Breast Milk and Food Allergy

Connections and Current Recommendations

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KEYWORDS

• Breast milk • Breast feed • Newborn immune system • Food allergy

KEY POINTS

- Breast milk has important effects on the developing newborn and infant immune and gastrointestinal systems.
- The role of breast milk in the development of an infant's immunoglobulin E response is uncertain.
- Whether maternal dietary antigens appear in breast milk is the subject of ongoing research.

INTRODUCTION

Breast milk, the most natural source of nutrition for babies, is recommended by the American Academy of Pediatrics (AAP), who in 2012 reaffirmed its recommendation of "exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant."[1] Breastfeeding rates are on the increase in the United States. In 2011, 79% of newborn infants started to breastfeed, 49% were breastfeeding at 6 months, and 27% at 12 months.[2] The incidence of food allergies is also on the increase: between 1997 and 2007, the incidence of food allergy increased by 18% in children younger than 18 years.[3] In 2011, 8% of children had food allergies.[4] Moreover, 29% of patients with food allergies also reported other atopic conditions such as asthma and eczema, compared with only 12% of children without

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food allergies.[3] The driving force, or forces, behind the increase in allergies is unknown, and the subject of wide discussions and research.

The objective of this article is to review the composition of human breast milk and its role in food allergy by exploring the nutrition and immunology of breast milk, including the effects of a mother's diet and contemporary means of storage of breast milk. The current literature on breast milk and food allergy is also reviewed.

THE PHYSIOLOGY OF BREAST MILK

Human breast milk is synthesized to match the developmentally appropriate nutritional needs of the baby. The processes and structures needed to create human milk begin when the woman herself is in her mother's womb. As reviewed by Creasy,[5] the milk streak is present at the fourth week of gestation, and the mammary gland is formed at the sixth week of gestation. Proliferation of milk ducts continues throughout embryogenesis, and breast buds are present at birth but, as maternal hormones diminish in the baby's circulation, the buds regress, growing proportionally to body growth until puberty.

Prepubertal changes in hormonal circulation induce the first phase of mammogenesis. Ductal growth is stimulated by estrogen production, which is generally unopposed in the first 1 to 2 years of menstrual cycles, creating type I lobules, which are alveolar buds clustered around a duct; upon cyclical changes in hormones, the types of lobules differentiate into type II lobules, which are more complex lobules that contain more alveoli.[6] This process continues throughout puberty, completing mature breast development.

The second phase of mammogenesis occurs when a woman becomes pregnant so that breast milk may be produced by lactocytes, which use 5 transport mechanisms to create breast milk (**Table 1**).[7] During the first half of pregnancy, lobules further differentiate into types III and IV, which have increased numbers of alveoli per lobule, thus establishing the milk-producing and milk-secreting framework.[6] During the second half of pregnancy, protein synthetic structures, such as the rough endoplasmic reticulum, mitochondria, and Golgi apparatus, begin to increase within the alveoli, and complex protein, milk fat, and lactose synthetic pathways are activated.[6] Regarding hormonal regulation, the initiation of human lactation involves (1) secretory differentiation, whereby mammary epithelial cells differentiate into lactocytes in the presence of progesterone, estrogen, and prolactin, and (2) secretory activation,

Table 1
Methods of transport within the mammary gland

Method of Transport	Transported Components
Exocytosis	Milk proteins Lactose Calcium Other components of the aqueous phase of milk
Lipid synthesis	Fat secretion with formation of cytoplasmic lipid droplets Secreted as a membrane-bound milk fat globule
Apical membrane transport	Monovalent ions Water Glucose
Transcytosis	Proteins such as immunoglobulins
Paracellular transport	Components of the interstitial space