

MOM ALERT: New Study Reveals Loss of Vitamins A, C and E in Some Baby Bottles During 20-Minute Simulated Feeding

A newly released study has revealed important information for moms to consider when they select a baby bottle for their infant. The study showed that after a 20-minute simulated bottle feeding, three important nutrients for infants – vitamins A, C and E – all declined during the course of the feedings. The most extreme result shows that in some cases there may be minimal amounts of vitamin C left after 20 minutes.

The study measured the level of loss of vitamins A, C and E during baby bottle feedings. The results suggest that the amount of air within a baby bottle, the bottle's design, and the impact on vitamin levels warrant closer examination. Details about the study can be found at www.nutrientstudy.com.

The results of the study, "Comparative Analysis of Retinol, Ascorbic Acid, and Alpha-Tocopherol in Baby Milk Using Varied Delivery Systems," were recently presented at the European Academy of Pediatrics Conference in Nice, France. The study was conducted by a group of researchers at the University of Nevada-Reno, led by Dr. Jimi Francis, an international board certified lactation consultant and researcher. The findings on vitamin C have been published in the *International Breastfeeding Journal* and were also presented at the 2008 International Lactation Consultant Association (ILCA) Annual Conference.

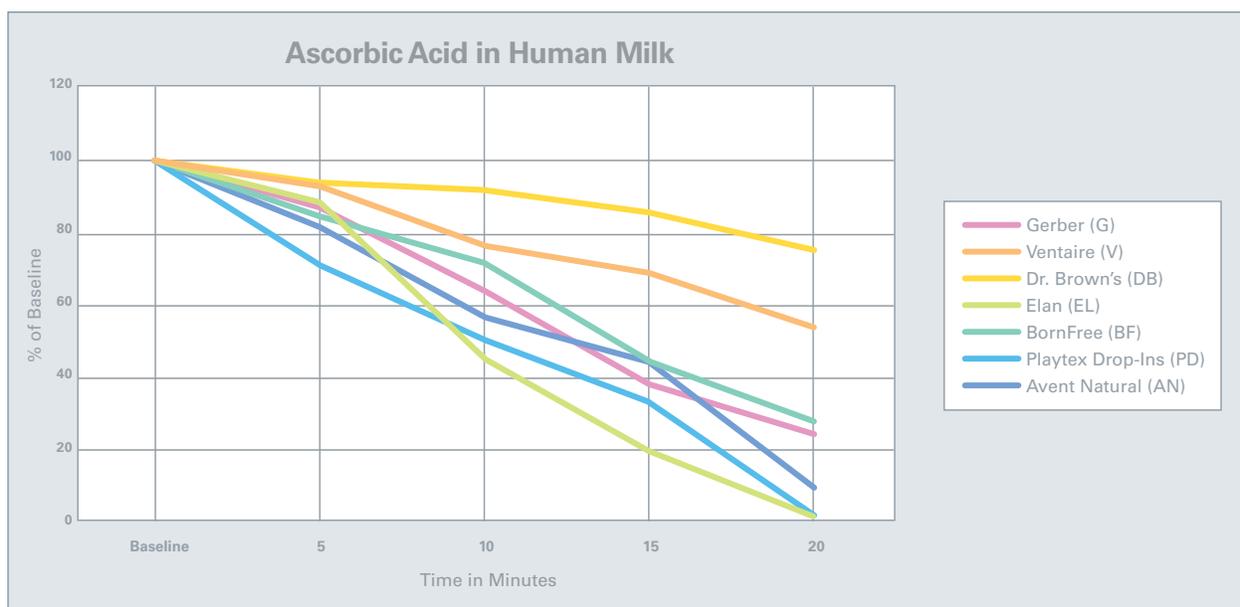
The bottle study was designed to investigate changes in nutrient levels that might occur during a typical bottle feeding time of 20 minutes, using both expressed human milk and infant formula, in both vented bottles and unvented bottles. The study looked at the amount of nutrients in the milk when delivered through seven commonly used baby bottles. The purpose was to determine if exposure to air within a baby bottle during a simulated feeding affected nutrient levels.

As milk is removed from the bottle by the infant, the milk is replaced by ambient air. Nutrient loss is likely caused by the oxidation of nutrients that takes place as air is introduced into the liquid. The amount of air moving through the milk and into the bottle depends on the bottle type, bottle shape, and bottle size.

"Handling and storage of breastmilk and formula can impact nutrient levels," Dr. Francis says. "The ability to maintain nutrients in bottle feeding appears to be influenced by bottle design." She adds that once vitamin C – which is known to be susceptible to oxidation – degrades to a certain point, vitamins A and E begin to decline as well. Importantly, degradation of nutrients during a feeding does not mean that the infant is getting insufficient nutrition over the course of a day, but rather that the vitamin levels are declining – in some cases quickly – during the duration of the feeding.

Mature human milk was donated by anonymous volunteers for the study. The milk was standardized for nutrient levels. In addition to studying effects on human milk, the study also examined two types of infant formula. The milks were delivered through seven different major brand baby bottles with five samples collected from each bottle: baseline, 5 minutes, 10 minutes, 15 minutes, and 20 minutes. Each sample was analyzed for nutrients using normal-phase high-performance liquid chromatography, and each collection was completed in triplicate to ensure the consistency of results.

The graph demonstrates the loss of vitamin C during a 20-minute simulated feeding. While vitamin C began to decline at 5 minutes as shown by this graph, vitamins A and E declined later. Vitamin C prevents oxidation of nutrients and as it is lost, other nutrients are more susceptible to damage. As an example based on the findings, a two-month old child, fed by bottle 10 times per day in 20-minute feedings, would take in approximately 13 mg of vitamin C with one bottle, and approximately 34 mg of vitamin C with a different bottle over a period of one day. The Food and Nutrition Board at the Institute of Medicine recommends a vitamin C intake of 40 mg per day, 3 mg of Vitamin E and 400 mcg of Vitamin A for infants aged up to six months old.



Changes in mean ascorbic acid concentration in human milk.

All three vitamins studied are important in infant health and growth. Medical research shows that children with low intakes of vitamin C are more vulnerable to developing frequent and more severe common day-to-day illnesses. Inadequate intake of vitamin E can lead to anemia and degeneration of the spine and brain. In infants, a low intake of vitamin A disrupts bone growth and interferes with the development of immature bone cells resulting in weak, poorly formed bones. Vitamin A is also needed to produce immune cells that are associated with increased resistance to infection.

The bottles used in the study were different from each other in the way that air is replaced in the bottle as milk is removed. Two bottles had removable screw-off bottoms with a diaphragm in the base of the bottle. One bottle had an insert inside the collar of the nipple. One bottle had a vent system that allows air moving into the bottle to bypass movement through the milk, with no bubbles forming as milk is removed. Those bottles observed to have more bubbles forming in the milk had lower levels of all three nutrients.

“Nutrition is an important area of study. Evaluating not only what we eat but how we eat can provide greater understanding of how to achieve optimal nutritional status. This is about looking at bottle design and other factors that can influence maintaining optimal nutrition levels of bottle-fed milk and formula,” Dr. Francis says. “With even a basic understanding of possible differences between bottles, moms are armed with useful information to help them make informed choices for their babies.”

Dr. Francis emphasized that there are many other factors, including length of time and manner of storage, which are thought to impact nutritional levels of key nutrients. She adds that additional research is needed to fully understand how nutrients in breastmilk and infant formula are affected by handling, storage, and the delivery through a bottle.

As more data becomes available, changes may need to be made regarding the protocols recommended for the handling of human milk with regard to preserving the integrity of specific nutrients.

Almost two-thirds of women in the United States work outside of the home, according to the U.S. Department of Labor. The changes in lifestyle and economic activities of lactating mothers have led to an increase in the expression of human milk for later use in infant feeding. While breastfeeding is consistently recommended as the best choice for feeding infants, many infants are fed with a bottle. The expression, handling, storage, and delivery of breastmilk or infant formula to infants through a bottle may diminish nutrient levels.

Recommendations for Moms

So what’s a mom to do? Dr. Francis offers the following tips:

- Select bottles that minimize air traveling through the bottle.
- Look for little to no bubbles forming in the milk as the baby feeds.
- Use breastmilk that is as fresh as possible.
- Use small bottles that minimize the amount of air at the top of the milk.
- When using infant formula, make it fresh for every feeding.
- Feed babies with small, frequent feedings.

Footnotes

- 1) The study did not examine whether the observed differences would have any effect on infant health, a complex subject that is beyond the scope of the study.
- 2) The study did not involve infants, nor did the researchers study any potential impact on vitamin A, C or E intake for infants.