# The Relationship Between Feeding Pattern and Measurements of Refraction in Preschool Children

## Okul Öncesi Çocuklarda Beslenme Şekli ile Kırma Kusurları Arasındaki İlişki

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## ABSTRACT

**Objective:** To compare the effect of feeding human milk as opposed to formula and human milk on refractive error in preschool children aged 3 to 6 years.

**Material and Methods:** One hundred and seventy six eyes of 88 children were evaluated. According to the feeding pattern, the patients who fed only breast-fed were classified as Group I, and the patients who fed with combination of breast-fed and formula were classified as Group II. Results were retrospectively compared between groups.

**Results:** A total of 88 children undergone detailed ophthalmological examinations, of which 40 (45.5 %) were males and 48 (54.5 %) were females. Maternal birth age of 27.3% (n=24) of the children included in the study was over 30 years and birth weight of 96.6% (n=85) was over 2500 grams.

The mean ± standard deviation of the spherical, cylindrical and spherical equivalent (SE) values were 1.61±1.46 D; -0.98 ± 0.69 D and 1.12±1.43 D in group I and 1.00±2.57 D; -0.90 ± 0.81 D and 0.55 ± 2.72 D in group II, respectively (p=0.507 for spherical; p=0.299 for cylindrical and p=0.799 for SE). Although myopic refraction was less common in the breastfed group, there was no significant difference in myopic refraction between the groups (p= 0.507).

**Conclusion:** In conclusion, mean refractive error were different according to feeding pattern, but this study did not show significant differences between groups (p<0.050). There is a need to confirm this finding by performing more studies with a larger sample sizes.

**Key Words:** Breastfeeding, Human milk, Preschooler, Refractive errors

## ÖZ

**Amaç:** 3-6 yaş arası okul öncesi çocuklarda sadece anne sütü alımı ile anne sütü ve formula mamanın birlikte alımının kırma kusurları üzerine etkisini karşılaştırmak.

**Gereç ve Yöntemler:** 88 çocuğun yüz yetmiş altı gözü değerlendirildi. Beslenme şekline göre sadece anne sütü ile beslenenler Grup 1, anne sütü ve formula mama ile beslenenler Grup 2 olarak sınıflandırıldı. Sonuçlar geriye dönük olarak gruplar arasında karşılaştırıldı.

**Bulgular:** Çalışmaya 40'ı (%45.5) erkek, 48'i (%54.5) kız olmak üzere toplam 88 çocuğun 176 gözü dâhil edildi. Çalışmaya dâhil edilen çocukların %27.3'ünün (n=24) anne doğum yaşı 30 yaşın üzerinde ve %96.6'sının (n=85) doğum ağırlığı 2500 gramın üzerindeydi.

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Sferik, silendirik ve sferik eşdeğer (SE) değerlerinin ortalama ± standart sapması sırasıyla grup I'de 1.61±1.46 D; -0.98 ±0.69 D, 1.12±1.43 D ve grup II'de 1.00±2.57 D; -0.90±0.81 D ve 0.55 ±2.72 D'di (Sferik için p=0.507; silendirik için p=0.299 ve SE için p=0.799). Anne sütü alan grupta miyopik kırılma daha az olmasına rağmen, gruplar arasında miyop kırma kusuru açısından anlamlı bir fark yoktu.

**Sonuç:** Sonuç olarak, ortalama kırma kusurları beslenme şekline göre farklıydı, ancak bu çalışmada gruplar arasında anlamlı fark saptanmadı (p<0.050). Daha büyük örneklem büyüklükleri ile daha fazla çalışma yaparak bu bulguyu doğrulamaya ihtiyaç vardır.

**Anahtar Sözcükler:** Emzirme, Anne Sütü, Kırma Kusurları, Okul Öncesi

## INTRODUCTION

Refractive errors, especially myopia, are one of the most common causes of visual impairment. Although the prevalence of refractive errors varies among countries, the reasons for these differences remain unclear. Studies have indicated that in addition to genetic factors, gene-environment interaction may also be effective in the occurrence of refractive errors (1-6). Also, nutrition intake, particularly breastfeeding during infancy, is thought to affect retinal and visual development, which may have a vital role in eye development.

Breast milk intake is very important in the growth and development of the newborn and especially in protecting it from diseases. The intake of DHA (docosahexaneoic acid) and arachidonic acid (ARA) especially in the early stages of life in term newborns is very effective in terms of eye and neural development, because DHA is accumulated in the membrane lipids of the retina and brain (7-10). Inadequate infant nutrition can affect vision development and especially retinal development, leading to myopia (11).

Some studies have suggested that the probability of refractive errors, especially myopia, is lower in those who are initially breastfed, and that they have better vision levels than those who are formula-fed. In other words, breastfed children have a higher sferik equivalent (SE) than formula-fed children (12-14).

In our current study, we aim to evaluate the association between feeding pattern and refraction errors in preschool children.

## MATERIAL and METHODS

This retrospective study following the Helsinki Declaration standards was reviewed and approved by the Ethics Review Committee of Etlik Zübeyde Hanım Maternity and Women's Health Teaching and Research Hospital and numbered 2022/80. Informed consent was obtained from all patients.

Children born between 37-42 weeks postmenstrual age admitted to Etlik Zübeyde Hanım Maternity and Women's Health Teaching and Research Hospital ophthalmology clinic were accepted in the study. Children born prematurely and without cycloplegic examination results were excluded from the study. Questions were directed to the families of the children, and their gestational birth weight (BW), age, gender, feeding pattern during the initial 6 months of life (only breastfeed, breastfeed and formula together) and information on the mothers' pregnancy and delivery type and maternal birth age were recorded. Children were evaluated into two subgroups according to feeding pattern during the initial 6 months of life; only breastfed children (Group I, n= 52) and children fed with combination of breast and formula milk (Group II, n= 36). In the group fed with a combination of breast and formula milk, the frequency of feeding with formula was less than half of the daily feeding amount. All of the participants underwent a complete ophthalmic examination and cycloplegic refraction. Refraction examination was performed with cycloplegic retinoscopy, automated refractometry (Welch Allyn SureSight Autorefractor, USA) and autokeratorefractometer (Zeiss Autoref keratometer, Germany). Two drops of 1% cyclopentolate hydrochloride (Sikloplejin, Abdi İbrahim, Turkey) were performed for dilatation before the examination. The cycloplegic examination values of all patients were recorded as diopters (D). Also, according to results, significant myopia is -3.00 D or less; significant hyperopia is +3.00 D or more; significant astigmatism is -2.00 D or less and anisometropia was 1.00 D or more were recorded.

SPSS 25.0 program was used for statistical analysis. Categorical data were presented as n (numbers) and % and descriptive data as mean ± standard deviation (SD). Chi-square test was used in the analysis of categorical data. Normal distribution fit was checked with the Kolmogorov-Smirnov test. The differences were evaluated by using the t-test for normally distributed data, and the Mann-Whitney U test for non-normally distributed data. p-values of 0.050 or less were noted statistically significant.

## RESULTS

A total of 88 children undergone detailed ophthalmological examinations retrospectively, of which 40 (45.5 %) were males and 48 (54.5 %) were females. The mean age of the children was 4.6 ± 1.1 (3 to 6 years) in group I and 4.7 ± 1.1 (3 to 6 years) in group II, respectively. The gestational BW of 96.6 % (n=85) of the children participating in the study was over 2500 grams and the maternal birth age of 72.7 % (n=64) of the children participating in the study was less than 30 years. Moreover, 49 (55.7%) children were delivered vaginally, and 39 (44.3%) were delivered via Caesarian section. Of the 88 children included in the study, 59.1% (n=52) had a history of breastfeeding, and 40.9% (n=36) had a history of breastfeeding and formula. There were no significant difference between the groups for age (A), BW, gender distribution, type of birth (The p values for A, BW, gender and type of birth were 0.485, 0.786, 0.060 and 0.197 respectively) (Table I).

The spherical, cylindrical and spherical equivalent (SE) values were 1.61 ± 1.46 D; -0.98 ± 0.69 D and 1.12 ±1.43 D in

**Table I: Demographic data of children.**

| | Group 1 (n=52) | Group 2 (n=36) | p |
|---|---|---|---|
| Gender | | | |
| Female* | 24 (46.1) | 24 (66.7) | 0.060ǂ |
| Male* | 28 (53.9) | 12 (33.3) | |
| Age at examination (years)† | 4.6 ± 1.1 (3-6) | 4.7 ± 1.1 (3-6) | 0.485§ |
| Birth weight* | | | |
| <2500 g | 2 (4) | 1 (2.8) | 0.786ǂ |
| >2500 g | 50 (96) | 35 (97.2) | |
| Maternal age* | | | |
| <20 years | 38 (73) | 26 (72.2) | 0.929ǂ |
| >20 years | 14 (27) | 10 (27.8) | |
| Type of birth* | | | |
| NSVD | 26 (50) | 23(63.9) | 0.197ǂ |
| C/S | 26 (50) | 13 (36.1 ) | |

***:** *n(%),* **†:** *Mean ± SD (Range),* **ǂ:** *Chi-square test,* **§:** *Student-t test,* ***SD:** Standart deviation*

**Table II: Refraction values of groups.**

| | Group 1 (n=52) | Group 2 (n=36) | p |
|---|---|---|---|
| Spherical (D)* | 1.61 ± 1.46 (-3.50 to 4.50) | 1.00 ± 2.57 (-6.25 to 4.50) | 0.507‡ |
| Cylindrical (D)* | -0.98 ± 0.69 (-3.25 to 0.00) | -0.90 ± 0.81 (-4.00 to 0.00) | 0.299‡ |
| SE (D)* | 1.12 ± 1.43 (-4.50 to 4.25) | 0.55 ± 2.72 (-7.13 to 4.00) | 0.799‡ |
| Significant myopia (<-3.00 D) | 1 (1.9) | 3 (8.3) | 0.275§ |
| Significant astigmatism † (<-2.00 Dn | 3 (5.8) | 2 (5.5) | 1.000§ |
| Significant hyperopia † (>3.00 D) | 6 (11.5) | 6 (16.7) | 0.411§ |
| Anisometropia † (>1.00 D) | 6 (11.5) | 2 (5.5) | 0.463§ |

***:** *Mean ± SD (Range),* **†:** *n(%),* **ǂ:***Student-t test,* **§:** *Chi-square test,* ***SE:** Spherical equivalent,* ***SD:** Standard deviation,* ***D:** Diopter*

group I and 1.00 ± 2.57 D; -0.90 ± 0.81 D and 0.55 ± 2.72 D in group II, respectively (p=0.507 for spherical; p=0.299 for cylindrical and p=0.799 for SE). Although myopic refraction was less common in the breastfed group, there was no significant difference in myopic refraction between the groups (p= 0.507). Also, significant myopia was found in 1.9 % (n=1) and 8.3 % (n=3) of group I and group II patients, respectively. There was no statistically significant difference between groups (p=0.275). On the other hand, significant astigmatism was seen in 5.8 % (n=3) of the patients in Group I and 5.5 % (n=2) of patients in Group II, and there was no significant difference between the groups (p= 1.000).

In addition, no significant difference was observed between the groups in terms of anisometropia (p=0.463) and the significant hyperopia (p=0.411). Feeding types and refractive errors of children are presented in Table II.

## DISCUSSION

This study is one of the rare publication in the literature comparing feeding pattern and refraction errors in preschool children. In present study, although the SE values were higher in the breast-fed group, no significant difference was observed between feeding pattern and refractive errors.

In the study of Chong et al. (13) including 797 Singaporean children aged 10-12 years, the association between breastfeeding and myopia was evaluated. Myopia was detected in 521 children (65.4%), and 8.5% of them had a history of breastfeeding. The prevalence of myopia in breastfed children was found to be lower than in children who were not breastfed (p = 0.040) (13).

In the study performed by Sham et al. (14) with 3009 children aged between 6-72 months, 29.4% of the children had a history of breastfeeding. The prevalence of myopia was found to be 11.3%, and this rate was found to be lower in the breast-fed group (11.2%) than in the non-breastfed group (11.9%). However, this difference was not found to be significant.

In the study of Shirzadeh et al. (15) 367 children aged 1-5 years were evaluated and refractive measurement was performed with retinoscopy without cycloplegic agents. The frequency of myopia (SE at least -0.5 D) was determined as 5.2%, and it was suggested that myopia was less common in breastfed children compared to other feeding groups. Although the SE values differed between the groups, there was no statistically significant difference. It has been stated that age, ethnicity and refraction examination without the use of cycloplegic agents may play an important role in the emergence of these results.

Studies in the literature have found differences in astigmatism rates. In the study of Shirzadeh et al. (15) astigmatism (cylinder of -0.50 D or higher ) was 11.2% in the right eye and 10.2% in the left eye, while this rate was 28.9% (cylinder of 0.75 D or higher ) in the study of Tajbakhsh et al. (16). In present study, astigmatism (cylinder of -1.00 D or higher) was 32.7% in breast-fed group and 16.7% in group who fed with combination of breast-fed and formula. Also, significant astigmatism (cylinder -2.00 D and higher) was 5.8% and 5.6 % in group I and group II, respectively. An important reason for the difference between studies may be the different age groups included in the study.

Chong et al. (13) found that breastfed children (SE -1.61 D) were more hyperopic than non-breast-fed children (SE -2.1D). Similarly, Sham et al. (14) reported that hyperopia was more important in the breastfed group and breastfeeding status was independently associated with SE. In their study examining the relationship between breastfeeding and SE, Liu et al. (17) found that breastfeeding for less than 6 months was positively associated with increased hyperopia. In our study, although hyperopia (38.9%) was less common in the non-breast-fed group, no significant difference was found between the groups.

In the early stages of life, which is a critical period of growth and development, it has shown that breast milk is affect eye development and also retinal and nerve development (18). Although there is a progression from neonatal hyperopia to emmetropia in this period, it has been reported that age has a significant impact on the development of myopia (16,19). It has been stated that breast milk intake at an early age affects retinal development, which may be effective in the development of juvenile-onset myopia (12). However, since eye development continues in early childhood, the effect of breastfeeding can be masked by eye development. Limitations of the study include its design, sample size, lack of ocular biometry, and family history.

On the other hand, the number of patients fed only with formula was not included in the study because the number of patients was very small. This may have affected the comparison of refraction between groups.

## CONCLUSION

In conclusion, this study supports that myopia is seen less frequently in breastfed children in preschool age. Considering the emmetropization process, there is a need for larger, longer-term studies with a wider age range to shed light on this issue in the future.

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