Nutrition during Lactation: What do Mom and Baby Need?

Summary
Nutritional needs during lactation are unique and one of the highest demands for good nutrition during a women's life. Many breastfeeding moms are not meeting the optimal nutrient intakes for both mom and baby.

Scientist Biography

Christina Sherry is a Research Scientist working in the area of prenatal and pregnancy nutrition with a focus on nutritional early programming of later health outcomes. She is responsible for product support and innovation of Similac Mom, clinical studies involving breastfeeding as well as supporting innovations around early programming for the Similac brand. Christina received her undergraduate degree in dietetics from Bluffton University and her PhD in Nutritional Science from The University of Illinois at Urbana-Champaign. She has published in the area of nutritional regulation of the immune system. Prior to joining Abbott, Christina was a post-doctoral fellow at the University of Michigan.

Nathan Pratt is a doctoral student in Nutritional Sciences at the University of Illinois at Urbana-Champaign working as an intern with Abbott Nutrition. His work with Abbott has focused on studying the diets of lactating women to identify nutritional shortcomings that could affect infant or maternal health. He received his Bachelor's degree in biology from Illinois Wesleyan University and plans to receive his PhD at the end of 2014. On campus, he studies consumer behavior and nutrition education to understand the best methods of communicating nutrition information to successfully improve food choices, primarily with regard to weight management.

Why is nutrition so important during breastfeeding?

Lactation is one of the most complex and nutritionally demanding phases of the human life cycle. The breastfed infant is still dependent on the mother for nutrition while growing at a rate of 5 to 7 ounces per week. Muscle and nerve development are remarkable during this time, allowing the infant to quickly develop motor skills such as head control and grip. Cognitive development is also underway; the infant's senses begin to mature and the brain is developing to process these sensory inputs. By 3 months, an infant may be able to lift his head, track objects, and control his hands and feet. By 6 months, he has developed color vision, can sit without support, and is beginning the first steps of language development.[1]

All of these developmental processes require resources in the form of nutrition. Some nutrients perform regulatory roles while others are used as structural components of nerve cells or for biochemical pathways within the cell. To support optimal health for both the infant and the mother, it is important to understand how nutrient needs change during lactation and the consequences of inadequate intakes. In addition, it is critical to be familiar with typical dietary intakes of lactating mothers so that we can identify education needs and interventions to promote health.

Almost all nutrients have increased dietary requirements during lactation compared to pregnancy. The caloric expenditure of 9 months of lactation can exceed that of pregnancy by 98%.[2] Similarly, requirements of most vitamins and minerals increase to varying degrees (Table 1).[3] Some requirements only increase marginally, such as zinc or potassium, while others increase up to 69% in the case of vitamin A.

Nutrients affecting infant health

Breastmilk concentrations of some nutrients can be altered by changes in maternal intakes or nutrient stores. The main nutrients in this group include vitamins A, C, and D, the B vitamins, iodine, and choline.[4] With these nutrients, infants who are exclusively breastfed by mothers who have deficient intakes may be at risk of inadequacy. Milk is still produced when the mother is undernourished, but concentrations of certain nutrients may not be optimal or even sufficient for proper development under those conditions.

The adverse health outcomes associated with deficient intakes vary from nutrient to nutrient. In the case of vitamin D, breast milk concentrations remain inadequate even when mothers meet their dietary needs of vitamin D. This means that the infant is at a risk of developing rickets and, as a result, direct supplementation of vitamin D is recommended for all breastfed infants.[5] Deficient intakes of iodine can lead to abnormal brain development that is irreversible.[6] Breastmilk content of vitamin A, whose dietary needs increase greatly during lactation, has been shown to be 7 times higher in well-nourished women than undernourished women.[7] Low intakes can lead to the development of subclinical vitamin A deficiency in exclusively breastfed infants, which increases risk for infection and xerophthalmia in more severe cases.

Given the surge in brain and nerve development in early infancy, it is not surprising that DHA (docosahexaenoic acid, an omega 3 fatty acid) and lutein have become a focal point for neonatal nutrition research in recent years. DHA is a major component in the brain and may have an important role in cognitive development.[8] Lutein may be particularly important for developing infants. It is the main component found in the fovea, which is the part of the eye responsible for visual acuity and is under development in the first few months of life.[9] Breastmilk concentrations for both of these nutrients respond to maternal intake, allowing the mother's diet to influence the nutrition received by the breastfed infant.[10-12]

Nutrients affecting maternal health

Other nutrients have breastmilk concentrations which are not altered by nutrition status of mothers. These are primarily the nutrients associated with infant growth such as calcium, zinc, phosphorous, protein, and calories.[4] The mother's body will ensure there is a sufficient concentration of these nutrients in the milk at the expense of depleting maternal stores. As a result, inadequate intakes of nutrients in this group will lead to health effects in the mother rather than the infant. Potential health effects would be anemia for iron deficiency and a decrease in bone mineral density for calcium, increasing future risk for osteoporosis. Fortunately, we have good screening methods in the US for detecting effects of low iron and calcium levels. In addition, the requirements of calcium during lactation are the same as those of pregnancy and iron requirements are 67% lower (Table 1). However, these two conditions are already a public health concern for women in the United States prior to lactation, underlining the importance of ensuring adequate intake of these nutrients and proper monitoring.

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Should we be concerned?

Maternal intake during breastfeeding has the potential to significantly impact both infant and maternal health. How adequate is the typical diet of a breastfeeding mom in the US? This is an important question to understand to provide guidance on interventions and recommendations. Table 2 demonstrates that average intakes of 16 nutrients important during breastfeeding are below recommendations. Eight of those are actually less than half of recommendations.[13] Additionally, the majority of nutrients with low intakes are those which can affect the infant's health and development (green), including vitamin D, iodine, vitamin A, DHA, and lutein. Nutrients which may affect the mother's health (blue), on the other hand, have intakes relatively close to recommendations. These nutrients, whose breast milk content responds to maternal intake, have the highest public health concern; they generally have the lowest intakes as shown in Table 1, their health consequences are the most severe, and, most importantly, the consequences are preventable through diet changes.

What is the solution as a health care provider?

From a practical point of view, lactating women are consuming inadequate amounts of the foods that are a good source of the nutrients previously mentioned, primarily fruits, vegetables, dairy and fatty fish. Previous research has shown that vegetables, fruits, and dairy intakes are less than half of recommended amounts and can explain the low intake of nutrients found in those foods. Grains and protein, on the other hand, had intakes much closer to recommendations; therefore, nutrients mainly found in grains and protein foods such as vitamin B6, thiamin, folate, and iron had intakes that were close to 100%.[13] Previous public health campaigns that have shown to be effective include the combined awareness of increasing folic acid intake and food fortification which increased the median serum folate 173% from 1988-1999 in women of childbearing age.[14] Overall improvement of dietary intake and increasing consumption of fruit, vegetables and dairy may be a bit more challenging; however, one of the first steps is recognizing and understanding unique dietary needs of lactating women to target intervention.

Table 1. Differences in nutrient requirements during lactation compared to pregnancy

Nutrient	Change from pregnancy	Nutrient	Change from pregnancy
Calories	↑ ~100 kcal/day	Folate	↓ 17%
Carbohydrates	↑ 20%	Potassium	↑ 9%
Fiber	↑ 4%	Iodine	↑ 32%
Fluids	↑ 27%	Magnesium	↓ 11%
Vitamin A	↑ 69%	Zinc	↑ 9%
Vitamin C	↑ 41%	Selenium	↑ 17%
Iron	↓ 67%	Cooper	↑ 30%
Vitamin E	↑ 27%	Copper	↑ 30%
B vitamins	↑ 5–20%	Chromium	↑ 50%
Niacin	↓ 6%	Choline	↑ 22%

Green: increase in requirement compared to pregnancy
Red: decrease in requirement compared to pregnancy

Table 2. Lactating mothers' average intake of nutrients important for infant or maternal health

Nutrient	Intake as % recommendation	Common food sources
Chromium (mcg)	16*	Fruits, vegetables
Iodine (mcg)	21	Dairy, seafood, potatoes
Vitamin D (mcg)	24	Fortified dairy, eggs, fatty fish
DHA	30	Fatty fish
Vitamin E (α-tocopherol) (mg)	33	Oils, nuts
Lutein	42	Leafy greens
Choline (mg)	46*	Eggs, meat, green vegetables
Vitamin A (mcg RAE)	50	Dark green/orange vegetables, fortified dairy
Biotin (mcg)	53*	Egg, proteins
Vitamin C (mg)	67	Citrus fruits, vegetables
Pantothenic Acid (mg)	67*	Dairy, fruit, vegetable
Zinc (mg)	85	Proteins
Copper (mg)	85	Proteins
Calcium (mg)	89	Dairy, vegetables
Vitamin B6 (mg)	90	Meat
Folate (mcg DFE)	98	Leafy greens, fortified grains
Thiamin (mg)	107	Grains
Riboflavin (mg)	129	Dairy, proteins
Vitamin B12 (mcg)	150	Proteins
Iron (mg)	165	Proteins

Green nutrients are those whose concentrations in breast milk are affected by maternal intake.
Blue nutrients are those whose concentrations in breast milk are not altered by maternal nutrition status.
[a] Intake as percent of Recommended Daily Allowance (RDA). Percentage of Adequate Intake is shown for nutrients without an RDA (*).

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