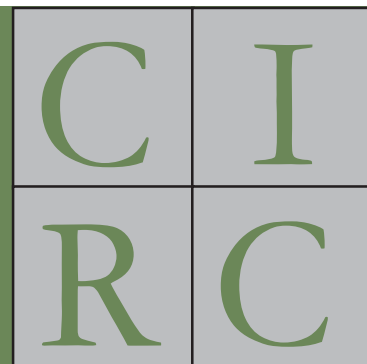


Does Breastfeeding Make Babies Smarter Later In Life?



Source: Mortenseon, E. L., Michaelsen, K. F., Sanders, S. A., & Reinisch, J. M. (2002).
The association between duration of breastfeeding and adult intelligence. *The Journal
of the American Medical Association*, 287, 2365-2371.

Goals:

Teach the meaning
and importance of
controlling for
multiple variables.

Teach how to
distinguish biased
versus unbiased
sources of
information.

Basic Idea:

This lesson looks at
the potential
relationship between
the number of months
a person spent
breastfeeding as an
infant and the
person's adult
intelligence.

Gain Attention/Interest:

What would you do if I told you that I could give you something to eat, and if you ate it everyday for a few months you would wind up smarter than if you hadn't eaten it? Would you eat it? For how long?

Now imagine that this food is available to almost every baby anywhere in the world — rich or poor, male or female. Imagine also that babies eat it for different lengths of time, and they don't get to decide when it will be taken away.

Not eating this food would not make a person stupid; people could still be very intelligent even if they never tasted this food or had tasted it only a few times. And conversely, eating it would not automatically make you into a genius.

What is this seemingly magical food? Has anyone figured it out? It's breast milk.

What does breastfeeding have to do with intelligence later in life, and how could you possibly tell if being breastfed makes a person more intelligent? You can't give some babies breast milk, see how they turn out, and then go back and not give them breast milk and see what happens then.



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The answer to these questions can be found through science.

Think & Write #1

How could breast milk make people smarter?

What could breast milk have to do with intelligence?

Some students may need more specific questions to write more than “I don’t know”. Some sample additional questions: Think of some specific differences between a baby who is breastfed and one who is not. List them, and try to come up with an explanation for how these differences could influence intelligence.

Activity

Have students form a value line based on their current opinion. One side of the classroom can represent 100% confidence that breastfeeding and intelligence are related, while the other side can represent 100% confidence that breastfeeding and intelligence are not related. Places in between can represent varying levels of middle ground. Once students have chosen their respective places, ask for volunteers to express why they made the choice they did.

Ask: What is Science?

1 Ask: What is Science?

The purpose of science is to answer questions. Science does this through the method of **proof by disproof**. A non-scientist might try to answer a question by gathering evidence, or proof, in support of her answer. Scientists answer questions in a slightly different way. They look for disproof; they try to find any possible way that a specific answer could be shown to be incorrect. If all other answers are eliminated, or disproved, then the answer that is left has a lot of support. Thus, scientists gather proof for their answer by trying to disprove it. If they fail to disprove their answer, they can conclude that their answer might be true. This is called the method of proof by disproof.

Imagine someone gives you a list of many different foods you have eaten, and one by one you eliminate the foods you liked the least. After eliminating all the different foods except one, the last food left on the list is more than likely a food that you like. But scientists wouldn't conclude that it is your favorite food because there might be another option out there that wasn't even on the list. By eliminating a lot of incorrect answers, scientists feel better about concluding they might have a correct answer.

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Define the Problem:

See Many Sides.

Define the Problem: See Many Sides

How can anyone possibly measure the connection between breastfeeding and intelligence? How can all other possible answers be eliminated? There are a lot of different people who were raised by different types of parents, in different ways, and in different environments. One of the important first steps in science is to clearly state the question being considered. Often, an overly broad or general question can be really hard to answer. To avoid this, scientists usually try to answer a set of specific questions first, before trying to answer broader questions. However, it's important to know that even specific questions can be quite difficult to answer. For example, answering a question such as "what is the relationship between the amount of time spent breastfeeding and adult intelligence?" can be quite difficult because different groups approach the problem in different ways. Depending on who is

looking at the question, their goals and interests in how the question is asked and how it is answered can differ.

Think & Write #2

Hypothesis formation

Ask students to form a hypothesis about how a particular group might view the relationship between breastfeeding and intelligence. Below are some examples, as well as information regarding education requirements for such groups.

Parents. Parents want their children to be healthy and happy. Do you think they would want to do something that would help their kids grow up smarter? But not all parents feed their children by breastfeeding — some buy baby formula from the store. There is no education requirement to be a parent, but knowing more about parenting can help parents to better raise their children.

Pediatrician. Pediatricians care for the medical needs of children when they are ill. They also advise parents on how to keep kids healthy. Information regarding intelligence and the feeding of infants is important to pediatricians. If any action might be considered potentially harmful to a child's health, then a doctor would likely not recommend it. Or if there was something a mother could do to help her child, doctors would be in favor of it. Pediatricians attend four-year colleges and medical school and get further training on the job.

Policy Analyst. A policy analyst looks at how making different decisions can influence the government, businesses, and people's lives. Policy analysts often work in places like Washington D.C., and attend four-year colleges to study political science or law.

Educator. It is the job of educators to teach kids and help prepare them for further education and life beyond school. Educators would likely welcome a way of helping kids become as smart as possible. Teachers attend four-year colleges and usually attend some graduate school.

Baby Formula Manufacturer. Companies that make baby formula are highly interested in selling their product. News that breastfeeding can increase intelligence is very important to them because it could negatively influence sales of their product.

BIASED SOURCE

Any group that could potentially make a profit depending on the outcome of a study will likely have a biased view.

Because there are so many different questions, and so many different sides to each question, it is important to focus on the topic and study one question at a time. When scientists approach a problem, they seek to answer a specific question. For today, we will focus on the relationship between the amount of time spent breastfeeding as a baby and adult intelligence.

Distinguish Fact From Opinion: Learn What Constitutes Scientific Evidence

This is a difficult question to consider. As we discussed, scientists go about answering questions by trying to eliminate as many answers as possible. For example, if we were to ask the smartest adults whether or not they were breastfed, we would likely get a variety of answers: Some would say "yes", some would say "no", and a lot would probably say "I don't know." Besides, we all know

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Fact Versus Opinion: What Constitutes Evidence?

there is a lot more to being smart than just breastfeeding as a baby! What about how smart your parents are, how many years of school they attended, how many years of school you attended, in what kind of environment you were raised, and how healthy you were while growing up? There are many factors that can play a role in the development of intelligence.

With this type of question, scientists don't just want to go around and ask people their opinions, they want facts and evidence. So, given that there are numerous factors that can help make someone more intelligent as an adult, how can scientists possibly measure whether or not breastfeeding as a baby leads to higher intelligence? To answer this question, we need to know the difference between a fact and an opinion, and know what information can be used as evidence to help answer our question. Which of the following are opinions, and which are facts? Which scenarios, if true, would help answer our question?

You may want to consider having students form small groups to discuss the following scenarios.

Scenario 1: A doctor at a hospital keeps track of whether or not her patients breastfeed their children. Then, when these children are 16 years old, she measures their intelligence.

Scenario 2: A reporter who is interested in breastfeeding and intelligence begins to investigate whether or not Albert Einstein, one of the smartest people ever to live, was breastfed or not. What influence should the reporter's results have on scientific research?

Scenario 3: The president of a baby-formula-making company says her son had nothing but baby formula as an infant, but he grew up and got into every college he applied to.

Scenario 4: A parent thinks using baby formula to feed her child is better because this way it is easier for her to measure how much her baby is eating each day.

Things to discuss about each scenario:

Scenario 1: This information would yield facts and evidence. As long as the doctor was able to keep track of a wide variety of people, she would get results that interest the scientific community.

Scenario 2: This story would be a fact (assuming the reporter found accurate information). However, even though the reporter's research may result in an interesting story, a single person's life, regardless of how important he was, does not represent adequate scientific evidence to answer a question about something that affects all people. Scientists are interested in how breastfeeding is related to intelligence for a lot of people, not just for one particular person.

Scenario 3: This is a fact; her son had only baby formula and got into all the colleges he applied to. However, as the president of a baby formula company, she has an obvious interest in showing that breastfeeding isn't the only way for kids to be smart. Additionally, as president of a company, she is likely well educated and has the financial ability to support a strong education. These factors would have influenced her son's development.

Scenario 4: This is an opinion. It may very well be true that a parent prefers baby formula because it can be measured, but without gathering evidence, she doesn't know for sure. Also, no matter whether it is true or false, it doesn't really help us answer our question, so the information is not relevant.

The above examples show that even if you get "the facts," this doesn't necessarily mean that you have scientific evidence. Often, it depends on the source of your information. If you get your information from one person, or from a group of people all of whom have something in common, this is not a **representative sample**. To conduct representative sampling, you need to make sure that all different kinds of people have an equal chance of being chosen to participate. Albert Einstein and the son of a company president are not representative samples of the general population. You need many people, from all different kinds of backgrounds, to make up a representative sample.

To make sure your information is really based on facts and that these facts represent evidence related to the question, you have to make sure that it is the amount of time spent breastfeeding and not something else that is influencing intelligence (i.e., parent education, time spent in school, etc.). Here's an example that may clear up how scientists are able to eliminate some of the other factors and look only at time spent breastfeeding.

REPRESENTATIVE SAMPLE

A representative sample is an accurate reflection of the population being measured.

Activity

Have students partner up girl-boy and see how high they can reach on the wall while standing. Record whether the male or the female can reach higher. Then make the conclusion that <insert gender (most likely male) here> have longer arms because they tend to be able to reach higher on the wall. Hopefully, the students will note that boys tend to be taller than girls and thus claim "it's not fair". We can then introduce how to **control** for a variable. Controlling for a variable is to hold it equal. In this case, to control for height would mean to do the same activity, but subtract the difference in heights between the two people. (Example: Will is 6 feet tall and can reach 8 feet high and Amy is 5 feet tall and can reach 7 feet high. Because their height difference is one foot, their arm reach ability is the same.) Thus controlling for height eliminates the difference in height.

When measuring whether breastfeeding leads to higher intelligence, scientists have to hold equal the many factors representing different

CONTROL

To help students understand the word control, tell them they can substitute the words "hold equal" if that makes more sense to them.

aspects of people's lives. After holding these differences equal (e.g., how much education a person has received) scientists look at whether the breastfed people grow up to be smarter. If a difference in intelligence still exists, there must be a relationship between breastfeeding and intelligence. It's like the example of reaching height: If, after controlling for body height, there is still a difference, then the arm

reach must be longer. If we made equal a group of people in years of school, for example, we could ask if the smarter people in the group were the ones who were breastfed, knowing that we're not confusing the issue with years of schooling.

Weigh Evidence and Make Decisions

When studying breastfeeding and intelligence, scientists tried to hold equal many factors they thought might cause differences in adult intelligence. This process of holding things equal is called controlling for other factors.

Scientists controlled for:

- parental social status and education
- "single mother" status
- mother's height, age, and weight gain during pregnancy
- cigarette consumption in the third trimester
- number of pregnancies
- estimated gestational age (i.e., how many weeks the baby grew before being born).
- birth weight
- birth length
- any complications during pregnancy or delivery.

The result they found was that longer lengths of breastfeeding typically lead to higher scores on intelligence tests. Obviously, they didn't have fifteen-year-old kids being breastfed participating in their study; they measured children only up to about one year of age. On average, the highest peak intelligence was for those babies who were breastfed for 7-9 months.

4 Weigh Evidence and Make Decisions.

Think & Write #3

How about now?

Have students write about their thoughts now that they have learned what scientists have done and the results they have found. Do they feel the same as they did during Think & Write 1?

Now that we know this, what does it mean? Does it mean that if a baby is not breastfed that he will automatically be dumb? Does it mean that being breastfed longer will make someone really smart? What if she was breastfed her entire life, would that make her the smartest person in the world?!

A nonscientist might mistakenly conclude that all infants who were breastfed for 7-9 months were the smartest babies. This conclusion would be incorrect. A more accurate conclusion is that, on average, the people who were breastfed for this long scored higher on intelligence tests than people who were not breastfed as long. It doesn't happen for every baby who is breastfed, but it happens to many of them. The difference is not big enough to turn the babies into Albert Einstein, but there is a difference.

Being breastfed does not automatically make someone smart, nor does not being breastfed automatically make a person stupid. We can't really make predictions about what a person would be like if he or she were breastfed for his or her whole life because no one has ever tested this option. Besides, being breastfed while in math class might be a bit awkward.

Why does breastfeeding tend to lead to higher scores on intelligence tests?

Three possibilities are:

- Human milk contains some nutrients that baby formula does not. These nutrients may stimulate brain development.
- The physical contact of feeding and the psychological connection between mother and child may stimulate brain development.
- Some unidentified factors are related both to breastfeeding and to infant cognitive development.

Move From Science to Society

There are many questions about the relationship between breastfeeding and intelligence. Many of the questions don't necessarily have "right" and "wrong" answers, because arguments can be made for and against each side. It's like arguing about which is a better snack, ice cream or cookies: There's no "right" answer, it just depends.

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Move
From
Science
To
Society.

For example:

Depending on time, have the class discuss a few of these questions.

- If breast milk makes us smarter, should the government require mothers to breastfeed their babies?
- If breastfeeding makes us smarter, should we try to consume breast milk all our lives? Or is there a point at which the benefits no longer happen? At what age do the benefits of breastfeeding cease? (12 months? 24 months? 3-4 years?)
- If breastfeeding leads to higher intelligence, does this mean that all intelligent people were breastfed for longer than anyone else?
- What about the opposite? Does it mean that people who aren't as intelligent weren't breastfed?

What should our society's position be on baby formula? Should we allow advertisements for it? Should we allow hospitals to give out free samples of formula? Should we allow nurses to encourage women to feed formula to infants when the women are tired after giving birth? Should we require hospitals to give out information on the benefits of breastfeeding? What are the implications for our society and our children? Should we offer breastfeeding mothers private places to feed their babies in restaurants, malls, stores, etc? These are all examples of relevant real world questions with which scientists grapple.

Revisit, Review, Reflect, and Re-evaluate

As of right now, scientists believe there is a relationship between time spent breastfeeding and adult intelligence. However, scientists are far from done asking questions about breastfeeding. To make sure they have the best information possible, scientists continually revisit questions, reflect, and re-evaluate how they could potentially better answer the questions, or how they could check to see if the answer that was found before still applies today. Just because something was true ten years ago doesn't mean that it still remains true today. Scientists constantly review their old work to make sure it remains up to date.

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Revisit,
Review,
Reflect,
and
Re-evaluate.

Think & Write #4

What's next?

Based on what they know now, have students hypothesize about which further scientific studies might be done so that scientists can better understand how breastfeeding and intelligence are related. Potential ideas: Are some babies more influenced than others? Which ones? Why? What can be done for infants whose mothers cannot breastfeed them?

Discussion Questions

1. Given what you know now, should the government take any action to spread this information? If so, what actions should be taken? If not, why not?
2. What could scientists do differently to learn more about the relationship between breastfeeding and intelligence?

Homework Questions

1. Find another situation in which variables have to be controlled for. Describe.

**Cornell Institute for
Research on Children**

Quiz Questions

Version A

1. In general, which of the following groups of people would have the strongest motivation to show that there is no relationship between breastfeeding and intelligence?
 - a. Parents
 - b. Doctors
 - c. Schools
 - d. Baby-formula makers
2. Who would be more interested to learn whether or not Albert Einstein, one of the smartest people ever to live, was breastfed as a baby— a newspaper reporter or a scientist? Why?

Quiz Questions

Version B

1. Circle any of the following groups that would have strong motivation to show that there is no relationship between breastfeeding and intelligence.

- | | |
|------------------------|-------------------------|
| a. Parents | e. Nurses |
| b. Doctors | f. Advertisers |
| c. Schools | g. Bottle manufacturers |
| d. Baby formula makers | |

2. If consuming breast milk makes children smarter, should the government require mothers to breastfeed their babies? Think of at least one reason for the answer to be ‘yes’ and one reason for the answer to be ‘no.’

3. Who would be more interested to learn whether or not Albert Einstein, one of the smartest people ever to live, was breastfed as a baby— a newspaper reporter or a scientist? Why?

Quiz Questions

Version C

1. In 2-3 sentences, explain as specifically as possible the perspective of each of the following groups' responses to the question, "What is the relationship between the amount of time spend breastfeeding and adult intelligence?"

Parents

Baby formula makers

Doctors

Bottle manufacturers

Teachers

Nurses

2. Which of the above perspectives do you think are the most similar? Why? Which two perspectives do you think are the most different? Why?

3. In 2-3 sentences, explain why it might be more interesting to a newspaper reporter rather than a scientist to learn that Albert Einstein, one of the smartest people ever to live, was breastfed as a baby.