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An evaluation of the effects of breast milk on vision: A study of the long term effects in adults

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Abstract
Several recent studies have shown that breast-feeding leads to optimal visual and cognitive development in human children. This study evaluated the possible long-term effects that breast milk might have on vision. The subjects, 49 optometry students from Pacific University, completed a survey indicating whether they were breast-fed or formula-fed. A brief visual screening battery of tests followed. Subjects were placed into the breast-fed group if they had been breast-fed for 3 months or more. They were placed into the formula-fed group if they were breast-fed less than 3 months, or completely formula-fed. The results showed no significant difference between the breast-fed and formula-fed groups in regards to visual acuity, stereoacuity, refractive error, eye motilities, distance cover test, or red lens test. However, there was a significant difference between the groups for the near cover test. Additional research should include a longitudinal study of children into early adult-hood to measure whether visual performance is enhanced in those infants fed breast milk compared to those fed with formula.

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AN EVALUATION OF THE EFFECTS OF BREAST MILK ON VISION:
A STUDY OF THE LONG TERM EFFECTS IN ADULTS

By:

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A thesis submitted to the faculty of the
College of Optometry
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I am a fourth-year optometry student at Pacific University. I attended Indiana University, Purdue University, and Portland State University for my undergraduate education. I received a Bachelor of Visual Science degree from Pacific University in May 1997.

I am a member of several optometric organizations: Amigos, OEP, AOSA, OOA, and WAOP. I have been Secretary of the Class of 1999 and have attended many Amigos sponsored school screenings, and participated in an Amigos Eyecare Mission to El Fuerte, Mexico.

After graduation, I plan on practicing in the Portland Metro area, and hope to be able to continue the research ideas that I have pursued with this project. I would like to develop a long-term study following infants through childhood and into early adulthood to determine the effects of breastfeeding versus formula feeding on visual development.
Several recent studies have shown that breast-feeding leads to optimal visual and cognitive development in human children. This study evaluated the possible long-term effects that breast milk might have on vision. The subjects, 49 optometry students from Pacific University, completed a survey indicating whether they were breast-fed or formula-fed. A brief visual screening battery of tests followed. Subjects were placed into the breast-fed group if they had been breast-fed for 3 months or more. They were placed into the formula-fed group if they were breast-fed less than 3 months, or completely formula-fed. The results showed no significant difference between the breast-fed and formula-fed groups in regards to visual acuity, stereoacuity, refractive error, eye motilities, distance cover test, or red lens test. However, there was a significant difference between the groups for the near cover test.

Additional research should include a longitudinal study of children into early adult-hood to measure whether visual performance is enhanced in those infants fed breast milk compared to those fed with formula.
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INTRODUCTION

Recent research suggests that levels of docosahexaenoic acid (DHA), an important omega-3 fatty acid, in visual cortex and retinal tissue are related to visual performance outcomes.\(^1,2\) The source of DHA for infants is human breast milk. Currently there are no infant formulas supplemented with this or other important fatty acids. Several studies have been done relating levels of DHA infants receive from human breast milk to their visual functioning. Also studies have been conducted to determine if it would be beneficial to supplement formulas with DHA.\(^3,4\)

This project was modeled after a study that compared visual development related to DHA levels in infants.\(^2\) The study included pre-term and full-term infants who were either breast-fed or, if their mother elected not to nurse, were fed corn oil-based formula. Visual function tests included visual evoked potential acuity (VEP), forced-choice preferential-looking acuity (FPL), operant forced-choice preferential-looking stereoacuity, color vision, letter matching, picture naming, and an orthoptic examination which included ocular motility, cover testing, the 10-diopter base down fixation preference test, the Worth 4-dot test at near and distance, and gross stereopsis screening. Results concluded that at 57 weeks of age, both pre-term and full-term human milk-fed subjects had significantly better VEP and FPL acuity than formula-fed. At 36 months, full-term breast-fed children had significantly better random dot stereo acuity and letter matching ability than formula-fed children. The levels of increased visual
performance corresponded to an increase in levels of omega-3 fatty acids measured in the red blood cells, as a result from breast milk.\(^2\)

Another recently published study showed the long-term cognitive benefits of breast milk. The study involved over 1000 children in New Zealand and followed them from birth to age 18. Breast-fed children had slightly significantly better cognitive functioning than formula-fed children did, after taking into account all the confounding factors. This study further showed that children who have been breast-fed for a minimum of 3 to 5 months have an advantage over formula-fed children, and that advantage increases with the number of months of breast-feeding.\(^5\)

Additional studies have also shown the link between higher levels of DHA, and other fatty acids necessary for brain and retinal development, and a corresponding increase in visual and cognitive functioning.\(^6,7\) Some of these studies included formulas that were fortified with DHA. One such study concluded that even the fortified formulas provided enough DHA to promote higher visual development.\(^4\) Yet, another more recent study found no evidence that infants given unsupplemented formula performed less well than breast-fed infants or infants given formula with DHA supplementation.\(^3\) They suggested further study be pursued before concluding that DHA should be included in formula as a norm.

The American Academy of Pediatrics promotes breast-feeding and the overall benefits and recommends that mothers breast-feed at least 6 months,
and preferably for 12 months. They cite many benefits of breast milk beyond increased visual and cognitive functioning in their 1997 policy statement.⁸

All studies mentioned have only followed children to age 3 for the visual function tests and to age 18 for cognitive functioning tests. This study looks at the possible long-term effects on vision that breast milk may have into adulthood. This study will test the same aspects of vision covered in the Birch study; the measures will be age and ability appropriate.

METHODS

First, a survey questionnaire was given to students at Pacific University College of Optometry inquiring how long the students had been breast-fed or formula-fed as infants, as well as questions regarding visual conditions and refractive status (see Appendix A). Subjects with ocular pathology, trauma or significant family ocular history were disqualified. Qualified subjects were placed into breast-fed and formula-fed groups. Subjects were placed into the breast-fed group if they had been breast-fed for 3 months or more. They were placed into the formula-fed group if they were breast-fed less than 3 months, or completely formula-fed.

The 49 qualified subjects, aged 21 to 51, were then screened for visual performance (see Appendix B). Visual acuity was assessed using projected Snellen charts at far and printed Snellen charts at near both with and without correction; results were converted to logMAR values. Stereoacuity was assessed at 40cm using the Wirt circles. Orthoptic examination included ocular
motilities, red lens test at near (40cm) and far (20feet), and cover test at near (40cm) and far (20feet).

RESULTS

Results of acuities, phorias, refractive status, and stereo acuity were compared between the two groups using a t-test. Overall, the results of all the visual function testing were not significantly different between the breast-fed and formula-fed groups, except for the results of the near cover test. All subjects had full range of motion with ocular motilities. The red lens test at far and near did not show a significant difference between the two groups. An interesting note is that the four subjects who displayed vertical phorias had all been formula fed.

Mean refractive error was not statistically different between the breast-fed group (-3.81 D) and the formula-fed group (-2.32 D); (t=-1.92, p<0.08). Average age of first correction worn was not significantly different between the two groups; with breast-fed at 13.7 years of age and formula-fed at 12.4 years of age. Although the breast-fed group had better stereoacuity without correction (109.4 arc sec), it was not significantly different from the formula-fed group (116.8 arc sec).

Distance unaided acuities in the two groups were not significantly different yet the formula-fed had slightly better acuities (0.642 logMAR, 20/87), than the breast-fed group (0.967 logMAR, 20/185). The same was true for near unaided acuities with formula-fed being 0.280 logMAR (20/38), and breast-fed being 0.340 logMAR (20/44), as shown in the following chart.
Cover tests at far and near showed some interesting results. The breast-fed group was 1.2 pd exophoric at far, while the formula-fed group was ortho at far; these differences were not significant. The only result of all the testing that was significant was the near cover test ($t=2.68$, $p<0.01$). The breast-fed group was found to be 5.2 exophoric and the formula-fed group was ortho at near.

**DISCUSSION**

The results of this study showed no significant difference between the breast-fed and formula-fed groups in regards to visual acuity, stereoacuity, refractive error, eye motilities, distance cover test, or red lens test. However, there was a statistically significant difference in the near cover test with the breast-fed group 5pd exophoric, and the formula-fed group ortho. Perhaps confounding factors, such as socioeconomic status, parental educational level, or birth weight, should have been taken into account; as well as noting that the subjects were not a representative sampling from the general population.
A longitudinal study of a random group of children followed from birth into early adulthood would provide a more complete comparison of visual performance between those who were fed breast milk and those who were fed formula. It is important that optometrists be actively involved in further research concerning the benefits of breast-feeding.
References


Appendix A

Survey For Thesis Project

1. Age _______ Sex: M / F Year of birth _______

2. Were you born prematurely or on-time? (circle one). If premature, how many weeks? ____________

3. As an infant were you breast-fed, formula-fed, or both? (circle one) How many months were you breast-fed? ____________ How many months were you formula-fed? ____________

4. What is your refractive status? (Circle all that apply) myopic, hyperopic, emmetropic, astigmat, presbyopic

5. Do you currently wear glasses? Y / N Contacts? Y / N What is your prescription? (if known) Full time or part time wear? (Circle) Right eye: ___________________________ Left eye: ___________________________

At what age did you first wear visual correction? _______

6. Do you have any of the following visual conditions? (Circle all that apply) strabismus, amblyopia, color vision problems, stereoacuity problems, cataracts, glaucoma, none, others? (specify) ___________________________

7. Have you ever had any of the following? (circle all that apply) eye injuries, eye surgeries, eye trauma, eye diseases, none If you circled any of these, please explain:

____________________________

8. Some conditions can run in families, has anyone in your immediate family had any of the following? (circle all that apply) strabismus, amblyopia, glaucoma, blindness, cataracts, none, others? ___________________________

All information will be held confidential by the experimenter and will not be released. By signing this survey, you agree to be called by the experimenter, if you qualify for the screening portion, to set up a time for the screening. Thanks!

Printed Name ___________________________ Class of _______
Signature ______________________________
Phone Number ___________________________
Date _________________________________
Appendix B

Thesis Screening

Name: _________________________________

VA's with correction  Distance  OD 20/___  Near  OD 20/___
OS 20/___  OS 20/___
OU 20/___  OU 20/___

w/o correction  Distance OD 20/___  Near OD 20/___
OS 20/___  OS 20/___
OU 20/___  OU 20/___

Stereo acuity  _______ arc sec with correction  _______ arc sec w/o correction

Ocular Motilities:  Full with no restrictions or

Restrictions, specify ________________

Cover Test  Distance: _____ pd----eso/exo/ortho/hyper----phoria/tropia
Near:  _______ pd----eso/exo/ortho/hyper----phoria/tropia

Red Lens Test:  Distance: Fusion_________ Suppression_________

Other_________

Near:  Fusion_________ Suppression_________

Other_________