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Are formula-fed infants of different ethnicities more likely to become overweight children?

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## **Are formula-fed infants of different ethnicities more likely to become overweight children?**

### **Abstract:**

A number of health risks are associated with being overweight in childhood. Because early experiences with food shape later eating habits and metabolism, investigators have hypothesized that the type of infant feeding would have a great impact on later development of obesity. Based on a series of conflicting studies that have examined the link between bottle-feeding and childhood overweight, there seems to be a minor protective effect of breastfeeding, but it is unlikely that bottle-feeding plays an important role in an infant's risk of developing into an overweight child.

**Keywords:** breast milk, infant formula, ethnicity, childhood overweight

## INTRODUCTION

As the prevalence of overweight children in the United States has risen (1), the question of whether bottle-feeding increases the risk of overweight children has become important. The association between bottle-feeding and adult obesity remains controversial due to the difficulty of separating variables in such long-term longitudinal studies (2). But studies comparing the BMI of children who were breastfed or bottle-fed have yielded clearer results. Though there is a minor protective effect of breastfeeding, it is unlikely that bottle-feeding plays an important role in an infant's risk of developing into an overweight child (3-6).

## OVERWEIGHT CHILDREN

Being overweight during childhood is associated with a number of health risks. The definitions for childhood overweight and obesity vary across studies. Before three years of age, childhood overweight is not an important determinant of adult obesity. After that time, as a child matures, childhood overweight becomes an increasingly important determinant of adult obesity (7). In adulthood, it is extremely difficult to sustain weight loss; early intervention is vital to prevent the health risks associated with adult obesity (8). More alarming is the emergence of Type 2 Diabetes in youth. This growing problem is largely limited to black, Hispanic, Asian, and Native American youth and is strongly associated with the presence of obesity (9). Childhood overweight is defined as a Body Mass Index (BMI) over 95<sup>th</sup> percentile in a child up to 19 years (10), overweight in adults is defined as a BMI >25, and obesity in adults is defined as a BMI >30 (11).

The cause of childhood overweight is a complex interplay between genetics and environment. While obesity in at least one parent remains the strongest determinant of childhood overweight (12), the environment plays a very important role. This includes the types and amounts of foods and sweetened juices that the child eats after transitioning from bottle or breastfeeding, the amount of physical activity of the child, and the interaction between the two (13). Because early experiences with food shape later eating habits (14), investigators have hypothesized that the type of infant feeding would have a great impact on later development of obesity. However, the results of many studies examining this hypothesis are contradictory.

## INITIAL CONTROVERSY

In 2001, Butte (2) reviewed the literature on the role of breastfeeding in obesity, and concluded that the protective effect of breastfeeding on later obesity remains controversial. Studies varied considerably in regards to design, sample size, proportion of breastfed infants, control for confounding variables, and age of follow-up. Two case-control studies found a significant increase in relative risk of being overweight in adolescents who were not breastfed. But in a series of cohort studies and in later studies that controlled for confounding variables such as parental BMI, no significant protective effect of breastfeeding was found.

Soon after Butte's review came out, JAMA published two studies examining the same hypothesis (4, 5). There were many differences between these two studies. While Gillman et. al analyzed data from 15,000 children who were 9-14 years old, a cohort drawn from the children of women enrolled in the Nurses' Health Study II, Hediger et. al studied a sample of 2,685 children who were 3-5 years old taken from the National Health and Nutrition Examination Survey III (NHANESIII). Gillman et. al determined birth measurements and feeding practices during infancy by a questionnaire sent to the mothers, and children reported their own height and weight. Hediger et. al determined birth measurements by locating the birth certificate for each

subject. They directly measured body weight and height of subjects, and asked mothers to recall feeding practices during infancy. Finally, and perhaps most importantly, 93.6% of participants in the Gillman et. al study were white, while the Hediger et. al study over-sampled blacks and Mexican Americans, and findings were weighted accordingly.

As a result of these differences, the two studies came to opposite conclusions. Gillman et. al found a modestly increased risk for overweight in adolescents who were bottle-fed. Hediger et. al found that breastfeeding is not an effective way to prevent children 3-5 years old from becoming overweight.

Dietz (3) explained these differences in an editorial in the same issue of JAMA and argued that breastfeeding was indeed protective against childhood obesity, but that the protective effects do not become apparent until adolescence. Dietz pointed out that most studies that have shown a lack of an effect for breastfeeding have examined children younger than seven years. Furthermore, the two studies could be interpreted to support one another. The failure of Hediger et. al to find a significant protective effect of breastfeeding may have been due to a small sample size, and, though not significant, the odds ratios were very similar to the odds ratios in the study done by Gillman et. al.

#### ETHNICITY—A KEY FACTOR

However, more recent findings show that the most accurate analysis would focus on the ethnic differences between the two studies. In a longitudinal study published in 2004 (6), data was drawn from the Pediatric Nutrition Surveillance System on 177,304 4-year-olds. Data from maternal pregnancy records, including mother's age, education, pre-pregnancy BMI, weight gain during pregnancy, and smoking, were linked to data on the children in a subset of 12,587 subjects. The study explored the effects of ethnic differences as well as differences in breastfeeding, and included the duration of breastfeeding in the analysis. The sample included only low-income children and there were high percentages of black and Hispanic children. In the larger, unlinked, data set, 29.0% were non-Hispanic black, and 13.9% were Hispanic, and in the subset, 23.6% were non-Hispanic black, and 26.3% were Hispanic.

This study demonstrated the minor importance of breastfeeding as a way to prevent childhood overweight. After controlling for the infant's gender, race/ethnicity, and birth weight, as well as the mother's age, education, pre-pregnancy BMI, weight gain during pregnancy, and postpartum smoking, only breastfeeding for more than 12 months had a protective benefit, but that benefit was not statistically significant. Shorter durations of breastfeeding showed little effect. After stratifying for race/ethnicity, breastfeeding was significantly protective against overweight only if the duration of breastfeeding was longer than 6 months and only in the sample of non-Hispanic white 4- year-olds. In all other races/ethnicities, no protective effect of breastfeeding was observed for any duration of breastfeeding.

These findings would suggest that what distinguished the study by Gillman et. al from the study by Hediger et. al was the large difference in racial/ethnic diversity in their samples.

#### MODEST EFFECTS OF BREASTFEEDING ON BEING OVERWEIGHT

Importantly, the 2004 study also showed why breastfeeding in a population might appear to be beneficial. The BMI did not decrease in the sample of infants who were breastfed longer. What did decrease was the standard deviation of the BMI in that sample. In the sample of infants breastfed for longer than 6 months, there were fewer overweight *and* fewer underweight infants. Rather than causing all infants to have a lower BMI, breastfeeding reduced the variability of

BMI in the population as a whole. Breastfeeding for longer than 6 months increases the likelihood that feeding is appropriate regardless of parents' beliefs or feeding behaviors.

Even in the population of non-Hispanic white children, the clinical significance of the protective effect of breastfeeding appears to be moderate at best. In a review of large studies focusing on older children and adolescents, when the protective effects of breastfeeding is most apparent, the odds of being overweight were only 21 to 34% lower in children who were breastfed as infants (15). This benefit could be due to an improved ability in breastfed children to self-regulate food intake, or it may be due to a difference in hormonal response between breast milk and formula. It is also possible that the higher protein content of formula affects lifelong glucose metabolism (6).

The small effect of breastfeeding found among non-Hispanic whites may be obliterated by other environmental factors that differ among racial/ethnic groups. The National Health and Nutrition Examination Survey of 2000 showed that at ages 2-5 years, there was no significant difference between the prevalence of overweight between non-Hispanic whites, non-Hispanic blacks, and Mexican Americans. This would suggest that children in this age bracket were either experiencing similar levels of physical activity and eating behavior, or that their heights and weights were not reflecting their environmental differences. After that time, the prevalence of obesity is much higher among non-Hispanic blacks and Mexican Americans than non-Hispanic whites. These differences are probably due to a difference in physical activity and eating behaviors (1).

## CONCLUSION

Breastfeeding has already been shown to improve infant health for a number of measures. Breastfed infants have fewer infections, lower rates of asthma, fewer gastrointestinal complaints, and higher IQs than bottle-fed infants (16). Despite that, the use of formula is very common. In a recent national survey, 24% of infants were never breastfed. About 80% of infants aged 4 to 5.9 months and 90% of older infants were fed formula on a daily basis (14). Although health care providers can add obesity prevention to the list of advantages of breast milk when encouraging women to breastfeed, a better way to prevent obesity in children and adults is to increase physical activity and reduce caloric intake (13).

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