and formula) and Group 3 (breast feeding only). The difference among the groups was statistically significant ($p=0.014$, chi-squared test). Allergic conjunctivitis was found in 5 subjects in Group 1, 3 in Group 2, and 2 in Group 3. There was no significant difference among the groups ($p=0.395$).

Conclusions: Refractive errors were more frequent in Group 1 (no breast feeding) than in Group 2 (breast feeding and formula) or Group 3 (breast feeding only). There is a need to confirm this finding by performing studies with larger sample sizes.

MeSH Keywords: **eye disease • ocular morbidity • human milk • breast feeding • refractive errors**

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Background

Consumption of human milk protects infants from several diseases and is very important for infant growth and development. Human milk provides all the dietary essential fatty acids, linoleic acid (LA; 18: 2n-6), and alpha-linolenic acid (18: 3n-3), in addition to their longer-chain more-unsaturated metabolites, including arachidonic acid (20: 4n-6) and DHA (22: 6n-3), to support the growth and development of the breast-fed infant. The action of docosahexaenoic acid (DHA) in infant nourishment is especially important because DHA is characteristically collected in the membrane lipids of the brain and retina, where it is critical to visual and neural function [1,2]. The first year of life is an important period in which a dietary intake of DHA and arachidonic acid (ARA) can optimize visual development in term infants [3–5]. The dietary carotenoids lutein and zeaxanthin prevent certain eye diseases [6,7].

Previous studies have shown that human milk contain factors that reduce the severity of retinopathy in premature and in low birth weight infants [8,9]. Nevertheless, to our best knowledge there is no published study investigating the effect of breast feeding on ocular development of normal birth weight or term infants.

This study aimed to detect ocular morbidity in infants who did not consume human milk during infancy and to compare breast-fed only infants with those who received formula and breast milk and those who received no breast milk.

Material and Methods

This retrospective randomized study was carried out between September 2012 and April 2013. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research. The local Medical Ethics Committee gave approval and all parents gave informed consent for the study. The study protocol followed the guidelines of the Declaration of Helsinki.

Of a total of 2080 primary school students screened, 1200 had received both breast milk and formula during the first 6 months of life. From the 2080 children, we randomly selected 154. These 154 children were divided into 3 age- and sex-matched groups. Group 1 consisted of 52 children who had not received any breast milk except for the first month of life. Group 2 consisted of 42 children who had received both breast milk and formula during the first 6 months. Group 3 was composed of 42 randomly selected, healthy, age- and sex-matched children who had only received breast milk during the first 6 months. We performed eye exams on 800 randomly selected eyes. All of the participants received a complete ophthalmological examination and cycloplegic

refraction. In the first step, from the children's medical records we recorded type of nourishment received during the initial 6 months of life, and the birth time and weight; we used a questionnaire with their parents to determine parents' refractive status and known eye disease, as well as whether the parents experienced any additional medical problems. The study subjects were first or second grade primary school students, 66–84 month of age. All subjects were born at term and were normal birth weight (2.6–4.0 kg). None of them had ocular surgery or trauma prior to the study ophthalmological examination. No subject had any systemic disorders affecting the ocular tissues.

All subjects underwent a complete ophthalmic examination, including best corrected visual acuity, biomicroscopic anterior segment examination, and fundus examination. Presence of strabismus was evaluated using Hirschberg's test, cover test, and alternant cover test. Refractive errors were examined by a retinoscope through the dilated pupil after adequate cycloplegia. Any refractive errors higher than ± 1 diopter were accepted as 'significant refractive error'.

We performed statistical analysis using the chi-squared test, except for means, for which we used the 1-way ANOVA test. A p value of less than 0.05 was considered statistically significant.

Results

The demographic characteristics of the subjects are shown in Table 1. There was no difference between the groups with regard to age ($p=0.923$, ANOVA) or sex ($p=0.783$, chi-squared test).

We found significant refractive errors in 12 (23%) subjects in the NBF Group. There was no significant refractive error in the MF Group or the BF Group. The difference among the groups was statistically significant ($p=0.014$, chi-squared test). Allergic conjunctivitis was present in 5 subjects in the NBF Group, 3 subjects in the MF Group, and 2 subjects in the BF Group. There was no significant difference among the groups ($p=0.395$) (Table 2). No strabismus was found in any of the study groups.

Discussion

This is the first prospective randomized study comparing ocular morbidity in first or second grade primary school students according to feeding types in their 6 months of life.

The first 6 months of age is very important for the promotion of optimal growth, health, and cognitive development of a child. Adequate feeding is fundamental to the development of a child's full human potential [10]. The American Academy of Pediatrics (AAP) has determined that formula has higher protein content

Table 1. Demographic data of the subjects.

	NBF Group (n=52)	MF Group (n=42)	BF Group (n=60)	p
Mean age (month, SD, range)	74.2±8.1 (66–84)	74.9±8.1 (66–84)	73.5±7.0 (66–84)	0.923
Sex (Male/Female)	30/22	20/22	32/28	0.813

Table 2. Ocular morbidity.

	NBF Group (n=52)	MF Group (n=42)	BF Group (n=60)	p
Significant refractive errors (n,%)	12 (23)	0	0	0.014
Allergic conjunctivitis (n,%)	10 (19)	6 (14)	4 (7)	0.395

than human milk, but the protein in breast milk is more easily and completely digested by babies. Breast milk has higher carbohydrate content than formula and has large amounts of lactose, a sugar found in lower amounts in cow's milk. Research shows that animals whose milk contains higher amounts of lactose experience greater brain development. Minerals such as iron are present in lower quantities in breast milk than in formula, but the minerals in breast milk are more completely absorbed by the baby. In formula-fed babies, the unabsorbed portions of minerals can change the balance of bacteria in the gut, which gives harmful bacteria a chance to grow. This is one reason why bottle-fed babies generally have harder and more odorous stools than breast-fed babies.

Human milk is species-specific, and all substitute feeding preparations differ remarkably from it, making human milk uniquely superior for infant feeding. It contains, on average, 1.1% protein, 4.2% fat, and 7.0% carbohydrate and supplies 72 kcal of energy per 100 g [11]. Human milk also has antioxidant properties. It contains vitamin C and E, and enzymes such as superoxide dismutase, catalase, and glutathione peroxidase. These are known to protect against the potentially harmful effects of oxidative stress [12]. In addition to its role in maintaining the viability and texture of human tissue cells, it also modulates immune-mediated mechanisms in the body for healthy survival.

Lutein is a carotenoid that selectively accumulates in the macular region of the retina and protects retinal cells required for vision [13]. Humans cannot synthesize lutein and thus all lutein in the human body comes from dietary sources. Some epidemiological evidence suggests lutein may reduce the risk of age-related macular degeneration [14,15]. Lutein may be important well before adulthood. It was reported that breast-fed infants have higher mean serum lutein concentrations than infants who consume formula unfortified with lutein. The nutritional and immunological benefits of providing human milk to preterm infants

have been described [16]. One of the mechanisms through which human milk reduces the severity of retinopathy of prematurity may be its potential contribution to the normal development of retinal blood vessels. Human milk has been shown to increase the levels of insulin-like growth factor-I (IGF-I), which is required for normal vascularization of the retina [13,17–19].

Addition of 0.36% DHA and 0.72% ARA to formula fed to term infant during the first year of life produced clear alterations in total RBC lipid composition and in visual function [5].

Breast milk from women well-supplied with dietary vitamin A provides sufficient vitamin A to their infants; all infant formulas include vitamin A in specific amounts required by national and international regulations. In contrast, detecting DHA insufficiency is more subtle and relates directly to visual acuity. DHA is present in breast milk, although its concentration differs substantially, depending on diet [2,6,20]. The above-mentioned data led us to design the current study. In the beginning, we aimed to study children who had never been received mother's milk during their first 6 months of life, but we could not find any such subjects. Thus, the study was composed of subjects who had not been breast fed (NBF Group) except for the first month of life. This condition is a major limitation of our study.

Conclusions

Our most significant finding was that refractive errors were more frequent in the non-breast-fed group than in the mixed feeding or only human milk groups. We found no ocular morbidity in the subjects in the non-breast-fed group except for refractive errors and allergic conjunctivitis, which might be a result of our small sample size. These results need to be confirmed by studies with larger samples sizes and including subjects who had never received breast milk at any time.

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