

Breastfeeding Duration and Cognitive Performance in Elementary School Children

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Breastfeeding has been studied vigorously to determine the benefits for infants. Nutrients in breast milk have been found to help the infant grow, protect the child through transfer of antibodies from the mother to the child, and advancing their cognitive ability. Only 47.2% of children are breastfed at six months old and only 25.5% of children are breastfed at 12 months (Center for Disease Control and Prevention, 2012). Few studies have examined the long term effects of breastfeeding the child and determining if the child is breastfed longer, the cognitive performance in their school age years will be better developed. Does breast milk have an everlasting effect on the cognitive function of the brain? Do children benefit from breast milk long term?

Van Esterik (2003) states that breast milk has evolved in order to fit the needs of the infant throughout development as the child's demands change. Milk supplied by the mother right after birth is called colostrum. Colostrum contains vital nutrients that are needed by the newborn. Colostrum changes into traditional breast milk within a day or two. Breast milk is unique in that it is a living substance that contains white blood cells beneficial to the child's immune system, providing the child with antibodies. Breast milk contains protein, fat, carbohydrates, vitamins and minerals. All of which are needed for the child for the first six months of life. The primary carbohydrate in breast milk is lactose. Whey and casein are the primary proteins in breast milk and make digesting breast milk easier for the baby than cow's milk. Women can produce between 500 and 800 milliliters of breast milk a day. The author states that breast milk is beneficial in multiple ways for the child. Breast milk has protective factors that can reduce the risk of multiple health factors such as allergies, sudden infant death syndrome, multiple sclerosis, and Crohn's disease. Breast milk is sterile and never too hot for the child (Van Esterik, 2003).

Nutrients found in breast milk are beneficial to the child as an infant because it is developing cognitive functions, which could possibly be beneficial to the child in their later years.

A review was done on a study that examines the link between the length of breastfeeding and intelligence in young adults (Breastfeeding and Intelligence, 2002). The study conducted by Mortensen included 2,280 men born at the Copenhagen University Hospital between October of 1959 and December of 1961. The Wechsler Adult Intelligence Scale was administered individually by psychologists. The test targeted the three different types of IQ: verbal, performance, and full scale. Another intelligence test was also given by the Danish military in a 45 minute group test. This test was based on number series, letter matrices, geometric figures, and analogies. The study indicated that children who breastfed for up to nine months scored an average of 6.6 points higher than children who were breastfed for one month or less. The author states that breastfeeding trends have increased since 1970, 26.5% to 68.4% of new mothers in 2000. However, only 31.4% of mothers of babies who are six months and older continue to breastfeed. Furthermore, the author explains that formula is not unhealthy, however it is not filled with natural antibodies, polyunsaturated fatty acids, and docosahexaenoic acid that can be found in breast milk (Breastfeeding and Intelligence, 2002). There are multiple benefits from breastfeeding including cognitive development.

Fergusson, Boden, and Horwood performed a longitudinal study that examined the associations between neonatal circumcision and breastfeeding, and health and cognitive ability outcomes associated with breastfeeding (2007). The study followed 1265 children born in Christchurch, New Zealand in 1977. The children were studied at birth, one month, four months, and annually to 16 years of age. They were also studied again at 18, 21, and 25 years of age. The initiation of breastfeeding was examined through medical records indicating if the child was

breastfed at the hospital after birth. At one month and four months, indication of breastfeeding was collected through parental reports. Of the participants, 80.7% of the samples were breastfed at the hospital. At one month, the reports indicated that 63% exclusively were breastfed and at four months, 13.4% were exclusively breastfed. Cognitive ability was measured through intelligence score (IQ). The child was tested from eight to nine years old. The Test of Scholastic Abilities scores were taken at 13 years of age. The results found that circumcision was not significantly associated with childhood illness or cognitive ability (Fergusson, et al., 2007). Nutrition is a key factor in development in children and their academic success.

Taras's (2005) literature review is a review of multiple research studies. Taras found in his research that zinc deficient children are at a disadvantaged in academics. This is corroborated by Halterman in a study that took blood samples that identified iron levels and administrated standardized test scores for intelligence. The study found that children that were iron deficient scored lower in math compared with children in the normal iron status (2001, referenced in Taras, 2005). Taras also reveals that schools that offer a nutritious breakfast before school from a higher rate of attendance, academic performance, and a decrease in tardiness. Zinc is a prominent ingredient in breast milk and may contribute to the cognitive development in children.

Jedrychowski, Perera, Jankowski, Butscher, Mroz, Flak, Kaim, Lisowska-Miszczyk, Skarupa, and Sowa conducted a seven-year longitudinal study of cognitive development in children that were breastfed (2011). They examined if the cognitive gain in the first year of life followed into childhood adjusting for child gender, maternal education, parity and weight gain to test the hypothesis that the cognitive gain in breastfed children in the first years of life is sustained and may be a strong predictor of the cognitive development trajectory in children, in pregnancy. The participants included 505 women from Krakow, Poland. The women that

participated in the study were chosen when they were between eight and 13 weeks pregnant. For them to qualify, the babies needed to be born after 36 weeks gestation. The mothers participated in interviews that were taken in three month intervals throughout the postpartum period. The duration of breastfeeding was measured by months. The children were administered a mental ability scale at a three year follow up by trained examiners. The study assessed number concepts, social skills, habituation, problem solving, language, generalization, vocalization, and classification. At the age of six and seven, the children were assessed for general intelligence. Jedrychowski et al. (2011) found that an increase in the duration of breastfeeding during infancy led to a slight increase in cognitive development demonstrated by an average IQ score increase of four to five points. These findings are important because they suggest that breastfeeding can lead to a higher IQ score compared with non-breastfed children. Jedrychowski et al. studied children's cognitive development longitudinally up to seven years old and their intelligence related to breastfeeding. Another study examined children up to nine years old of children's cognitive function in the Krakow prospective birth cohort study (2011). Studies have been completed about the benefits of breastfeeding on cognitive development as the children were less than one year of age.

Holme, MacArthur, and Lancashire examined if breastfeeding was associated with differences in childhood cognitive and neurological abilities (2010). The study was a nine year follow up of the 1,853 mothers and children who participated in an earlier study. Of the original 1853 participants, 1,218 families were followed for nine years. The mothers were interviewed to determine whether the child was breastfed and for how many weeks. Cognitive development was determined from neurological screening test through an individual assessment of each child with a psychologist. IQ was measured along with cognitive development and neurological

development. Holme et al. (2010) found that duration of breastfeeding positively correlated with IQ scores. It was also determined that more highly educated women were more likely to breastfeed. We will also be looking into cognitive development and duration of breastfeeding. However, ours will target elementary students in America.

The purpose of this study is to examine the influence of duration of breastfeeding and its lasting effects on cognitive development. There is a positive relationship between the length of breastfeeding and children's cognitive performance in elementary school. The benefits of this study will hopefully motivate more mothers to extend the duration of breastfeeding and the child's cognitive performance.

Method

Overview

The purpose of this study is to examine the long term relationship between the duration of breastfeeding and the child's cognitive performance in their elementary school years. This is a cross-sectional approach using a correlational design to assess the relationship between the two naturally occurring variables. The predictor variable is the duration that the child was breastfed and the outcome variable is the child's cognitive performance in elementary school. Breastfeeding duration will be measured at the ratio level and cognitive performance will be measured at the interval level.

Procedures

Prior to administering this study, the Institutional Review Board at California State University, Chico will need to approve the proposal. The school district will need to approve the study and then school principals will need to agree to participate before contacting classroom

teachers for their approval to use their class for the study. Families will be contacted through an informed letter sent home with the children. The parents will be given an informed consent letter that will be their agreement for their children to participate in the study. The children will give written assent on the day of the assessment. The demographic measure will be sent home to parents with the informed consent letter. The children will be administered the TONI-3 by a trained administer in the classroom at a set time of day. The data collected will be kept anonymous and in a locked filing cabinet only accessible by the researcher. No incentives will be provided to participate in this study.

Participants

This study will be non-probability convenience sample of 500 elementary school aged children from ten different schools. The participants will be from the Pacific Northwest. The age range of the children will be from age seven to nine, the mean being eight. The group of children included 275 female students and 225 male students. The sample will include 48% Caucasian, 23% African Americans, 23% Hispanic, and 6% of other descents.

Materials

The Wechsler Intelligence Scale for Children (WISC) will be administered to the children. The WISC is a verbal test of 106 questions that is given by a trained administrator to the children. Questions range in difficulty. Questions are such as “how many ears do you have?” or “please define the word amanuensis.” The score is a compilation of 25 information questions, ten comprehension questions, seven digital span forward questions, seven digital span backward questions, 12 similarity questions, and 45 vocabulary questions. The data collected would be quantitative data (Wechsler 1946). The parents will receive a demographic questionnaire with

their informed consent letter. The demographic questionnaire will include questions such as: “How long was your child breastfed?” The questions will be answered by the parent circling the answer that best represents themselves. This is a fixed format.

Data Analysis Plan

The researcher hypothesized that there will be a positive relationship between longer breastfeeding duration and increased cognitive performance in elementary school children. A Pearson Product Moment Correlation Statistic will be used to be used measure the systematic between the two naturally occurring variables.

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Breastfeeding and Cognitive Abilities of Elementary School Children

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April 29, 2013

Dear Parent,

The purpose of this study is to examine the long term relationship between breastfeeding and your child's current cognitive performance in elementary school. The reason for conducting this study is to identify long term benefits of breastfeeding in children. Your child's expected time commitment for this study is roughly 45 to 60 minutes. He or she will be asked several questions that measure current cognitive and problem solving abilities. The measure will be given at school during class time.

The risks of participation in this study are minimal. These risks are similar to those your child experience in normal daily life. The topics in the survey may upset some respondents. Your child may decline to answer any or all questions and your child may end their involvement at any time if they choose without penalties or negative consequences. There will be no direct benefit to them for their participation in this study. However, we hope that the information obtained from this study may give us a better understanding of breastfeeding and children's problem solving abilities and brain development.

Please do not write any identifying information on your questionnaire. Your child's responses will be anonymous. Internal Review Board has reviewed this study and has approved it. Should you have any questions about the research or any related matters, please contact the Amanda at aduntsch@csuchico.edu. If you have questions regarding your rights as a research subject, or if problems arise which you do not feel you can discuss with the Investigator, please contact the Office of Research and Sponsored Programs at California State University, Chico (801) 898-5700.

Your child's participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign this consent form. If you decide to take part in this study, you are still free to withdraw at any time and without giving a reason. Your child is free to not answer any question or questions if they choose. This will not affect the relationship you have with the researcher.

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

First and last name of participant (please print): _____

Signature _____ Date _____

Sincerely,

Amanda Duntsch _____ April 29, 2013

Parent Survey

Parent's Age: _____ Child's Age: _____

Parent's age when the child was born: _____

Parent's Race: (Please Circle)

Caucasian

African American

Asian American

Native American

Other (Please Specify): _____

Child's Race: (Please Circle)

Caucasian

African American

Asian American

Native American

Other (Please Specify): _____

Please circle the one that best fits your child.

How long was your child breastfed?

0-1 week 2 weeks-1 month 1- 3 months 4-6 months 6-9 months
9-12 months 12+ months

How often did your child breastfeed?

Always Often Sometimes Rarely Never

Thank you for your participation!

Wechsler Intelligence Scale for Children

Verbal Test (edited)

Directions: Read questions in conversational; tone and in order given. When correctness of response is in doubt, ask Subject to "explain more fully." No leading questions are permitted. Write out doubtful responses verbatim. Unless mental deficiency is suspected, begin with item No. 1. However, if Subject fails any of the first three questions give items A-F inclusive. Continue until five consecutive questions are failed.

Information questions:	Correct Answers
A. How many ears do you have?	2
B. What do you call this finger? (showing thumb)	Thumb
C. How many legs does a dog have?	4
D. From what animal do we get milk?	Cow
E. In what kind of a store do you buy sugar?	Grocery
F. How many pennies make a nickel?	5
1. How many days are in a week?	7
2. What must you do to make water boil?	Heat it
3. How many things make a dozen?	12
4. What are the four seasons of the year?	Spring, summer, fall, winter
5. What is the color of rubies?	Red
6. What is celebrated on the Fourth of July?	Independence Day
7. Where is Chile?	South America
8. How many pounds in a ton?	2,000
9. Who wrote "Romeo and Juliet"?	Shakespeare
10. Where does the sun set?	West
11. What does your stomach do?	Digests food
12. What is the capital of Greece?	Athens
13. Why does oil float on water?	Lighter
14. When is Labor Day?	1 st Monday in September
15. What do we get turpentine from?	Trees; sap from trees
16. How far is Chicago from New York?	From 800- 1000 miles
17. What is rayon? fibers	Silk fabric made from wood
18. What is a harrow? ground.	Farm tool used to level ploughed
19. What is a hieroglyphic?	Ancient Egyptian writing
20. What does it mean to impeach someone?	Charge formally with a crime
21. What is a lien? property	Legal claim or charge against
22. Who was Ghengis Khan?	Great Mongol (Chinese) conquer
23. Who wrote "Paradise Lost"?	Milton

- | | |
|--|-------------------------------------|
| 24. What is a barometer?
atmospheric pressure | Instrument for measuring |
| 25. What is a prime number?
one. | Number divisible only by itself and |

Directions: Be sure subject is attending when you ask questions. Subjects sometimes find it difficult to remember the entire question from a single statement. It is, therefore, always permitted to repeat the question. Write the response verbatim. Sometimes it is necessary to encourage the Subject. It is done with such remarks as “yes,” “go ahead,” etc. If the response is unclear, add “please explain further.” Except for low grade individuals, ask all the questions.

Comprehension Questions:

1. What is the thing you do if you lose a book belonging to the library?
2. Why is better to build a house with brick than wood?
3. What should you do if you see a train approaching a broken track?
4. Why is it generally better to give money to an organized charity than to a street beggar?
5. What is the thing to do if a very good friend asks you for something you don't have?
6. Why are criminals locked up or put in prison?
7. Why should most government positions be filled through Civil Service Examinations?
8. Why does the United States require that a person wait at least two years from the time he makes the application to until the time he receives his final citizen papers?
9. Why is cotton used in making cloth?
10. Why should a promise be kept?

Directions: Use set of digits given below. Examiner says “I am going to say some numbers. Listen carefully and when I am through, say them after me.” If the Subject repeats the series correctly, mark plus and continue with the next higher series. If Subject fails, give second on trial of equal length. Discontinue after Subject has failed on both trials of equal series. The sub score is highest number of digits repeated without error on either of two trials. Thus, if Subject repeats correctly five digits forward on either trial, but fails in both of six digits forward, he gets a five.

Digit Span Forward and Backward:

Digits Forward:

- (3) 3, 8, 6
6, 1, 2

- (4) 3, 4, 1, 7
6, 1, 5, 8
- (5) 8, 4, 2, 3, 9
5, 2, 1, 8, 6
- (6) 3, 8, 9, 1, 7, 4
7, 9, 6, 4, 8, 3
- (7) 5, 1, 7, 4, 2, 3, 7
9, 8, 5, 2, 1, 6, 3
- (8) 1, 6, 4, 5, 9, 7, 6, 3
2, 9, 7, 6, 3, 1, 5, 4
- (9) 5, 3, 8, 7, 1, 2, 4, 6, 9
4, 2, 6, 9, 1, 7, 8, 3,

Directions: Use set of digits given below. Examiner says "I am going to say some numbers. Listen carefully and when I stop I want you to say them backwards. If I say 9-7-2, you say 2-7-9." If the Subject repeats the series correctly, mark plus and continue with the next higher series. If Subject fails, give second on trial of equal length. Discontinue after Subject has failed on both trials of equal series. The sub score is highest number of digits repeated without error on either of two trials. Thus, if Subject repeats five correctly 5 digits backward on either trial, but fails in both of six digits backward, he gets a five.

Digits Backwards:

- (2) 2, 5
6, 3
- (3) 5, 7, 4
2, 5, 9
- (4) 7, 2, 9, 6
8, 4, 1, 3
- (5) 4, 1, 6, 2, 7
9, 7, 8, 5, 2

- (6) 1, 6, 5, 2, 9, 8
3, 6, 7, 1, 9, 4
- (7) 8, 5, 9, 2, 3, 4, 2
4, 5, 7, 9, 2, 8, 1
- (8) 6, 9, 1, 6, 3, 2, 5, 8
3, 1, 7, 9, 5, 4, 8, 2

Directions: Examiner says: "I am going to name two things which are the same or alike in certain ways and I want you to tell me in what ways they are alike. For example: in what ways are a plum and peach alike?" If the subjects reply with: "They are both fruits." Say, "That's right." If he fails to answer within 10 to 15 seconds, or gives an inferior reply, the Examiner says: well, you might say you can eat them both. That they are both are fruits or that they both have skins. Now tell me how beer and wine are alike." After giving the first three pairs, Examiner notes the score of less than 3 out of 6 possible, Examiner continues with the remaining verbal similarities using the same formula. Continue until three have been consecutively failed. Spontaneous corrections are allowed. If such response occurs, one response could be scored as 2 and the other as 1 point, Examiner asks: "Which one is it?" and scores the subject's choice.

Similarities:

- | | |
|-------------------|----------------|
| 1. Plum | Peach |
| 2. Beer | Wine |
| 3. Cat | Mouse |
| 4. Piano | Violin |
| 5. Paper | Pen |
| 6. Pound | Yard |
| 7. Scissors | Pan |
| 8. Mountain | Lake |
| 9. First | Last |
| 10. Salt | Water |
| 11. Liberty | Justice |
| 12. The number 49 | The number 121 |

Directions: Examiner says: "I want to see how many words you know. Listen carefully. When I say a word you tell what it means. What does _____ mean?" Start with 6. If the subject passes words 6, 7, and 8, credit words 1-5 as correct and add to score; but if subject fails any of these words, present 1-5 and score them individually. Continue until 5 consecutive have been failed. If subject is literate, the page of words in this Manual may be exposed to him and phrase

“next please” may be substituted for the question “What does _____ mean?” The list of words is printed on the next page in large type to facilitate this procedure.

Vocabulary:

1. Bicycle
2. Knife
3. Hat
4. Apple
5. Donkey
6. Box
7. Bad
8. Umbrella
9. Brave
10. Nuisance
11. Diamond
12. Letter
13. Join
14. Fur
15. Cushion
16. Nail
17. Gamble
18. Spade
19. Shilling
20. Fable
21. Sword
22. Nonsense
23. Hero
24. Nitroglycerine
25. Microscope
26. Espionage
27. Stanza
28. Seclude
29. Spangle
30. Belfry
31. Recede
32. Affliction
33. Ballast
34. Catacomb
35. Imminent
36. Mantis
37. Hara-kiri

38. Vesper
39. Aseptic
40. Chattel
41. Dilatory
42. Amanuensis
43. Moiety
44. Flout
45. Traduce