

# Lactation

Baby is finally here and must be fed. Milk production is initiated by the loss of the placenta, which leads to a sharp decline in estrogen and progesterone levels. Prolactin and oxytocin are the two hormones central to lactation. Prolactin supports milk secretion while oxytocin, the release of which is stimulated by the suckling of the breast, promotes ejection of breast milk.

Lactation is also beneficial for mom; oxytocin release helps the uterus to return to its normal size. Lactation also suppresses menses through the inhibition of two hormones: LH and FSH thereby preventing another pregnancy and preventing maternal resources from being shared between the newborn and a new developing embryo.



For the newborn, breast milk is far superior to any other food or infant formula. Breast milk contains all the nutrients required for infant growth and development but also immune factors. Passive immunity mediated through the transfer of immune factors and probiotics from maternal breast milk protects the newborn from infections until the infant can mount an adequate immune response on his own. Nutrients in breast milk can be present in concentrations that exceed maternal blood levels - once again demonstrating that infant growth may take precedent over maternal requirements. For example, breast milk folate levels are five to 10 times the

maternal blood concentrations.<sup>181</sup> In addition, folate levels in women who nursed for more than 6 weeks are significantly lower than the levels seen in women who did not nurse<sup>182</sup>, suggesting maternal folate depletion during lactation. Vitamin B12 has a similar course, excretion through breast milk reaching 0.6 mcg/day.<sup>183</sup> It is therefore important to support the maternal nutritional requirements so that both mother and infant can meet their essential nutritional needs.

## Beneficial Nutrients during Lactation

### Choline

Choline requirements are increased during lactation because high concentrations of choline are present in breast milk.<sup>184</sup> Animal studies also show a greater risk of developing choline deficiency while lactating.<sup>185</sup> Furthermore, in rodents, adequate choline is essential soon after parturition, emphasizing the importance of adequate maternal choline consumption for breastfed infants.

### DHA

During lactation, fatty acid delivery to the infant may modify cellular membrane composition, especially in the nervous system, which in turn affects the function of neurons.<sup>186</sup> Long chain polyunsaturated fatty acids are supplied to the infant through breast milk. DHA intake levels in breast milk vary according to dietary intake. For instance, Inuit women eating large amounts of fish, often have breast milk DHA concentrations that are 10 times higher than in their European or North American counterparts.<sup>187</sup> Animal studies have demonstrated that raising the neonates DHA intake increases DHA levels in neurons, glial cells (cells with a supportive role in the nervous system) and in the retina.<sup>188</sup> Since infant formulas are typically lower in DHA than breast milk, formula-fed infants have lower blood and brain DHA levels.<sup>189</sup> This may explain why studies have shown that breast-fed infants have higher IQ's as early as six months after birth, with differences still present at 15 years of age<sup>190-191</sup>, and also why studies have shown that breast-fed infants have a better visual acuity prior to six months,<sup>192</sup> suggesting that the impact of DHA on visual development is moderate.<sup>193</sup>

An early study reported that infants receiving a formula with a high EPA oil concentration exhibited worse growth than infants receiving a formula without long chain polyunsaturated fatty acids (LCPUFA).<sup>194</sup>

These results however, were not reported in later studies, which used formulas that contained both omega-3 (DHA, EPA) and omega-6 (GLA, AA) fatty acids. High omega-3 intake, especially EPA, decreases arachidonic acid (AA) levels, also essential for normal growth and development. Further work in the area has revealed that supplementation of formula-fed preterm infants should include a balance of omega-3 to omega-6 fatty acids. Suggestions include DHA levels of approximately 0.4% and AA levels around 0.6% - such levels represent the lowest range of DHA levels found in human milk worldwide but greater amounts have not been evaluated.

DHA supplementation in nursing mothers increases breast milk DHA concentrations and the infants' blood DHA levels. However, DHA breast milk levels above 0.8% resulted in negligible increases in the infant blood DHA levels.<sup>195</sup> Furthermore, maternal supplementation with DHA did not affect breast milk AA or tocopherol levels.<sup>196</sup>

### Vitamin K levels are running Low

Transfer of vitamin K from mother to fetus is insignificant. Indeed, cord levels are extremely low and prophylactic vitamin K is administered intramuscularly to newborn infants to minimize the risk of deficiency and prevent hemorrhagic disease of the newborn. A condition which affects newborn infants which was recently renamed "vitamin K deficiency bleeding" and has an incidence of 2.5 to 17.0 per 1000 infants not receiving vitamin K at birth.<sup>197</sup> Vitamin K deficiency in newborn infants is common due to the limited transfer between mom and fetus in utero. Also, the fetal liver is incapable of producing sufficient clotting factors and the intestinal flora of newborns does not produce vitamin K<sup>2</sup><sup>198</sup> - a significant source of vitamin K in adults. Vitamin K deficiency is more common in breastfed infants because infant formulas contain higher concentrations of vitamin K than breast milk. However, research has established that maternal vitamin K supplementation significantly raises breast milk concentrations with 5 mg of vitamin K1 per day resulting in breast milk vitamin K levels that correspond to the levels seen in infant formulas.<sup>199</sup> More interestingly however, is the latest information showing that menatetrenone (a type of vitamin K<sup>2</sup>) concentrations are significantly higher in breast milk than they are in the maternal plasma. This means that menatetrenone is selectively concentrated in breast milk.<sup>200</sup> Nonetheless, the amounts of vitamin K present in breast milk are not

sufficient to compensate for the vitamin K given to newborns as a cautionary measure<sup>201</sup> but a Danish study has indicated that weekly oral supplementation of the newborn with vitamin K (without intramuscular vitamin K injection) was an effective measure against vitamin K deficiency bleeding.<sup>202</sup>

### Vitamin C in Breast Milk Influences Risk of Atopy

Although the word may not have meaning for them, atopy is the black sheep that all parents dread. With it come the frustrations of allergies, the fright of asthma, the annoyance of rhinitis and the irritation of dermatitis. Atopy is the hereditary and genetic predisposition to immediate allergic reactions, conditions for which the prevalence in Western countries continue to increase. However, genetic expression is influenced by nutritional and environmental factors.<sup>203</sup>

Case in point: vitamin C in breast milk. Vitamin C is one of the main antioxidants found in breast milk. Antioxidants are believed to be a significant factor in atopic diseases. Indeed, allergic reactions lead to inflammation and free radical production. Antioxidants are well known for their ability to curb both free radical production and the inflammatory response.<sup>204</sup> Furthermore, atopic diseases are characterized by the presence of an overabundance of free radicals and allergy sufferers seem to be consuming lesser amounts of antioxidants. Together, those observations motivated Finnish researchers to examine the subject more attentively.



Thirty-four mother and children pairs were selected. All mothers suffered from atopic diseases such as allergic rhinitis, dermatitis and asthma. The infant's progress was monitored throughout the first year of life and breast milk samples were analyzed at one month of age for their antioxidant content. All mothers underwent skin prick allergy testing, in which 68%

experienced positives. Dietary vitamin C intakes were significantly correlated with breast milk vitamin C content and the vitamin C content of breast milk did not differ between women with positive or negative skin prick tests. Although mothers with positive skin prick tests and food hypersensitivities were more likely to have atopic children, the increased presence of vitamin C in breast milk reduced the risk of atopy by an odds ratio of 0.3.<sup>205</sup>

**“Nothing you do for children is ever wasted”**

Garrison Keillor

Pregnancy is a time of high metabolic demands. Gestation is a crucial developmental period where inadequate supply of essential nutrients will negatively affect long-term health in the newborn and compromise maternal well-being. The health of the mother and child are dependant on the maternal nutritional status as is the quality of the breast milk. After all, pregnancy and lactation are developmental periods where mom is eating for two.

Pregnancy is characterized by rapid development – a growth spurt that will not be seen at any other time throughout the life span. Unfortunately, rapid growth is also accompanied by vulnerability. The swift pace at which organs and body systems emerge leaves the embryo in a precarious position. Major changes to the fetal environment may disrupt a valuable balance resulting in costly consequences and nutritional deficits also produce serious consequences: growth is altered by deficiencies. The consequences of inadequate nutrition during pregnancy, as illustrated by fetal programming, result in unrecoverable metabolic inadequacies and developmental irregularities. The research is clear; the potential associated with improved nutrition is at no time greater than throughout pregnancy. As folate, iodine and vitamin A saved countless from the complications of congenital malformations, mental deficits and blindness so will vitamin B12, choline and vitamin D in the future.

**Tomorrows are established today  
and at no time is this truer than  
during pregnancy**

# Get More Iron

**Iron deficiency  
affects 50-70% of  
women during  
pregnancy**

