



Human milk

Reference Books:

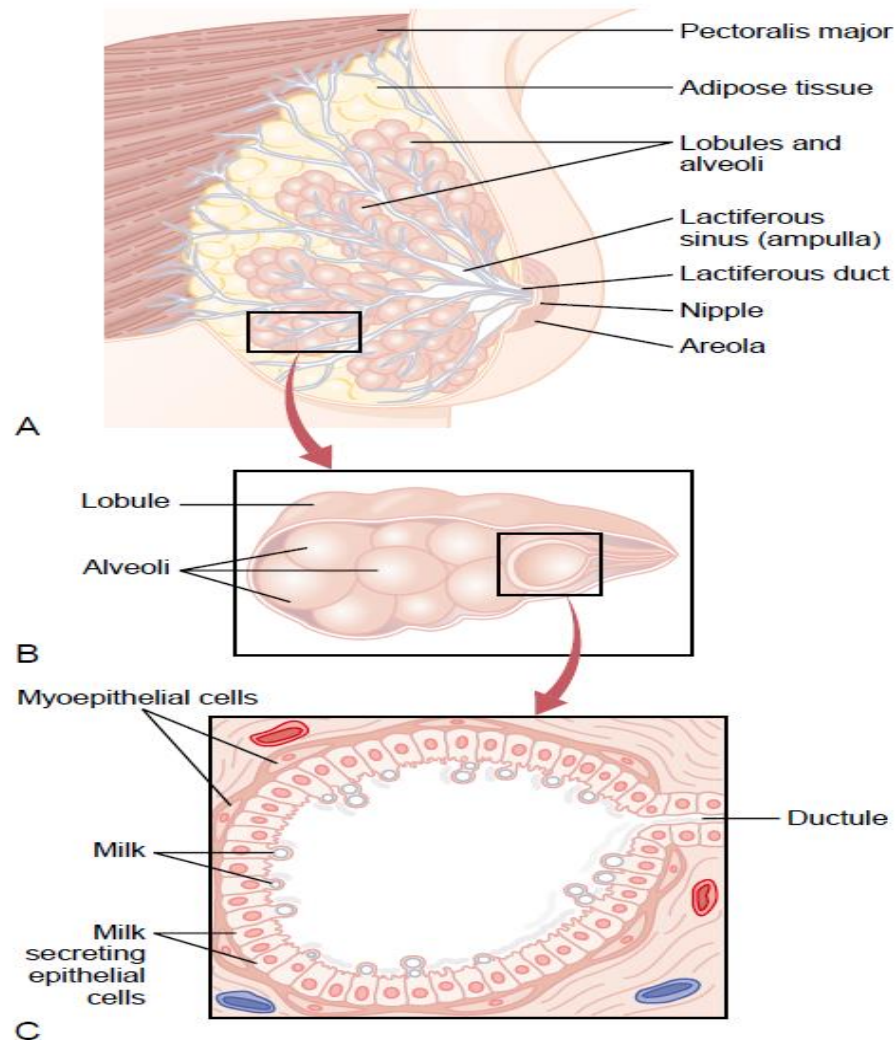
- **Text Book of Medical physiology** (Guyton and Hall)
Eleventh edition

Human milk

Human milk is the natural and superior food for infants containing the optimal composition to meet their nutritional needs in early life and providing associated immunological, psychological and economic advantages.

Breast feeding benefits

- Contains the most complete mixture of nutrients & antibodies.
- Fewer incidences of vomiting and diarrhea.
- Protection against gastroenteritis, infections, allergies and meningitis.
- Reduced risk of sudden infant death syndrome.
- Reduced risk of childhood diabetes and obesity.
- Breastfed improved brain and nervous system development.
- Reduced risk of heart disease later in life.
- Increased bone density and decreased tooth decay .
- Breastfed babies enjoy a special warm bonding and emotional relationship with their mothers.




The breast and its secretory lobules, alveoli, and lactiferous ducts (milk ducts) that constitute its mammary gland (A). *The enlargements show a lobule (B) and milk-secreting cells of an alveolus (C).*

Initiation of Lactation (Function of Prolactin)

- *Prolactin* promote milk secretion and secreted by the mother's anterior pituitary gland, and its concentration in her blood rises steadily from the fifth week of pregnancy until birth of the baby, at which time it has risen to 10 to 20 times the normal non pregnant level.
- The placenta secretes large quantities of *human chorionic somatomammotropin*, which probably has lactogenic properties, thus supporting the prolactin from the mother's pituitary during pregnancy.

- Because of the suppressive effects of estrogen and progesterone, no more than a few milliliters of fluid are secreted each day until after the baby is born. The fluid secreted during the last few days before and the first few days after parturition is called *colostrums*, it contains essentially the same concentrations of proteins and lactose as milk, but it has almost no fat, and its maximum rate of production is about 1/100 the subsequent rate of milk production.

- Immediately after the baby is born, the sudden loss of both estrogen and progesterone secretion from the placenta allows the lactogenic effect of prolactin from the mother's pituitary gland to assume its natural milk promoting role, and over the next 1 to 7 days, the breasts begin to secrete copious quantities of milk instead of colostrum. After birth of the baby, the basal level of prolactin secretion returns to the non pregnant level over the next few weeks. However, each time the mother nurses her baby, nervous signals from the nipples to the hypothalamus cause a 10- to 20-fold surge in prolactin secretion that lasts for about 1 hour.



This prolactin acts on the mother's breasts to keep the mammary glands secreting milk into the alveoli for the subsequent nursing periods. If this prolactin surge is absent or blocked as a result of hypothalamic or pituitary damage or if nursing does not continue, the breasts lose their ability to produce milk within 1 week or so. However, milk production can continue for several years if the child continues to suckle, although the rate of milk formation normally decreases considerably after 7 to 9 months.

Ejection (or “Let-Down”) Process in Milk Secretion-Function of Oxytocin

Milk is secreted continuously into the alveoli of the breasts, but milk does not flow easily from the alveoli into the ductal system and, therefore, does not continually leak from the breast nipples. Instead, the milk must be ejected from the alveoli into the ducts before the baby can obtain it. This is caused by a combined neurogenic and hormonal reflex that involves the posterior pituitary hormone oxytocin, as follows.

- When the baby suckles, it receives virtually no milk for the first half minute or so. Sensory impulses must first be transmitted through somatic nerves from the nipples to the mother's spinal cord and then to her hypothalamus, where they cause nerve signals that promote oxytocin secretion at the same time that they cause prolactin secretion.
- The oxytocin is carried in the blood to the breasts, where it causes **myoepithelial cells** (which surround the outer walls of the alveoli) to contract, thereby expressing the milk from the alveoli into the ducts at a pressure of +10 to 20 mm Hg. Then the baby's suckling becomes effective in removing the milk. Thus, within 30 seconds to 1 minute after a baby begins to suckle, milk begins to flow. This process is called milk ejection or milk let-down.

Milk Composition and the Metabolic Drain on the Mother Caused by Lactation

- At the height of lactation in the human mother, 1.5 liters of milk may be formed each day. With this degree of lactation, great quantities of metabolic substrates are drained from the mother. For instance, about 50 grams of fat enter the milk each day, and about 100 grams of lactose, which must be derived by conversion from the mother's glucose.

Composition of Milk

Constituent	Human Milk (%)
Water	88.5
Fat	3.3
Lactose	6.8
Casein	0.9
Lactalbumin and other proteins	0.4
Ash	0.2

Also, 2 to 3 grams of calcium phosphate may be lost each day; unless the mother is drinking large quantities of milk and has an adequate intake of vitamin D, the output of calcium and phosphate by the lactating mammae will often be much greater than the intake of these substances. To supply the needed calcium and phosphate, the parathyroid glands enlarge greatly, and the bones become progressively decalcified. The mother's bone decalcification is usually not a big problem during pregnancy, but it can become more important during lactation.

Antibodies and Other Anti-infectious Agents in Milk.

Not only does milk provide the newborn baby with needed nutrients, but it also provides important protection against infection. For instance, multiple types of antibodies and other anti-infectious agents are secreted in milk along with the nutrients. Also, several different types of white blood cells are secreted, including both *neutrophils* and *macrophages*, some of which are especially lethal to bacteria that could cause deadly infections in newborn babies. Particularly important are antibodies and macrophages that destroy *Escherichia coli* bacteria, which often cause lethal diarrhea in newborns.