LEARNING OBJECTIVES

• Describe current recommendations for infant feeding.
• Explain the nurse’s role in helping families to choose an infant feeding method.
• Describe nutritional needs of infants.
• Recognize newborn feeding-readiness cues.
• Discuss benefits of breastfeeding for infants, mothers, families, and society.
• Examine nursing interventions to facilitate and promote successful breastfeeding.
• Analyze common problems associated with breastfeeding and nursing interventions to help resolve them.
• Compare powdered, concentrated, and ready-to-use forms of commercial infant formula.
• Develop a teaching plan for the formula-feeding family.

KEY TERMS AND DEFINITIONS

colostrum  The fluid in the breast from pregnancy into the early postpartum period; rich in antibodies, which provide protection from many diseases; high in protein, which binds bilirubin; and laxative acting, which speeds the elimination of meconium and helps loosen mucus

demand feeding  Feeding a newborn when feeding cues are exhibited by the baby, indicating that hunger is present

ingurgement  Swelling of breast tissue brought about by an increase in blood and lymph supply to the breast, which precedes true lactation; lasts approximately 48 hours and usually reaches a peak between the third and fifth postbirth days

feeding-readiness cues  Infant responses (mouthing motions, sucking fist, awakening, and crying) that indicate optimal times to begin a feeding

growth spurts  Times of increased neonatal growth that usually occur at approximately 6 to 10 days, 6 weeks, 3 months, and 4 to 5 months; increased caloric needs necessitate more frequent feedings to increase the amount of milk produced

inverted nipples  Nipples invert rather than evert when stimulated; interferes with latch-on

lactogenesis  Beginning of milk production

latch-on  Attachment of the infant to the breast for feeding

let-down reflex  Release of milk caused by the contraction of the myoepithelial cells within the milk glands in response to oxytocin; also called milk ejection reflex (MER)

mastitis  Infection in a breast, usually confined to a milk duct, characterized by influenza-like symptoms and redness and tenderness in the affected breast

nipple confusion  Difficulty experienced by some infants in mastering breastfeeding after having been given a pacifier or bottle

plugged milk ducts  Milk ducts blocked by small curds of dried milk

rooting reflex  Normal response of the newborn to move toward whatever touches the area around the mouth and to attempt to suck; usually disappears by 3 to 4 months of age

supply-meets-demand system  Physiologic basis for determining milk production; the volume of milk produced equals the amount removed from the breast

lactation consultant  Health care professional who has specialized training in breastfeeding
ood nutrition in infancy fosters optimal growth and development. Infant feeding is more than the provision of nutrition; it is an opportunity for social, psychologic, and even educational interaction between parent and infant. It also can establish a basis for developing good eating habits that last a lifetime. Health supervision of infants requires knowledge of their nutritional needs.

Through preconception and prenatal education and counseling, nurses play an instrumental role in assisting parents with the selection of an infant feeding method, which ideally will be breastfeeding. Whether the parents choose to breastfeed or to give their infant artificial breast milk (formula), nurses provide support and ongoing education. Education of parents is necessarily based on current research findings and standards of practice.

This chapter focuses on meeting nutritional needs for normal growth and development from birth to age 6 months, with emphasis on the neonatal period, when feeding practices and patterns are being established. Both breastfeeding and formula feeding are addressed.

**Recommended Infant Nutrition**

The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding or human milk feeding for the first 6 months of life and that breastfeeding or human milk feeding continue as the sole source of milk for the next 6 months. During the second 6 months of life, appropriate complementary foods (solids) are added to the infant diet. If infants are weaned from breast milk before 12 months of age, they should receive iron-fortified infant formula, not cow’s milk (Gartner et al., 2005).

**Breastfeeding Rates**

Breastfeeding rates in the United States have risen steadily over the past decade, reaching record levels with 70.1% of mothers initiating breastfeeding in the hospital. When their babies are 6 months old, 33.2% of mothers are still breastfeeding (Abbott Laboratories, 2003). If breastfeeding rates continue to rise at their current rate, it is likely that the breastfeeding goals of Healthy People 2010 will be attained; the goals are for breastfeeding initiation rates to reach 75% and continuation rates at 6 months to reach 50% (U.S. Department of Health and Human Services, 2000).

Although breastfeeding rates have increased across all demographic groups, certain trends still remain. Women least likely to breastfeed typically are younger than 25 years of age, have a lower income, are African-American, are primiparas, have a high-school education or less, are employed full time outside the home, and participate in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (Abbott Laboratories, 2003; Ryan, Wenjun, & Acosta, 2002).

**Benefits of Breastfeeding**

Human milk is designed specifically for human infants and is nutritionally superior to any alternative. It is bacteriologically safe and always fresh. The nutrients in breast milk are ideally balanced and more easily absorbed than are those in formula. Breast milk changes over time to meet changing needs as infants grow. It contains growth factors that promote development of the brain and gastrointestinal (GI) system. Breast milk provides immune factors that fight illnesses and allergens within the maternal-infant environment (Gartner et al., 2005; Lawrence & Lawrence, 2005).

Numerous research studies have identified the beneficial effects of human milk for infants during the first year of life. Long-term epidemiologic studies have shown that these benefits do not cease when the infant is weaned, but instead extend into childhood and beyond. Breastfeeding has many advantages for mothers, for families, and for society in general. In discussing the benefits of breastfeeding with parents, it is critical that nurses and other health care professionals have a thorough understanding of these benefits from both a physiologic and a psychosocial perspective (Gartner et al., 2005; Lawrence & Lawrence, 2005). Benefits of breastfeeding are listed in Table 20-1.
Breastfeeding is a natural extension of pregnancy and childbirth; it is much more than simply a means of supplying nutrition for infants. Women most often breastfeed their babies because they are aware of the benefits to the infant. Many seek the unique bonding experience between mother and infant that is characteristic of breastfeeding. The support of the partner and family is a major factor in the mother’s decision to breastfeed and in her ability to do so successfully. Prenatal preparation ideally includes the father of the baby, giving him information about benefits of breastfeeding and how he can participate in infant care and nurturing (Pollock, Bustamante-Forest, & Giarrantano, 2002).

Parents who choose to formula-feed often make this decision without complete information and understanding of the benefits of breastfeeding and the potential hazards of formula feeding. Even women who are educated about the advantages of breastfeeding may still decide to formula-feed. Cultural beliefs, as well as myths and misconceptions about breastfeeding, influence women’s decision making. Many women see bottle-feeding as more convenient or less embarrassing than breastfeeding. Formula feeding is often viewed as a way to ensure that the father, other family members, and day-care providers can feed the baby. Some women lack confidence in their ability to produce breast milk of an adequate quantity or quality. Women who have had previous unsuccessful breastfeeding experiences may choose to formula feed subsequent infants. Breastfeeding is seen by some women as incompatible with an active social life, or they think that it will prevent them from going back to work. Modesty issues and societal barriers exist against breastfeeding in public. A major barrier for many women is the influence of family and friends. There are situations in which breastfeeding is contra-indicated. Newborns who have galactosemia should not be breastfed. Mothers with active tuberculosis or human immunodeficiency virus (HIV) infection and those who are positive for human T-cell lymphotropic virus type I or type II should not breastfeed. Breastfeeding is not recommended when mothers are receiving chemotherapy or radioactive isotopes (e.g., with diagnostic procedures). Maternal use of drugs of abuse (“street drugs”) is incompatible with breastfeeding (Gartner et al., 2005; Kline et al., 2003).

<table>
<thead>
<tr>
<th>BENEFITS FOR THE INFANT</th>
<th>BENEFITS FOR THE MOTHER</th>
<th>BENEFITS TO FAMILIES AND SOCIETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increased incidence and severity of infectious diseases: bacterial meningitis, bacteremia, diarrhea, respiratory infection, necrotizing enterocolitis, otitis media, urinary tract infection, late onset sepsis in preterm infants</td>
<td>• Decreased postpartum bleeding and more rapid uterine involution</td>
<td>• Convenient; ready to feed</td>
</tr>
<tr>
<td>• Decreased postneonatal infant mortality</td>
<td>• Reduced risk of breast cancer, uterine cancer, and ovarian cancer</td>
<td>• No bottles or other necessary equipment</td>
</tr>
<tr>
<td>• Decreased rates of SIDS</td>
<td>• Earlier return to pre-pregnancy weight</td>
<td>• Less expensive than infant formula</td>
</tr>
<tr>
<td>• Decreased incidence of type 1 and type 2 diabetes</td>
<td>• Decreased risk of postmenopausal osteoporosis</td>
<td>• Reduced annual health care costs</td>
</tr>
<tr>
<td>• Decreased incidence of lymphoma, leukemia, Hodgkin disease</td>
<td>• Unique bonding experience</td>
<td>• Less parental absence from work due to ill infant</td>
</tr>
<tr>
<td>• Reduced risk of obesity, and hypercholesterolemia</td>
<td>• Increases maternal role attainment</td>
<td>• Reduced environmental burden related to disposal of formula cans</td>
</tr>
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TABLE 20-1
Benefits of Breastfeeding

Breastfeeding: Engagement and Nipple Soreness

Mary was discharged from the birthing center at 48 hours postpartum with her newborn son, Matthew. He is now 4 days old, and she has brought him to the clinic for a follow-up visit. She states that her milk came in yesterday, and her breasts have been hard and painful ever since. It has been difficult to latch the baby on. She reports that breastfeeding is very painful and that her nipples are cracked and so sore she “can hardly stand to feed the baby.” Matthew has had only one wet diaper and no bowel movements in the last 24 hours. He is crying most of the time and never seems to settle down to sleep for very long. Mary states, “I am ready to give up on this breastfeeding thing and just switch to formula.”

1 Evidence—Is there sufficient evidence to draw conclusions about the feeding difficulties experienced by this mother and infant?
   a. Mary’s milk supply
   b. Mary’s sore nipples
   c. Matthew’s urinary output and bowel elimination pattern
   d. Mary’s commitment to breastfeeding

2 Assumptions—What assumptions can be made about the following issues?
   a. Mary’s milk supply
   b. Mary’s sore nipples
   c. Matthew’s urinary output and bowel elimination pattern
   d. Mary’s commitment to breastfeeding

3 What implications and priorities for nursing care can be identified at this time?

4 Does the evidence objectively support your conclusion?

5 Are there alternative perspectives to your conclusion?

The key to encouraging mothers to breastfeed is education, beginning as early as possible during pregnancy and even before pregnancy. Each encounter with an expectant mother is an opportunity to educate, dispel myths, clarify misinformation, and address personal concerns. It may be helpful to connect expectant mothers with women from similar backgrounds who are breastfeeding or have successfully breastfed. Peer counseling programs, such as those instituted by Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) programs, are beneficial.

For those women with limited access to health care, the postpartum period may provide the first opportunity for education about breastfeeding. Even women who have indicated the desire to bottle-feed may benefit from information about the differences in formula and breast milk for their infants. Offering these women the chance to try breastfeeding even before pregnancy gives them the opportunity to begin the breastfeeding journey by building confidence in their ability to breastfeed. Offering these women the chance to try breastfeeding even before pregnancy is beneficial.

Nipple Soreness

For very long. Mary states, “I am ready to give up on this breastfeeding thing and just switch to formula.” Matthew has had only one wet diaper and no bowel movements in the last 24 hours. He is crying most of the time and never seems to settle down to sleep for very long. Mary states, “I am ready to give up on this breastfeeding thing and just switch to formula.”

1 Evidence—Is there sufficient evidence to draw conclusions about the feeding difficulties experienced by this mother and infant?
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   b. Mary’s sore nipples
   c. Matthew’s urinary output and bowel elimination pattern
   d. Mary’s commitment to breastfeeding

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   a. Mary’s milk supply
   b. Mary’s sore nipples
   c. Matthew’s urinary output and bowel elimination pattern
   d. Mary’s commitment to breastfeeding

3 What implications and priorities for nursing care can be identified at this time?

4 Does the evidence objectively support your conclusion?

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Nipple Soreness

It is the responsibility of the nurse and other health care professionals to promote feelings of competence and confidence in the breastfeeding mother and to reinforce the unequaled contribution she is making toward the health and well-being of her infant. Evidence-based guidelines for supporting breastfeeding are available for use by health care professionals (Association of Women’s Health, Obstetric and Neonatal Nurses [AWHONN], 1998; International Lactation Consultant Association [ILCA], 1999) (Box 20-1).

Cultural Influences on Infant Feeding

Cultural beliefs and practices are significant influences on infant feeding methods. Although recognized cultural norms exist, one cannot assume that generalized observations about any cultural group hold true for all members of that group. Within the United States many regional and ethnic cultures are found. Dealing effectively with these groups requires that the nurse be knowledgeable about and sensitive to the cultural factors influencing infant feeding practices.

Persons who have immigrated to the United States from poorer countries often choose to formula-feed their infants because they believe it is a better, more “modern” method or because they want to adapt to U.S. culture and perceive that it is the custom to bottle-feed.

Among some cultural groups within the United States, breastfeeding rates have declined. As increasing numbers of families leave Native American reservations to reside in urban areas, the traditional practice of breastfeeding often shifts to formula feeding. The separation from female relatives who lend childbirth and lactation support may be a factor in the change in feeding practices (Houghton, 2001).

The onset of breastfeeding varies among cultures. Because of beliefs about the harmful nature of colostrum, there may be restrictions on breastfeeding for a period of days after birth; this is true for many cultures in Southern Asia, the Pacific Islands, and parts of sub-Saharan Africa (Holman &
Before the mother’s milk is deemed to be “in,” babies are fed prelacteal food (Lefeber & Voorhoeve, 1999). Other cultures begin breastfeeding immediately and offer the breast each time the infant cries. Cultural attitudes regarding modesty and breastfeeding are important considerations. Some cultures have specific beliefs and practices related to the mother’s intake of foods that foster milk production. Korean mothers often eat seaweed soup and rice to enhance milk production. Hmong women believe that boiled chicken, rice, and hot water are the only appropriate nourishments during the first postpartum month. The balance between energy forces, hot and cold, or yin and yang is integral to the diet of the lactating mother. Hispanics, Vietnamese, East Indians, and Arabs often use this belief in choosing foods. “Hot” foods are considered best for new mothers; this does not necessarily relate to the temperature or spiciness of foods. For example, chicken and broccoli are considered “hot,” whereas many fresh fruits and vegetables are considered “cold.” Families often bring desired foods into the health care setting.

### Fluids

The fluid requirement for normal infants is 100 to 140 ml of water per kilogram of body weight per 24 hours; however, during the first 24 hours after birth, most infants need only 60 to 80 ml/kg/24 hours (Kliegman, 2002). In general, neither breastfed nor formula-fed infants need to be fed water, not even those living in very hot climates. Breast milk contains 87% water, which easily meets fluid requirements. Feeding water to infants may only decrease caloric consumption at a time when infants are growing rapidly.

Infants have room for little fluctuation in fluid balance and should be monitored closely for fluid intake and water loss. Infants lose water through excretion of urine and insensibly through respiration. Under normal circumstances, infants are born with some fluid reserve, and some of the weight loss during the first few days is related to fluid loss. In some cases, however, infants do not have this fluid reserve, possibly because of inadequate maternal hydration during labor or birth.
UNIT SIX  THE NEWBORN

Energy
Infants require adequate caloric intake to provide energy for growth, digestion, physical activity, and maintenance of organ metabolic function. For the first 3 months, the infant needs 110 kcal/kg/day. From 3 months to 6 months, the requirement is 100 kcal/kg/day. This decreases slightly to 95 kcal/kg/day from 6 to 9 months and increases to 100 kcal/kg/day from 9 months to 1 year (AAP, 1998).

Human milk provides 67 kcal/100 ml or 20 kcal/oz; the greatest amount of energy is provided by the fat content of breast milk. Infant formulas are made to simulate the caloric content of human milk; standard formulas contain 20 kcal/oz, with differences in composition varying among brands.

During the first 3 months, formula-fed infants consume more energy than breastfed infants and therefore tend to grow more rapidly (Ziegler, Fomon, & Carlson, 2003).

Carbohydrate
The average daily intake of carbohydrates for infants is 10 to 30 g/kg. Because newborns have only small hepatic glycogen stores, carbohydrates should provide at least 40% to 50% of the total calories in the diet. Moreover, newborns may have a limited ability to carry out gluconeogenesis (the formation of glucose from amino acids and other substrates) and ketogenesis (the formation of ketone bodies from fat), the mechanisms that provide alternative sources of energy.

As the primary carbohydrate in human milk and cow’s milk formula, lactose is the most abundant carbohydrate in the diet of infants up to age 6 months. Lactose provides calories in an easily available form. Its slow breakdown and absorption also increase calcium absorption. Corn syrup solids or glucose polymers are added to infant formulas to supplement the lactose in the cow’s milk and thereby provide sufficient carbohydrates.

Oligosaccharides, another form of carbohydrates found in breast milk, are critical in the development of microflora in the intestinal tract of the newborn. These prebiotics promote an acidic environment in the intestines, preventing the growth of gram-negative and other pathogenic bacteria, thus increasing the infant’s resistance to GI illness (Uauy & Araya, 2004; Ziegler, Fomon, & Carlson, 2003).

Fat
The daily fat intake for infants should be approximately 5 to 7 g/kg/day. For infants to acquire adequate calories from human milk or formula, at least 15% of the calories provided must come from fat (triglycerides). This fat must therefore be easily digestible. The fat in human milk is easier to digest and absorb than that in cow’s milk because of the arrangement of the fatty acids on the glycerol molecule. Fat absorption also is related to the natural lipase activity present in human milk.

Cow’s milk is used in most infant formulas, but the milk fat is removed, and another fat source such as corn oil, which can be digested and absorbed by the infant, is added in its place. If whole milk or evaporated milk without added carbohydrate is fed to infants, the resulting fecal loss of fat (and therefore loss of energy) may be excessive because the milk moves through the infant’s intestines too quickly for adequate absorption to take place. This can lead to poor weight gain.

Human milk contains the essential fatty acids (EFAs), linoleic acid and linolenic acid, as well as the long chain polyunsaturated fatty acids arachidonic acid (ARA) and docosahexaenoic acid (DHA). Fatty acids are important in the development of cellular membranes and are particularly important in eye and brain development. Cow’s milk contains fewer of the EFAs and no polyunsaturated fatty acids. Most formula companies are now adding DHA and ARA to their products (Preedy, Grimble, & Watson, 2001).

Protein
The protein requirement per unit of body weight is greater in the newborn than at any other time of life. The recommended daily allowance (RDA) for protein during the first 6 months is 2.25 to 4g/kg.

The protein content of human milk, which is lower than that of unmodified cow’s milk, is ideal for the newborn. The primary protein in human milk is whey, mainly consisting of lactoalbumin, lactoferrin, secretory immunoglobulin A (IgA), and enzymes (e.g., lysozyme and lipase). The major protein in cow’s milk is casein, which is more difficult to digest. Lactoglobulins in cow’s milk are responsible for much of the cow’s milk protein intolerance that is widely recognized (Preedy, Grimble, & Watson, 2001).

Vitamins
Human milk contains all of the vitamins required for infant nutrition, with individual variations based on maternal diet and genetic differences. Vitamins are added to cow’s-milk formulas to resemble levels found in breast milk. Although cow’s milk contains adequate amounts of vitamin A and vitamin B complex, vitamin C (ascorbic acid), vitamin E, and vitamin D must be added. Infants of mothers who are strict vegans also should receive vitamin B12 supplements (Tershakovec & Stallings, 2002).

Human milk contains small amounts of vitamin D, and therefore it is recommended that breastfeeding infants receive 200 international units of oral vitamin D drops daily starting during the first 2 months and continuing until the infant is consuming at least 500 ml per day of vitamin D–fortified formula or milk. Vitamin K required for blood coagulation, is produced by intestinal bacteria. However, the gut is sterile at birth, and a few days are needed for intestinal flora to become established and produce vitamin K. To prevent hemorrhagic problems in the newborn, an injection of vitamin K is given at birth to all newborns, regardless of feeding method (Gartner et al., 2005).

Minerals
The mineral content of commercial infant formula is designed to reflect that of breast milk. Unmodified cow’s milk is much higher in mineral content than is human milk,
which also makes it unsuitable for infants during the first year of life. Minerals are typically highest in human milk during the first few days after birth and decrease slightly throughout lactation.

The ratio of calcium to phosphorus in human milk is 2:1, a proportion optimal for bone mineralization. Although cow’s milk is high in calcium, the calcium-to-phosphorus ratio is low, resulting in decreased calcium absorption. Consequently, young infants fed unmodified cow’s milk are at risk for hypocalcemia, seizures, and tetany. The calcium-to-phosphorus ratio in commercial infant formula is between that of human milk and cow’s milk.

Iron levels are low in all types of milk; however, iron from human milk is better absorbed (50%) than that from cow’s milk, iron-fortified formula, or infant cereals. Breastfed infants draw on iron reserves deposited in utero and benefit from the high lactose and vitamin C levels in human milk that facilitate iron absorption. The infant who is entirely breastfed normally maintains adequate hemoglobin levels for the first 6 months. After that time, iron-fortified cereals and other iron-rich foods are added to the diet. Infants who are weaned from the breast before 6 months of age and all formula-fed infants should receive an iron-fortified commercial infant formula until 12 months of age.

Fluoride levels in human milk and commercial formulas are low. This mineral, which is important in the prevention of dental caries, may cause spotting of the permanent teeth (fluorosis) in excess amounts. It is recommended that no fluoride supplements be given to infants under 6 months of age; from 6 months to 3 years, fluoride supplements are based on the concentration of fluoride in the water supply (Gartner et al., 2005).

**ANATOMY AND PHYSIOLOGY OF LACTATION**

**Breast Development**

Each female breast is composed of approximately 15 to 20 segments (lobes) embedded in fat and connective tissues and well supplied with blood vessels, lymphatic vessels, and nerves (Fig. 20-1). Within each lobe are alveoli, the milk-producing cells, surrounded by myoepithelial cells, which contract to send the milk forward into the ductules. Each ductule enlarges into lactiferous ducts and sinuses where milk collects just behind the nipple. Each nipple has 15 to 20 pores through which milk is transferred to the suckling infant.

The size of the breast is not an accurate indicator of its ability to produce milk. Although nearly every woman can lactate, a small number have insufficient mammary gland development to breastfeed their infants exclusively. Typically, these women experience few breast changes during puberty or early pregnancy. In some cases, women may still be able to breastfeed and offer supplemental nutrition to support optimal infant growth. Devices are available to allow mothers to offer supplements while the baby is nursing at the breast (Fig. 20-2).

Because of the effects of estrogen and progesterone during pregnancy, the lobular components of the breast enlarge while the ductal system proliferates and differentiates. The nipples become more erect, and pigmentation of the areola increases. Nipples and areola may enlarge. The breasts increase in size and sensitivity and exhibit more prominent veins. Around week 16 of gestation, the alveoli begin producing colostrum (early milk) in response to human placental lactogen.

**Lactogenesis**

After the mother gives birth, a precipitate decrease in estrogen and progesterone levels triggers the release of prolactin from the anterior pituitary gland. During pregnancy, prolactin prepares the breasts to secrete milk and, during lactation, to synthesize and secrete milk. Prolactin levels are highest during the first 10 days after birth, gradually declining over time, but remaining above baseline levels for the duration of lactation. Prolactin is produced in response to infant suckling and emptying of the breasts (lactating breasts are never completely empty; milk is constantly being produced by the alveoli) (Fig. 20-3, A). Milk production is a supply-mets-demand system; that is, as milk is removed from the breast, more is produced. Incomplete emptying of the breasts with feedings can lead to a decreased milk supply.

Oxytocin is the other hormone essential to lactation. As the nipple is stimulated by the suckling infant, the posterior pituitary is prompted by the hypothalamus to produce oxytocin. This hormone is responsible for the milk ejection reflex (MER), or let-down reflex (Fig. 20-3, B). The myoepithelial cells surrounding the alveoli respond to oxytocin by...
contracting and sending the milk forward through the ducts to the nipple. Many “let-downs” can occur with each feeding session. The MER can be triggered by thoughts, sights, sounds, or odors that the mother associates with her baby (or other babies), such as hearing the baby cry. Many women report a tingling “pins and needles” sensation in the breasts as let-down occurs, although some mothers can detect milk ejection only by observing the sucking and swallowing of the infant. Let-down also may occur during sexual activity, because oxytocin is released during orgasm.

Oxytocin is the same hormone that stimulates uterine contractions during labor. Consequently, the laboring woman can experience let-downs that may be evidenced by leakage of colostrum. This readies the breast for immediate feeding by the infant after birth. Oxytocin has the important function of contracting the mother’s uterus after birth to control postpartum bleeding and promote uterine involution. Thus mothers who breastfeed are at decreased risk for postpartum hemorrhage. These uterine contractions or “afterpains” that occur with breastfeeding can be painful during and after feeding for the first 3 to 5 days, particularly in multiparas.

Prolactin and oxytocin have been referred to as the “mothering hormones,” because they are known to affect the postpartum woman’s emotions, as well as her physical state. Many women report feeling thirsty or very relaxed during breastfeeding, probably as a result of these hormones.

The nipple-erection reflex is an important part of lactation. When the infant cries, suckles, or rubs against the breast, the nipple becomes erect. This assists in the propulsion of milk through the lactiferous sinuses to the nipple pores. Nipple sizes, shapes, and ability to become erect vary with individuals. Some women have flat or inverted nipples that do not become erect with stimulation. Babies are usu-
ally able to learn to breastfeed successfully with any nipple. It is important that these infants not be offered bottles or pacifiers until breastfeeding is well established.

**Uniqueness of Human Milk**

Human milk is a highly complex, species-specific fluid uniquely designed to meet the needs of the human infant. It is a dynamic substance whose composition changes to meet the changing nutritional and immunologic needs of the infant as growth and development ensue. Breast milk is specific to the needs of each newborn; for example, the milk of preterm mothers differs in composition from that of mothers who give birth at term.

**Human milk contains antimicrobial factors (antibodies) that provide some protection against a broad spectrum of bacterial, viral, and protozoan infections. Secretory IgA is the major antibody in human milk. Other factors in human milk that help protect against infection include lactoferrin, the bifidus factor, oligosaccharides, milk lipids, and milk leukocytes. Antiinflammatory agents, growth factors, hormones, and enzymes are found in human milk, many of which contribute to the maturation of the infant’s intestine. Immunomodulating agents found in human milk are instrumental in preventing disease after infancy (Table 20-3).**

Human milk composition and volumes vary according to the stage of lactation. In the lactogenesis stage I, beginning...
in pregnancy, the breasts prepare for milk production by producing colostrum. Colostrum, a clear yellowish fluid, is more concentrated than mature milk and is extremely rich in immunoglobulins. It has higher concentrations of protein and minerals but less fat than mature milk. The high protein level of colostrum facilitates binding of bilirubin, and the laxative action of colostrum promotes early passage of meconium. Colostrum gradually changes to mature milk; this is referred to as “the milk coming in” or as lactogenesis stage II. By day 3 to 5 after birth, most women have had this onset of copious milk secretion. Breast milk continues to change in composition for approximately 10 days, when the mature milk is established in stage III of lactogenesis (Lawrence & Lawrence, 2005).

Composition of mature milk changes during each feeding. As the infant nurses, the fat content of breast milk increases. Initially, a bluish-white foremilk is released that is part skim milk (about 35% of the volume). It provides primarily lactose, protein, and water-soluble vitamins. The hindmilk, or cream (about 5%), is usually let down 10 to 20 minutes into the feeding, although it may occur sooner. It contains the denser calories from fat necessary for ensuring optimal growth and contentment between feedings. Because of this changing composition of human milk during each feeding, it is important to breastfeed the infant long enough to supply a balanced feeding.

Milk production gradually increases as the baby grows. Babies have fairly predictable growth spurts (at about 10 days, 3 weeks, 6 weeks, 3 months, and 6 months), when more frequent feedings stimulate increased milk production. These growth spurts usually last 24 to 48 hours, and then the infants resume their usual feeding pattern.

CARE MANAGEMENT—THE BREASTFEEDING MOTHER AND INFANT

Effective management of the breastfeeding mother and infant requires that the caregivers be knowledgeable about the benefits of breastfeeding, as well as about basic anatomy and the physiology of breastfeeding, how to assist the mother with feeding, and interventions for common problems. Ongoing support of the mother enhances her self-confidence and promotes a satisfying and successful breastfeeding experience. Planning care for the breastfeeding couplet is based on thorough assessment of both the mother and infant.

Assessment and Nursing Diagnoses

Infant

Before the initiation of breastfeeding, the nurse must consider the following in preparing to assist the breastfeeding infant effectively:

- Maturity level: gestational age, term or preterm, birth weight (small for gestational age [SGA], large for gestational age [LGA])
- Labor and birth: length of labor, maternal medications (narcotics, magnesium sulfate [MgSO4]; type of birth: vaginal [with or without use of vacuum extraction or forceps] or cesarean; type of anesthesia)
- Birth trauma: fractured clavicle, bruising of face or head
- Maternal risk factors: diabetes, preeclampsia, infection, HIV, herpes, hepatitis B
- Congenital defects: left lip or palate, cardiac anomalies, Down syndrome, or other genetic anomalies
- Physical stability: vital signs within normal limits, unlabored respirations, bowel sounds present
- State of alertness: awake, sleepy, crying

Feeding readiness. Term neonates are born with reflexes that facilitate feeding: rooting, sucking, and swallowing. However, coordination of sucking, swallowing, and breathing in order to feed requires adaptation by the infant. Although the majority of newborns experience minimal hunger or thirst in the first hours after birth, they will waken when given the opportunity.

Physical assessment of the newborn reveals signs that the baby is physiologically ready to begin feeding:

- Vital signs within normal limits
- Unlabored respirations; nares patent; no cyanosis
- Active bowel sounds
- No abdominal distention

When newborns feel hunger, they usually cry vigorously until their needs are met. Some infants, however, will withdraw into sleep because of discomfort associated with hunger. Babies exhibit feeding-readiness cues that can be recognized by a knowledgeable caregiver. Instead of waiting to feed until the infant is crying in a distressed manner or withdrawing into sleep, it is better to begin a feeding when the baby exhibits some of these cues (even during light sleep):

- Hand-to-mouth or hand-to-hand movements
- Sucking motions
- Rooting reflex—infant moves toward whatever touches the area around the mouth and attempts to suck
- Mouthing

Babies normally consume small amounts of milk during the first 3 days of life. As the baby adjusts to extraterine life and the digestive tract is cleared of meconium, milk intake increases from 15 to 30 ml per feeding in the first 24 hours to 60 to 90 ml by the end of the first week.

At birth and for several months thereafter, all of the secretions of the infant’s digestive tract contain enzymes especially suited to the digestion of human milk. The ability to digest foods other than milk depends on the physiologic development of the infant. The capacities for salivary, gastric, pancreatic, and intestinal digestion increase with age, indicating that the natural time for introduction of solid foods may be around 6 months of age.

Babies are born with a tongue extrusion reflex that causes them to push out of the mouth anything placed on the tongue. This reflex disappears by 6 months—another indication of physiologic readiness for solids.
Early introduction of solids may make the infant more prone to food allergies. Regular feeding of solids can lead to decreased intake of breast milk or formula and may be associated with early cessation of breastfeeding.

The infant is assessed for latch-on (attachment of the infant to the breast for feeding), position, alignment, and sucking and swallowing by direct observation while breastfeeding. Behavior after feedings (contented, sleepy) is noted. Elimination patterns and the presence of jaundice; weight loss of less than 10%; and regaining of birth weight by age 10 to 14 days are important data.

Before breastfeeding is begun, the mother’s knowledge of breastfeeding, as well as her physical and psychologic readiness to breastfeed, are assessed. Factors to consider include previous experience with breastfeeding, cultural factors, feelings about breastfeeding, physical development of the breasts, physical limitations, time since giving birth, type of birth, complications, discomfort, energy level, and support.

During the time in the hospital, the nurse can help the mother to view each breastfeeding session as a “feeding lesson” or “practice session” that will foster maternal confidence and a satisfying breastfeeding experience for mother and baby. Nursing diagnoses for the breastfeeding woman include the following:

**Expected Outcomes of Care**

In planning care, the nurse discusses the desired outcomes with the parents. The expected outcomes include that the baby will do the following:

- Latch on and feed effectively at least eight times per day
- Gain weight appropriately
- Remain well hydrated (have six to eight wet diapers and at least three bowel movements every 24 hours after day 4)
- Sleep or seem contented between feedings
- Examples of expected outcomes for the mother include that she will do the following:
  - Report no nipple discomfort with breastfeeding
  - Express satisfaction with the breastfeeding experience
  - Consume a nutritionally balanced diet with appropriate caloric and fluid intake to support breastfeeding

**Plan of Care and Interventions**

Interventions are based on the expected outcomes and are influenced by the resources and time available to achieve the desired goals. In the early days after birth, interventions focus on helping the mother and the newborn initiate breastfeeding and achieve some degree of success and satisfaction before discharge from the hospital or birthing center. Interventions to promote successful breastfeeding include basics such as latch-on and positioning, signs of adequate feeding, and self-care measures such as prevention of engorgement. An important intervention is to provide the parents with a list of resources that they may contact after discharge from the hospital. Guidelines for Spanish-speaking patients are in the accompanying Guidelines/Guías box.

The ideal time to begin breastfeeding is immediately after birth. Newborns without complications should be allowed to remain in direct skin-to-skin contact with the mother until the baby is able to breastfeed for the first time (Gartner et al., 2005). Each mother should receive instruction, assistance, and support in positioning and latching on until she is able to do so independently (see Guidelines/Guías box).
Positioning

The four basic positions for breastfeeding are the football hold, cradle, modified cradle or across-the-lap, and side-lying position (Fig. 20-4). Initially it is advantageous to use the position that most easily facilitates latch-on while allowing maximal comfort for the mother. The football hold is often recommended for early feedings because the mother can easily see the baby’s mouth as she guides the infant onto the nipple. The football hold is usually preferred by mothers who gave birth by cesarean. The modified cradle or across-the-lap hold also works well for early feedings, especially with smaller babies. The side-lying position allows the mother to rest while breastfeeding and is often preferred by women with perineal pain and swelling. Cradling is the most common breastfeeding position for infants who have learned to latch on easily and feed effectively. Before discharge from the hospital, the nurse should assist the mother to try all of the positions so that she will feel confident in her ability to vary positions at home.

Whichever position is used, the mother should be comfortable. The infant is placed at the level of the breast, supported by pillows or folded blankets, turned completely on his or her side, and facing the mother so that the infant is “belly to belly,” with the arms “hugging” the breast. The baby’s mouth is directly in front of the nipple. It is important that the mother support the baby’s neck and shoulders with her hand and not push on the occiput. The baby’s body is held in correct alignment (ears, shoulders, and hips are in a straight line) during latch-on and feeding.

Latch-on

In preparation for latch-on, it may be helpful for the mother to manually express a few drops of colostrum or milk and spread it over the nipple. This lubricates the nipple and may entice the baby to open the mouth as the milk is tasted.

To facilitate latch-on, the mother supports her breast in one hand with the thumb on top and four fingers underneath at the back edge of the areola. The breast is compressed slightly, as one might compress a large sandwich in preparing to take a bite, so that an adequate amount of breast tissue is taken into the mouth with latch-on (Weissinger, 1998). Most mothers need to support the breast during feeding for at least the first days until the infant is adept at feeding.

With the baby held close to the breast with the mouth directly in front of the nipple, the mother tickles the baby’s lower lip with the tip of her nipple, stimulating the mouth to open. When the mouth is open wide and the tongue is down, the mother quickly pulls the baby onto the nipple (Fig. 20-5).

The amount of areola in the baby’s mouth with correct latch-on depends on the size of the baby’s mouth and the size of the areola and the nipple. In general, the baby’s mouth should cover the nipple and an areolar radius of approximately 2 to 3 cm all around the nipple.

When latched on correctly, the baby’s cheeks and chin are touching the breast (Fig. 20-6). Depressing the breast tissue around the baby’s nose is not necessary. If she is worried about the baby’s breathing, the mother can raise the baby’s hips slightly to change the angle of the baby’s head at the breast. The nurse should reassure the mother that if the baby cannot breathe, innate reflexes will prompt the baby to move the head and pull back to breathe.

When the baby is latched on correctly and sucking appropriately, (1) the mother reports a firm tugging sensation
on her nipples, but no pinching or pain; (2) the baby sucks with cheeks rounded, not dimpled; (3) the baby’s jaw glides smoothly with sucking; and (4) swallowing is audible. Sucking creates a vacuum in the intraoral cavity as the breast is compressed between the tongue and the palate. If the mother feels pinching or pain after the initial sucks or does not feel a strong tugging sensation on the nipple, the latch-on and positioning should be evaluated. Any time the signs of adequate latch-on and sucking are not present, the baby should be taken off the breast and latch-on attempted again. To prevent nipple trauma as the baby is taken off the breast, the mother is instructed to break the suction by inserting a finger in the side of the baby’s mouth between the gums and leaving it there until the nipple is completely out of the baby’s mouth (Fig. 20-7).

Milk ejection or let-down
As the baby begins sucking on the nipple, the let-down, or milk ejection, reflex is stimulated (see Fig. 20-3, B). The following signs indicate that let-down has occurred:

• The mother may feel a tingling sensation in the nipples, although many women never feel their milk let down.
• The baby’s suck changes from quick, shallow sucks to a slower, more drawing, sucking pattern.
• Swallowing is heard as the baby sucks.
• The mother feels uterine cramping and may have increased lochia during and after feedings.
• The mother feels relaxed, even sleepy, during feedings.
• The opposite breast may leak.

Frequency of feedings
Newborns need to breastfeed 8 to 12 times in a 24-hour period. Feeding patterns are variable because every baby is unique. Some infants will breastfeed every 2 to 3 hours
is more appropriate to go to the infant is feeding well and gaining weight adequately, it beginning of one feeding to the beginning of the next.) Once (Feeding frequency is determined by counting from the be-

3 hours during the day and at least every 4 hours at night. that they should awaken the baby to feed at least every

this often to feed. It is important that parents understand first 24 to 48 hours after birth, most babies do not awaken this often to feed. It is important that parents understand that they should awaken the baby to feed at least every 3 hours during the day and at least every 4 hours at night. (Feeding frequency is determined by counting from the be-
ginning of one feeding to the beginning of the next.) Once the infant is feeding well and gaining weight adequately, it is more appropriate to go to demand feeding, in which the infant determines the frequency of feedings. (With demand feeding, the infant should still receive at least eight feedings in 24 hours.) Parents should be cautioned about attempting to place newborn infants on strict feeding schedules.

Infants should be fed whenever they exhibit feeding cues. Crying is a late sign of hunger, and babies may become fran-
tic when they have to wait too long to feed. Some infants will go into a deep sleep when their hunger needs are not met. Keeping the baby close is the best way to observe and respond to infant feeding cues. Newborns should remain with moth-
ers during the recovery period after birth and room-in dur-
ing the hospital stay. At home, babies should be kept nearby so that parents can observe signs that the baby is ready to feed.

Duration of feedings

The average time for feeding is 30 to 40 minutes, or approximately 15 to 20 minutes per breast. Some moth-
ers do one-sided nursing, in which the baby nurses only one breast at each feeding. The first breast offered should be al-
ternated at each feeding to ensure that each breast receives equal stimulation and emptying. In reality, instructing moth-
ers to feed for a set number of minutes is inappropriate. Mothers can determine when a baby has finished a feeding:

Throughout a 24-hour period. Others may cluster-feed, breastfeeding every hour or so for three to five feedings and then sleeping for 3 to 4 hours between clusters. During the first 24 to 48 hours after birth, most babies do not awaken this often to feed. It is important that parents understand that they should awaken the baby to feed at least every 3 hours during the day and at least every 4 hours at night. (Feeding frequency is determined by counting from the beginning of one feeding to the beginning of the next.) Once the infant is feeding well and gaining weight adequately, it is more appropriate to go to demand feeding, in which the infant determines the frequency of feedings. (With demand feeding, the infant should still receive at least eight feedings in 24 hours.) Parents should be cautioned about attempting to place newborn infants on strict feeding schedules.

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ers to feed for a set number of minutes is inappropriate. Mothers can determine when a baby has finished a feeding:

the baby’s suck and swallow pattern has slowed, the breast is softened, and the baby appears content and may fall asleep or release the nipple.

If a baby seems to be feeding effectively and the urine out-
put is adequate but the weight gain is not satisfactory, the mother may be switching to the second breast too soon. The high-lactose, low-fat foremilk may cause the baby to have exp-
losive stools, gas pains, and intractable crying. Feeding on the first breast until it softens ensures that the baby will receive the hindmilk, which usually results in increased weight gain.

**Supplements, bottles, and pacifiers**

The AAP (2005) recommends that, unless a medical indi-
cation exists, no supplements should be given to breastfeed-
ing infants (Gartner et al., 2005). With sound breastfeeding knowledge and practice, supplements rarely are needed.

**Special considerations**

Sleepy baby. During the first few days of life, some babies need to be awakened for feedings. Parents are in-
structed to be alert for behavioral signs or feeding cues such
as rapid eye movements under the eyelids, sucking movements, or hand-to-mouth motions. When these signs are present, it is a good time to attempt breastfeeding. If the infant is awakened from a sound sleep, attempts at feeding are more likely to be unsuccessful. Unwrapping the baby, changing the diaper, sitting the baby upright, talking to the baby with variable pitch, gently massaging the baby’s chest or back, and stroking the palms or soles may bring the baby to an alert state (Box 20-2).

Fussy baby. Babies sometimes awaken from sleep crying frantically. Although they may be hungry, they cannot focus on feeding until they are calmed. The nurse can encourage parents to swaddle the baby, hold the baby close, talk soothingly, and allow the baby to suck on a clean finger until calm enough to latch on to the breast (Box 20-3).

Infant fussiness during feeding may be the result of birth injury such as bruising of the head or fractured clavicle. Changing the feeding position may alleviate this problem.

Infants who were suctioned extensively or intubated at birth may demonstrate an aversion to oral stimulation. The baby may scream and stiffen if anything approaches the mouth. Parents may need to spend time holding and cuddling the baby before attempting to breastfeed. An infant may become fussy and appear discontented when sucking if the nipple does not extend far enough into the mouth. The feeding may begin with well-organized sucks and swallows, but the infant soon begins to pull off the breast and cry. It may be helpful for the mother to support her breast throughout the feeding so that the nipple stays in the same position as the feeding proceeds and the breast softens.

Waking the Sleepy Newborn
- Lay the baby down and unwrap.
- Change the diaper.
- Hold the baby upright, turn from side to side.
- Talk to the baby.
- Gently, but firmly, massage the chest and back.
- Rub the baby’s hands and feet.
- Do baby “sit-ups.” Gently rock the baby from a lying to sitting position and back again until the eyes open.
- Adjust lighting up for stimulation or down to encourage the baby to open the eyes.
- Apply cool cloth to face.

Calming the Fussy Baby
- Swaddle the baby.
- Hold closely.
- Move or rock gently.
- Talk soothingly.
- Reduce environmental stimuli.
- Allow baby to suck on adult finger.
- Place baby skin-to-skin with mother.

### TABLE 20-4

<table>
<thead>
<tr>
<th>Drug</th>
<th>AAP Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen (Dacetril, Tylenol, Darvocet, Excedrin)</td>
<td>6</td>
</tr>
<tr>
<td>Alcohol (ethanol)</td>
<td>6</td>
</tr>
<tr>
<td>Aspirin (Bayer, Asacol, Bufferin, Excedrin, Fiorinal, Empirin)</td>
<td>5</td>
</tr>
<tr>
<td>Caffeine</td>
<td>6</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2</td>
</tr>
<tr>
<td>Codeine</td>
<td>6</td>
</tr>
<tr>
<td>Heroin</td>
<td>2</td>
</tr>
<tr>
<td>Ibuprofen (Advil, Naprin, Motrin)</td>
<td>6</td>
</tr>
<tr>
<td>Indomethacin (Indocin)</td>
<td>6</td>
</tr>
<tr>
<td>Ketorolac tromethamine (Toradal)</td>
<td>6</td>
</tr>
<tr>
<td>Marijuana</td>
<td>2</td>
</tr>
<tr>
<td>Medroxyprogesterone acetate</td>
<td>6</td>
</tr>
<tr>
<td>(Depo-Provera)</td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td>6</td>
</tr>
<tr>
<td>Morphine</td>
<td>6</td>
</tr>
<tr>
<td>Naproxen (Naproxyn, Anaprox, Naprosyn, Aleve)</td>
<td>6</td>
</tr>
<tr>
<td>Oxycodeone</td>
<td>Not rated</td>
</tr>
<tr>
<td>Phenobarbital (Luminal, Donnatal, Tedral)</td>
<td>6</td>
</tr>
<tr>
<td>Phenylalanine (Dillantin)</td>
<td>6</td>
</tr>
<tr>
<td>Propranolol</td>
<td>6</td>
</tr>
<tr>
<td>Thyroid and thyrroxine</td>
<td>6</td>
</tr>
<tr>
<td>Tolbutamide (Orinase)</td>
<td>6</td>
</tr>
</tbody>
</table>
| American Academy of Pediatrics (AAP) Committee on Drugs rated drugs that transfer into human milk. The ratings are as follows: 1. Drugs that are contraindicated during breastfeeding 2. Drugs of abuse that are contraindicated during breastfeeding 3. Radioactive compounds that require temporary cessation of breastfeeding 4. Drugs with unknown effects on breastfeeding but may be of concern 5. Drugs that have been associated with significant effects on some breastfeeding infants and should be given to breastfeeding mothers with caution 6. Maternal medication usually compatible with breastfeeding 7. Food and environmental agents that have an effect of breastfeeding

### BOX 20-2

Waking the Sleepy Newborn
- Lay the baby down and unwrap.
- Change the diaper.
- Hold the baby upright, turn from side to side.
- Talk to the baby.
- Gently, but firmly, massage the chest and back.
- Rub the baby’s hands and feet.
- Do baby “sit-ups.” Gently rock the baby from a lying to sitting position and back again until the eyes open.
- Adjust lighting up for stimulation or down to encourage the baby to open the eyes.
- Apply cool cloth to face.

### BOX 20-3

Calming the Fussy Baby
- Swaddle the baby.
- Hold closely.
- Move or rock gently.
- Talk soothingly.
- Reduce environmental stimuli.
- Allow baby to suck on adult finger.
- Place baby skin-to-skin with mother.
Slow weight gain. Newborn infants typically lose 5% to 10% of body weight before they begin to show weight gain. Weight loss of 7% in a breastfeeding infant during the first 3 days of life should be investigated (Lawrence & Lawrence, 2005). Thereafter they should begin to show a weight gain of 110 to 200 g/week or 20 to 28 g/day for the first 3 months. (Breastfed infants usually do not gain weight as quickly as formula-fed infants.) The infant who continues to lose weight after 5 days, who does not regain birth weight by 14 days, or whose weight is below the 10th percentile by 1 month should be evaluated and closely monitored by a health care provider.

Most often, slow weight gain is related to inadequate breastfeeding. Feedings may be short or infrequent, or the infant may be latching on incorrectly or sucking ineffectively or inefficiently. Other possibilities are illness or infection, malabsorption, or circumstances that increase the baby's energy needs such as congenital heart disease, cystic fibrosis, or simply being SGA.

Maternal factors may be the cause of slow weight gain. There may be a problem with inadequate emptying of the breasts, pain with feeding, or inappropriate timing of feedings. Inadequate glandular breast tissue or previous breast surgery may affect milk supply. Severe intrapartum or postpartum hemorhage, illness, or medications may decrease milk supply. Stress and fatigue also may negatively affect milk production.

Usually the solution to slow weight gain is to improve the feeding technique. Positioning and latch-on are evaluated, and adjustments made. It may help to add a feeding or two in a 24-hour period. If the problem is a sleepy baby, parents are taught waking techniques.

Using alternate breast massage during feedings may help increase the amount of milk going to the infant. With this technique, the mother massages her breast from the chest wall to the nipple whenever the baby has sucking pauses. Some think this technique also may increase the fat content of the milk, which aids in weight gain.

When babies are calorie deprived and need supplementation, expressed breast milk or formula can be given with a nursing supplementer (see Fig. 20-23), cup, syringe, or bottle. In most cases, supplementation is needed only for a short time until the baby gains weight and is feeding adequately. Some think this technique also may increase the fat content of the milk, which aids in weight gain.

Jaundice. Jaundice (hyperbilirubinemia) in the newborn is discussed in detail in Chapter 18. Physiologic jaundice usually occurs after age 24 hours and peaks by the third day. This has been referred to as early-onset jaundice or breastfeeding jaundice, which in the breastfed infant may be associated with insufficient feeding and infrequent stooling. Colostrum has a natural laxative effect and promotes early passage of meconium. Bilirubin is excreted from the body primarily through the intestines. Infrequent stooling allows bilirubin in the stool to be reabsorbed into the infant’s system, thus promoting hyperbilirubinemia. Infants who receive water or glucose water supplements are more likely to have hyperbilirubinemia, because only small amounts of bilirubin are excreted through the kidneys. Decreased caloric intake (less milk) is associated with decreased stooling and increased jaundice.

To prevent early-onset breastfeeding jaundice from occurring, babies should be breastfed frequently during the first several days of life. More frequent feedings are associated with lower bilirubin levels.

To treat early-onset jaundice, breastfeeding is evaluated in terms of frequency and length of feedings, positioning and latch-on, and the infant’s ability to empty the breast. Factors such as a sleepy or lethargic baby or breast engorgement may interfere with effective breastfeeding and should be corrected. If the infant’s intake of milk needs to be increased, a supplemental feeding device may be used to deliver additional breast milk or formula while the infant is nursing. Hyperbilirubinemia may reach levels that require treatment with phototherapy administered with a light or a fiberoptic blanket (see Chapter 19).

Late-onset jaundice or breast milk jaundice affects a few breastfed infants and develops in the second week of life, peaking at about age 10 days. Affected infants are typically thriving, gaining weight, and stooling normally; all pathologic causes of jaundice have been ruled out. It was once postulated that an enzyme in the milk of some mothers caused the bilirubin level to increase. It now appears that a factor in human milk increases the intestinal absorption of bilirubin. In most cases, no intervention is necessary, although some experts recommend temporary interruption of breastfeeding for 12 to 24 hours to allow bilirubin levels to decrease. During this time, the mother pumps her breasts, and the baby is offered alternative nutrition, usually formula (Lawrence & Lawrence, 2005).

Preterm infants. Human milk is the ideal food for preterm infants, with benefits that are unique and in addition to those received by term, healthy infants. Breast milk enhances retinal maturation in the preterm infant and improves neurocognitive outcome. It also decreases the risk of necrotizing enterocolitis. Greater physiologic stability occurs with breastfeeding as compared with bottle feeding (Lawrence & Lawrence, 2005).

Depending on gestational age and physical condition, many preterm infants are capable of breastfeeding for at least some feedings each day. Mothers of preterm infants who are not able to breastfeed their infants should begin pumping their breasts as soon as possible after birth with a hospital-grade electric pump (Fig. 20-4). To establish an optimal milk supply, the mother should use a dual collection kit and pump 8 to 10 times daily for 10 to 15 minutes and/or until the milk flow has ceased for a few minutes. These women are taught proper handling and storage of breast milk to
minimize bacterial contamination and growth (Riordan, 2005).

The mothers of preterm infants often receive specific emotional benefits in breastfeeding or providing breast milk for their babies. They find rewards in knowing they can provide the healthiest nutrition for the infant and believe that breastfeeding enhances feelings of closeness to the infant.

**Breastfeeding multiple infants.** Breastfeeding is especially beneficial to twins, triplets, and other higher-order multiples because of the immunologic and nutritional advantages, as well as the opportunity for the mother to interact with each baby frequently. Most mothers are capable of producing an adequate milk supply for multiple infants. Parenting multiples may be overwhelming, and mothers, as well as fathers, need extra support and assistance learning how to manage feedings (Fig. 20-9).

**Expressing breast milk**

In some situations, expression of breast milk is necessary or desirable, such as when engorgement occurs, the mother and baby are separated (e.g., preterm or sick infants), the mother is employed outside the home and needs to maintain her milk supply, the nipples are severely sore or damaged, or the mother is leaving the infant with a caregiver and will not be present for feeding.

Because pumping and hand expression are rarely as efficient as a baby in removing milk from the breast, the milk supply should never be judged based on the volume expressed.

**Hand expression.** After her hands are thoroughly washed, the mother places one hand on her breast at the edge of the areola. With her thumb above and fingers below, she presses in toward her chest wall and gently compresses the breast while rolling her thumb and fingers forward toward the nipple. These motions are repeated rhythmically until the milk begins to flow. The mother simply maintains steady, light pressure while the milk is flowing easily. The thumb and fingers should not pinch the breast or slip down to the nipple, and the mother should rotate her hand to reach all sections of the breast.

**Pumping.** For most women, it is advisable to initiate pumping only after the milk supply is well established and the infant is latching on and breastfeeding well. However, when breastfeeding is delayed after birth, pumping is started as soon as possible and continued regularly until the infant is able to breastfeed effectively.

Numerous ways exist to approach pumping. Some women pump on awakening in the morning, or when the baby has fed but did not completely empty the breast. Others choose to pump after feedings or may pump one breast while the baby is feeding from the other. Double pumping (pumping both breasts at the same time) saves time and may stimulate the milk supply more effectively than single pumping (Fig. 20-10).

The amount of milk obtained when pumping depends on the type of pump being used, the time of day, how long it has been since the baby breastfed, the mother’s milk supply, how practiced she is at pumping, and her comfort level (pumping is uncomfortable for some women). Breast milk may vary in color and consistency, depending on the time of day, the age of the baby, and foods the mother has eaten.
Types of pumps. Many types of breast pumps are available, varying in price and effectiveness. Before purchasing or renting a breast pump, the mother would benefit from counseling by a nurse or lactation consultant to determine which pump best suits her needs.

Manual or hand pumps are least expensive and may be the most appropriate where portability and quietness of operation are important. These are most often used by mothers who are pumping for an occasional bottle (Fig. 20-11).

Electric, self-cycling double pumps are efficient and easy to use. These pumps were designed for working mothers. Some of these pumps come with carry bags containing coolers to store pumped milk.

Manual or hand pumps are least expensive and may be the most appropriate where portability and quietness of operation are important. These are most often used by mothers who are pumping for an occasional bottle (Fig. 20-11).

Full-service electric pumps, or hospital-grade pumps (see Fig. 20-8) most closely duplicate the sucking action and pressure of the breastfeeding infant. When breastfeeding is delayed after birth (e.g., preterm or ill newborn), or when mother and baby are separated for lengthy periods, these pumps are most appropriate. Because hospital-grade breast pumps are very heavy and expensive, portable versions of these pumps can be rented for home use.

Electric, self-cycling double pumps are efficient and easy to use. These pumps were designed for working mothers. Some of these pumps come with carry bags containing coolers to store pumped milk.

Smaller electric or battery-operated pumps also are available. Some have automatic suck/release cycling, and others require use of a finger to regulate strength and speed of suction. These are typically used when pumping is done occasionally, but some models are satisfactory for working mothers or others who pump on a regular basis.

Storage of breast milk. Breast milk can be safely stored in any clean glass or plastic container. Plastic bags especially designed for freezing breast milk can be purchased.

For full-term, healthy infants, freshly expressed breast milk can be stored at room temperature for up to 8 hours and can be refrigerated safely for 5 days. Milk can be frozen for 3 to 6 months in the freezer section of a refrigerator with a separate door, and for 6 to 12 months in a deep freeze (0° C). When breast milk is stored, the container should be dated, and the oldest milk should be used first (Eglash, Chantry, & Howard, 2004).

Frozen milk is thawed by placing the container in the refrigerator for gradual thawing or in warm water for faster thawing. It cannot be refrozen and should be used within 24 hours. After thawing, the container should be shaken to mix the layers that have separated (Patient Instructions for Self-Care box).

Frozen milk is never thawed or heated in a microwave oven. Microwaving does not heat evenly and can cause encapsulated boiling bubbles to form in the center of the liquid. This may not be detected when drops of milk are checked for temperature. Babies have sustained severe burns to the mouth, throat, and upper GI tract as a result of microwaved milk (Lawrence & Lawrence, 2005).

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**Being away from the baby**

Many women are able to combine breastfeeding successfully with employment, attending school, or other commitments. If feedings are missed, the milk supply may be affected. Some women’s bodies adjust the milk supply to the times she is with the baby for feedings, whereas other women find they must pump or the supply diminishes quickly. Employers are becoming increasingly more aware of the importance of supporting breastfeeding mothers who return to work; some businesses provide rooms where mothers can nurse their infants or use breast pumps (see Fig. 1-4 on p. 6).

**Weaning**

Weaning is initiated when babies are introduced to foods other than breastmilk and concludes with the last breastfeeding. Gradual weaning, over a period of weeks or months, is easier for mothers and infants. Abrupt weaning is likely to be distressing for both mother and baby, as well as physically uncomfortable for the mother.

With infant-led weaning the infant moves at his or her own pace in omitting feedings. This usually facilitates a gradual decrease in the mother’s milk supply.

Mother-led weaning means that the mother decides which feedings to drop. This is most easily done by omitting the feeding of least interest to the baby or the one the infant is most likely to sleep through. Every few days thereafter, another feeding is dropped, and so on, until the infant is gradually weaned from the breast.

Infants can be weaned directly from the breast to a cup. Bottles are usually offered to infants younger than 6 months. If the infant is weaned before age 1 year, formula should be fed to the infant instead of cow’s milk.

If abrupt weaning is necessary, breast engorgement often occurs. The mother is instructed to take mild analgesia, wear a supportive bra, apply ice packs or cabbage leaves to the breasts, and pump small amounts if needed to increase comfort. It is best to avoid pumping because the breasts should remain full enough to promote a decrease in the milk supply.

Weaning can be a very emotional time for mothers. Many women feel that weaning is the end to a special, satisfying relationship with the infant and benefit from time to adapt to the changes. Sudden weaning may evoke feelings of guilt and disappointment; some women go through a grieving period after weaning. The nurse can assist the mother by discussing other ways to continue this nurturing relationship.

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**Milk banking**

For those infants who cannot be breastfed but who also cannot survive except on human milk, banked donor milk is critically important. Because of the antimicrobial and growth-promoting properties of human milk, as well as its superior nutrition, donor milk is used in many neonatal intensive care units for preterm or sick infants when the mother’s own milk is not available. Donor milk also is used therapeutically for a variety of medical conditions, such as in transplant recipients who are immunocompromised.

The Human Milk Banking Association of North America (HMBANA) has established annually reviewed guidelines for the operation of donor human milk banks. Donor milk banks collect, screen, process, and distribute the milk donated by breastfeeding mothers who are feeding their own infants and pumping a few ounces extra each day for the milk bank. All donors are screened both by interview and serologically for communicable diseases. Donor milk is stored frozen until it is heat processed to kill potential pathogens; then it is refrozen for storage until it is dispensed for use. The heat processing adds a level of protection for the recipient that is not possible with any other donor tissue or organ. Banked milk is dispensed only by prescription. A per-ounce fee is charged by the bank to pay for the processing costs, but the HMBANA guidelines prohibit payment to donors (see the Resource list at the end of this chapter).

**Diet.** The breastfeeding mother should eat a healthy, well-balanced diet that includes an extra 200 to 500 calories per day. Prenatal vitamins are continued throughout breastfeeding. Fluid intake of at least 2 to 3 quarts per day is recommended.

There are no specific foods for the mother to avoid while breastfeeding. In most cases, the mother can consume a normal diet, according to her personal preferences and cultural practices.

**Rest.** It is important for the breastfeeding mother to rest as much as possible, especially in the first 1 or 2 weeks after birth. Fatigue, stress, and worry can negatively affect milk production and let-down. The nurse can encourage the mother to sleep when the baby sleeps. Breastfeeding in a side-lying position promotes rest for the mother. Assistance with household chores and caring for other children can be done by the father, grandparents or other relatives, and friends.

**Breast care.** The breastfeeding mother’s normal routine bathing is all that is necessary to keep her breasts clean. Soap can have a drying effect on nipples, so she should be instructed to avoid washing the nipples with soap.

Breast creams should not be used routinely because they may block the natural oil secreted by the Montgomery glands on the areola. Some breast creams contain alcohol, which may dry the nipples. Vitamin E oil or cream is not recommended for use on nipples because it is a fat-soluble vitamin, and a breastfeeding infant might consume enough vitamin E from the nipple to reach toxic levels. In addition, some people are allergic to vitamin E oil.

Modified lanolin with reduced allergens can be used safely on dry or sore nipples. Lanolin is beneficial in moist wound healing of sore nipples. Because lanolin is made from wool, the nurse should ask the mother if she is allergic to wool before applying the lanolin.
The mother with flat or inverted nipples will likely benefit from wearing breast shells in her bra. These hard plastic devices exert mild pressure around the base of the nipple to encourage nipple eversion. It is advisable for women with flat or inverted nipples to begin wearing breast shells during the last month of pregnancy. Breast shells also are useful for sore nipples to keep the mother’s bra or clothing from touching the nipples (Fig. 20-12).

If a mother needs breast support, she will likely be uncomfortable unless she wears a bra, because the ligament that supports the breast (Cooper’s ligament) will otherwise stretch and be painful. Bras should fit well and provide nonbinding support.

If leakage of milk between feedings is a problem, breast pads (disposable or washable) may be worn inside the bra. Plastic-lined breast pads are not recommended because they trap moisture and may contribute to sore nipples.

**Sexual sensations.** Some women experience rhythmic uterine contractions during breastfeeding. Such sensations are not unusual because uterine contractions and milk ejection are both triggered by oxytocin. Occasionally, these sensations are not unusual because uterine contractions and milk ejection are both triggered by oxytocin. Occasionally, these sensations are not unusual because uterine contractions and milk ejection are both triggered by oxytocin. Occasionally, these sensations are not unusual because uterine contractions and milk ejection are both triggered by oxytocin.

**Breastfeeding during pregnancy.** It is possible for a breastfeeding woman to conceive and continue breastfeeding throughout the pregnancy if there are no medical contraindications (e.g., risk of preterm labor). When the baby is born, colostrum is produced. The practice of breastfeeding a newborn and an older child is called tandem nursing. The nurse should remind the mother always to feed the infant first to ensure that the newborn is receiving adequate nutrition. The supply-meets-demand principle works in this situation, just as with breastfeeding multiples.

**Medications and breastfeeding.** Although there is much concern about the compatibility of drugs and breastfeeding, few drugs are absolutely contraindicated during lactation (see Box 20-4). In evaluating the safety of a specific medication during breastfeeding, the health care provider considers the pharmacokinetics of the drug in the maternal system, as well as the absorption, metabolism, distribution, storage, and excretion in the infant. The gestational and chronologic age of the infant, body weight, and breast-feeding pattern also are considered. Breastfeeding mothers should be cautioned about taking any medications except those that are deemed essential; they should be advised to check with their physician before taking any medication. If a breastfeeding mother is taking a medication that has questionable effect on the infant, she can be advised to take the medication just after nursing the baby or just before the infant is expected to sleep for a long time. References are available with specific information about medications and breastfeeding (Hale, 2004; Hale & Berens, 2002; Ward, Bates, Benitz, Burchfield, Ring et al., 2001).

Alcohol consumed by the breastfeeding mother is transferred to the infant in significant amounts, although it is not deemed harmful if the amount and duration are limited (Hale, 2004). If a mother chooses to consume alcohol, she should be advised to minimize its effects by having only an occasional drink, and not to breastfeed for two hours after the drink. The mother who is pumping for a sick or preterm infant should avoid alcohol entirely until her infant is healthy (Lawrence & Lawrence, 2005).

Women who smoke are less likely to breastfeed than nonsmokers; smokers who choose to breastfeed tend to do so for shorter durations than nonsmokers (Amir & Donath, 2003). Nicotine is transferred to the infant in breast milk, whether the mother smokes or uses a nicotine patch, although the effect on the infant is uncertain. Exposing the infant to second-hand smoke is of concern, and breastfeeding mothers are encouraged to stop smoking. Mothers who smoke should be advised to limit smoking, to smoke after feeding the infant, and to consider switching to the nicotine patch (Hale, 2004).

Maternal intake of caffeine may cause infant irritability and poor sleeping patterns. For most women, two servings of caffeine a day does not cause untoward effects; however, some infants are sensitive to even small amounts of caffeine. Mothers of such infants should limit caffeine intake. Caffeine is found in coffee, tea, chocolate, and many soft drinks.

Herbs and herbal teas are becoming more widely used during lactation. Although some are considered safe, others contain pharmacologically active compounds that may have detrimental effects. A thorough maternal history should include the use of any herbal remedies. Each remedy should then be evaluated for its compatibility with breastfeeding. The regional poison control center may provide information on the active properties of herbs.

**Environmental contaminants.** Except under unusual circumstances, breastfeeding is not contraindicated because of exposure to environmental contaminants such as DDT (an insecticide) and trichloroethylene (used in dry cleaning plants) (Lawrence & Lawrence, 2005).

**Common problems of the breastfeeding mother**

**Engorgement.** Engorgement, characterized by painful overfilling of the breasts, can occur as a result of infrequent or ineffective emptying of the breasts. It typically
occurs 3 to 5 days after birth when the milk “comes in” and lasts about 24 hours. There is vascular congestion and increased vascularity, accumulation of milk in the breast tissue, and edema related to swelling and obstruction of lymphatic drainage (Mass, 2004). The breasts are firm, tender, and hot and may appear shiny and taut. The areole are firm, and the nipples may flatten. The unyielding areolae make it difficult for the infant to latch on. Because back pressure on full milk glands inhibits milk production, if milk is not removed from the breasts, the milk supply may diminish.

Breastfeeding the baby frequently, at least every 2 to 3 hours, as the milk is coming in may help prevent engorgement. The baby should be encouraged to feed at least 15 to 20 minutes on each breast or until one breast softens per feeding.

When engorgement occurs, the mother is instructed to feed every 2 hours, massaging the breasts as the baby is feeding. The baby should feed on the first breast until it softens before switching to the other side. If the infant does not soften the second breast, the mother may use a breast pump to empty the breast. Pumping during engorgement will not cause a problematic increase in milk supply. A warm shower just before feeding or pumping can aid in relaxation and let-down.

Cold compresses (ice packs) may reduce swelling, vascularity, and pain. Cold compresses are usually applied after feeding or pumping. Raw cabbage leaves placed over the breasts between feedings may help reduce the swelling. The cabbage leaves are washed, placed in the refrigerator until they are cool, and then crushed. The leaves are placed over the breasts for 15 to 20 minutes. This can be repeated for two or three sessions; frequent application of cabbage leaves can decrease milk supply. Cabbage leaves should not be used if the mother is allergic to cabbage or sulfa drugs or develops a skin rash. Antibiotics or medications, such as ibuprofen, may help reduce the pain and swelling associated with engorgement.

**Sore nipples.** Mild nipple tenderness during the first few days of breastfeeding is common. Severely sore and abraded, cracked, or bleeding nipples are not normal and most often result from poor positioning, incorrect latch-on, improper suck, or a monilial infection. The key to preventing sore nipples is correct breastfeeding technique.

To make the initial suckles less painful, the mother can express a few drops of colostrum or milk to moisten the nipple and areola before latch-on. If the mother continues to experience nipple pain or discomfort after the first few suckles, it is necessary to help the mother evaluate the latch-on and baby’s position at the breast. The nurse helps the mother to reposition as necessary to try to resolve the nipple discomfort. If the nipple pain continues, the mother needs to remove the baby from the breast, breaking suction with her finger in the baby’s mouth. She then proceeds to attempt latch-on again, making sure the baby’s mouth is open wide before the baby is pulled quickly to the breast (see Fig. 20-5). Often sore nipples are the result of the mother latching the baby onto the breast before the mouth is open wide.

The infant’s suck can be assessed by inserting a clean gloved finger into the baby’s mouth and stimulating the baby to suck. If the baby is not extruding the tongue over the lower gum, and the mother reports pain or pinching with sucking, the baby may have a short frenulum (commonly referred to as being “tongue-tied”). Sometimes this is corrected surgically to free the tongue for less painful, more effective breastfeeding (Griffiths, 2004; Messner, Lalakea, Aby, Macmahon, & Bair, 2000).

The treatment for sore nipples is first to correct the cause. Once the problem is identified and corrected, sore nipples should heal within a few days, even though the baby continues to breastfeed regularly. When sore nipples occur, it is more comfortable to start the feeding on the least sore nipple. After feeding, the nipples are wiped with water to remove the baby’s saliva. A few drops of milk can be expressed, rubbed into the nipple, and allowed to air dry. Sore nipples should be open to air as much as possible. Breast shells worn inside the bra allow air to circulate while keeping clothing off sore nipples (see Fig. 20-12).

Rapid healing of sore nipples is critical to relieve the mother’s discomfort, maintain breastfeeding, and prevent mastitis. Although numerous creams, ointments, and gels have been used to treat sore nipples, warm water, purified lanolin, and hydrogel are the only treatments that have been studied and shown to have some effect (Riordan, 2005). Purified lanolin helps sore nipples by retaining the skin’s natural moisture and protecting the nipple from further abrasion. It is applied to nipples after feeding and need not be removed for the next feeding. (Mothers with history of wool allergy should not use lanolin until a skin test is done.) Hydrogel dressings, applied to nipples after feeding, create a soothing, moist healing environment by using a glycerin-based gel or saline-based hydrophilic polymer to promote healing. An antibiotic ointment may be recommended if nipples are cracked, abraded, or bleeding; this must be washed off before the feeding (Riordan, 2005).

If nipples are extremely sore or damaged, and the mother cannot tolerate breastfeeding, she may be advised to use an electric breast pump for 24 to 48 hours to allow the nipples to begin healing before resuming breastfeeding. It is important that the mother use a pump that will effectively empty the breasts; a rental pump is likely the best choice (see Fig. 20-10).

**Monilial infections.** Nipple soreness that is not resolved by the previously mentioned methods may be caused by a monilial (yeast) infection. Sore nipples that occur after the newborn period are often the result of a yeast infection. The mother usually reports sudden onset of severe nipple pain and tenderness, burning, or stinging and may have sharp, shooting, burning pains into the breasts during and after feedings. The nipples appear somewhat pink and shiny or may be scaly or flaky; there may be a visible rash, small blisters, or thrush. Most often, the pain is out of proportion to the appearance of the nipple. Yeast infections of the nipples and breast can be exquisitely painful and can lead...
to early cessation of breastfeeding if not recognized and treated promptly. Babies may or may not exhibit symptoms of monilial infection. Oral thrush and a red, raised diaper rash are common indications of a yeast infection.

Mothers and babies must be treated simultaneously with antifungal medication, even if the infant has no visible signs of infection (Hoover, 2001).

**Plugged milk ducts.** A milk duct may become plugged or clogged, causing a red, tender area or small lump in the breast, which may or may not be tender. Plugged milk ducts are most often the result of inadequate emptying of the breast. This may occur because of poor breastfeeding, delayed or missed feedings, always using the same position for feeding, clothing that is too tight, or a poorly fitting or unwire bra.

Application of warm compresses to the affected area and to the nipple before feeding helps promote emptying of the breast and release of the plug. (A disposable diaper filled with warm water makes an easy compress.) Soaking in a warm bath before feeding may be helpful.

Frequent feeding is recommended, with the baby beginning the feeding on the affected side to foster more complete emptying. The mother is advised to massage the affected area while the baby nurses or while she is pumping.

Varying feeding positions and feeding without wearing a bra may be useful in resolving a plugged duct.

**Mastitis.** A breast infection, or mastitis, is characterized by the sudden onset of flu-like symptoms such as fever, chills, body aches, and headache. Localized breast pain and tenderness usually is accompanied by a warm, reddened area on the breast, often resembling the shape of a pie wedge. Mastitis most commonly occurs in the upper outer quadrant of the breast; it may affect one or both breasts (see Fig. 25-4).

Certain factors may predispose a woman to mastitis. Inadequate emptying of the breasts is common, related to engorgement, plugged ducts, a sudden decrease in the number of feedings, abrupt weaning, or wearing unwire bras. Sore, cracked nipples may lead to mastitis by providing a portal of entry for causative organisms (Staphylococcus, Streptococcus, and Escherichia coli are most common). Stress and fatigue, illness, family members, breast trauma, and poor maternal nutrition also are predisposing factors for mastitis (Mass, 2004; Osterman & Rahm, 2000).

Breastfeeding mothers should be taught the signs of mastitis before they are discharged from the hospital after birth, and they need to know to call the health care provider promptly if the symptoms occur. Treatment includes antibiotics such as cephalaxin or dicloxacillin for 10 to 14 days, and analgesic and antipyretic medications such as ibuprofen. The mother is advised to rest as much as possible, and she should feed the baby or pump frequently, striving to empty the affected side adequately. Warm compresses to the breast before feeding or pumping may be useful. Adequate fluid intake and a balanced diet are important for the mother with mastitis (Hale & Berens, 2002).

Complications of mastitis include breast abscess, chronic mastitis, or fungal infections of the breast. Most complications can be prevented by early recognition and treatment (Mass, 2004).

**Follow-up after hospital discharge**

Problems with sore nipples, engorgement, and jaundice are likely to occur after discharge. It is the role of the nurse to educate and prepare the mother for problems she may encounter once she is home. It is important that the mother be given a list of resources for help with breastfeeding concerns and that she realize when to call for assistance. Community resources for breastfeeding mothers include lactation consultants in hospitals, physician offices, or in private practice; nurses in pediatric or obstetric offices; support groups such as La Leche League; and peer counseling programs (e.g., those offered through WIC) (see Resources at end of chapter.)

Telephone follow-up by hospital, birth center, or office nurses within the first day or two after discharge can provide a means to identify any problems and offer needed advice and support. The AAP (2005) recommends that breastfeeding infants should be seen by a health care provider at 3 to 5 days of age and again at 2 to 3 weeks to assess weight gain and offer encouragement and support to the mother (Gartner et al., 2005).

**Evaluation**

Evaluation is based on the expected outcomes, and the plan of care is revised as needed based on the evaluation (Plan of Care).

**FORMULA FEEDING**

The vast majority of infants in the United States receive infant formula at some point during their first year of life (Ryan, Wenjun, & Acosta, 2002). Although some parents may choose to exclusively formula feed, formula also may be used to supplement breastfeeding if the mother’s milk supply appears to be inadequate, or it may be fed to the baby when the mother is away and leaves a bottle of formula instead of expressed breast milk.

**Parent Education**

Mothers and fathers who are formula feeding their infants need teaching, counseling, and support, particularly if they are first time parents or if they have never formula fed. Parents are likely to have questions related to feeding frequency, the appropriate amount of formula to give the infant at each feeding, formula intolerance, weight gain, and “spitting up” (Bonghete-Lang, Morrison, Ogle, & Wright, 2003). They may need assistance with the feeding process and with any problems they may have. Emphasis on the beneficial use of feeding times for close contact and socializing with the infant can help promote bonding and infant interaction.

The alarming increase in childhood and adolescent obesity in the United States is prevalent among low-income, mi-
The amount of formula per feeding should be increased by about 30 ml to meet the baby’s needs at these times.

Feeding patterns

Typically, a newborn will drink 15 to 30 ml of formula per feeding during the first 24 hours, with the intake gradually increasing during the first week of life. Most newborn infants should be fed every 3 to 4 hours, even if that requires waking the baby for the feedings. The infant showing an adequate weight gain can be allowed to sleep at night and feed only on awakening. Most newborns need six to eight feedings in 24 hours, and the number of feedings decreases as the infant matures. Usually by 3 to 4 weeks after birth, a fairly predictable feeding pattern has developed. Scheduling feedings arbitrarily at predetermined intervals may not meet a baby’s needs, but initiating feedings at convenient times often moves the baby’s feedings to times that work for the family.

Mothers will usually notice increases in the infant’s appetite at 7 to 10 days, and during wake and swallow episodes. If the infant sucks and swallows the water without difficulty, formula is then offered.

Feeding readiness

The first feeding of formula is ideally given after the initial transition to extrauterine life is made. Feeding readiness cues include such things as stability of vital signs, presence of bowel sounds, an active sucking reflex, and those described earlier for breastfed infants. The type of formula is usually determined by the pediatrician. Parents are advised to avoid switching formulas unless instructed to do so by the physician.

Before the first formula feeding, some institutions have initiatives concerning the offering of water to the newborn to assess patency of the GI tract and absence of tracheoesophageal fistula. If the infant sucks and swallows the water without difficulty, formula is then offered.
Feeding technique

Parents who choose formula feeding often need education regarding feeding techniques. Babies should be held for all feedings. During feedings, parents are encouraged to sit comfortably, holding the infant closely in a semiupright position with good head support. Feedings provide opportunities to bond with the baby through touching, talking, singing, or reading to the infant. Parents should consider feedings as a time of peaceful relaxation with the baby. A bottle should never be propped with a pillow or other inanimate object and left with the infant. This practice may result in choking, and it deprives the infant of important interaction during feeding. Moreover, propping the bottle has been implicated in causing nursing bottle caries, or decay of the first teeth resulting from continuous bathing of the teeth with carbohydrate-containing fluid as the infant sporadically sucks the nipple.

The bottle should be held so that fluid fills the nipple and none of the air in the bottle is allowed to enter the nipple (Fig. 20-13). When the infant falls asleep, turns aside the head, or ceases to suck, it is usually an indication that enough formula has been taken to satisfy the baby. Parents should be taught to look for these cues and avoid overfeeding, which can contribute to obesity.

Most infants swallow air when fed from a bottle and should be given a chance to burp several times during a feeding (Fig. 20-14) (see Guidelines/Guías box).

Common concerns

Parents need to know what to do if the infant is spitting up. They may need to decrease the amount of feeding, or feed smaller amounts more frequently. Burping the infant

![Fig. 20-13](image1)  
Father bottle feeding infant son. Note angled bottle that ensures that milk covers nipple area. (Courtesy Eugene Doerr, Leitchfield, KY.)

![Fig. 20-14](image2)  
Burping

GUIDELINES/GUÍAS

Burping

POSITION #1 (SEE FIG. 20-14, A)

• Hold your baby up, head on your shoulder.
• Ponga su bebé con la cabeza muy alta sobre su hombro.
• Put one arm under the baby’s bottom.
• Ponga un brazo debajo de las nalgas del bebé.
• With the other hand, pat or rub the baby’s back.
• Con la otra mano, dé leves palmaditas o sobe la espalda del bebé.

POSITION #2 (SEE FIG. 20-14, A)

• Sit your baby up in your lap.
• Sienta al bebé sobre su regazo.
• Hold the head and back with one hand.
• Con una mano, sostenga la cabeza y la espalda del bebé.
• Hold the chin and front with the other.
• Con la otra mano, sostenga la barbilla y la parte delantera del bebé.
• Rock the baby’s upper body back and forth.
• Mueva la parte superior del bebé hacia adelante y hacia atrás.
• Or pat the baby’s back.
• O dé suaves palmaditas a la espalda del bebé.

POSITION #3 (SEE FIG. 20-14, C)

• Lay your baby face down on your lap.
• Coloque al bebé boca abajo sobre su regazo.
• Hold the baby’s head with one hand.
• Con una mano, sostenga la cabeza del bebé.
• Rub or pat the baby’s back.
• Sobre o dé suaves palmaditas a la espalda del bebé.

Boiling of bottles and nipples is not needed unless there is some question about the safety of the water supply.

Infant formulas

Commercial formulas. Because human milk is species specific to meet the needs of the human infant, it is used as the “gold standard” for all infant formulas. Commercial infant formulas are designed to resemble human milk as closely as possible, although none has ever duplicated it. The exact composition of infant formula varies with the manufacturer, but all must meet specific standards.

In an effort to make formula as similar to breast milk as possible, formula manufacturers have added a variety of ingredients including iron and nucleotides. Recently, manufacturers have added long-chain polyunsaturated fatty acids (LCPUFAs), consisting of arachidonic acid (ARA) and docosahexaenoic acid (DHA); the rationale for the addition of these substances is to enhance brain growth and retinal development. Research is ongoing to determine if, in fact, this is true (Motin, 2004). Other possible additives are currently under consideration such as probiotics to promote the development of fecal flora and enhance the intestinal immune response (Agostoni & Haschke, 2003; Institute of Medicine, 2004).

Infants who are not breastfed should be given commercial formulas. If this is too expensive, the family would likely be eligible for services through the WIC program, which provides iron-fortified commercial infant formula. Cow’s milk is the basis for most infant formulas, although soy-based and other specialized formulas are available for the infant who cannot tolerate cow’s milk. Parents should be encouraged to use infant formulas that are fortified with iron.

Commercial formulas are available in three forms: powder, concentrate, and ready-to-feed. All are equivalent in terms of nutritional content, but they vary considerably in cost.

Powdered formula is the least expensive type. It is easily mixed by using one scoop for every 80 ml of water. Concentrated formula is more expensive than powder. It is diluted with equal parts of water and can be stored in the refrigerator for 48 hours after opening. Ready-to-feed formula is the most expensive but easiest to use. The desired amount is poured into the bottle. The opened can is safely refrigerated for 48 hours. This type of formula can be purchased in individual disposable bottles for the most convenient feeding.

Special formulas. Some infants have an allergic reaction to cow’s milk formula. They may have diarrhea, rash, colic, or vomiting, and, in extreme cases, failure to thrive. Some of these infants may better tolerate a soy-milk formula; however, some may be allergic to soy protein. If hypersensitivity to cow’s milk protein is suspected, a hydrolyzed casein formula may be recommended; however, special formulas are very expensive. Some women may be able to begin breastfeeding or, in life-threatening cases, obtain human milk through a milk bank, at least temporarily. Other special formulas are available for infants with a variety of disorders such as protein allergy, malabsorption syndromes, and inborn errors of metabolism.
EVIDENCE-BASED PRACTICE

Hydrolyzed Protein Infant Formula for Prevention of Allergies

BACKGROUND

Allergies are the specific immunoglobulin E (IgE) response to normally benign substances (allergens). Twenty percent of the population suffers from allergies, including allergic rhinitis (hay fever), asthma, eczema or atopic dermatitis, and food allergies. Half of all childhood asthma and 80% of all hay fever persists into adulthood. The risk of atopy (inherited allergy) is 33% if one parent has allergies and 70% if both parents are atopic. There is evidence that the longer the duration of exclusive breastfeeding, the less likely the baby will suffer childhood allergies. Food intolerance is an adverse reaction that is to the result of an enzyme error, irritation, toxicity, or pharmacologic effect. It is diagnosed when the cause is eliminated from the diet with subsequent symptom relief, and recurs with a challenge of the substance. Cow’s milk allergy is often associated with exposure to cow’s milk in the first month of life. Prevention of allergies can include maternal avoidance of allergens during pregnancy and lactation, and avoidance of infant sensitization to allergens. Cow’s milk and soy milk infant formulas may have their allergenic properties decreased by partially or completely hydrolyzing the protein. This may decrease childhood allergies in vulnerable children.

OBJECTIVES

The reviewers sought to compare allergy and food intolerance in infants fed hydrolyzed formula. Of interest was whether there was a difference among partially or completely hydrolyzed milk or soy formula, the most effective onset and duration of feeding, and the type of infant likely to benefit from hydrolyzed formula. The intervention was the hydrolyzed formula. The control group received human breast milk or cow’s milk-based infant formula. The subjects were infants up to 6 months of age without evidence of allergy. The outcomes could include maternal avoidance of allergens during pregnancy and lactation, and avoidance of infant sensitization to allergens. Cow’s milk and soy milk infant formulas may have their allergenic properties decreased by partially or completely hydrolyzing the protein. This may decrease childhood allergies in vulnerable children.

METHODS

Search Strategy

The authors searched Cochrane, MEDLINE, CINAHL, EMBASE, references, and conferences. Search keywords were infant, newborn, neonatal, pediatric, paediatric, plus feed, food, formula, hydrolysed, allergies, diet, protein, and milk. Eighteen randomized or quasi-randomized trials were included in the review, dated 1989 to 2001, representing 7453 infants. Countries were not always noted in the review, but included Canada, Belgium, The Netherlands, and the United Kingdom.

Statistical Analyses

Similar data were pooled. Reviewers calculated relative risks for categoric data and weighted mean differences for continuous data, all with a 95% confidence interval. Results outside the confidence interval represent significant differences.

FINDINGS

None of the trials compared the development of allergies in infants fed human milk with prolonged hydrolyzed formula-fed infants. Short-term hydrolyzed formula groups showed no significant difference in allergies with human milk–fed groups in two trials. In high risk infants, meta-analysis revealed a significant reduction in infant and childhood allergies, including asthma, eczema, allergic rhinitis, and cow’s milk allergy in the hydrolyzed formula group when compared with the cow’s milk-formula group. These benefits seem to persist at least until 5 years of age. When completely hydrolyzed formula was compared with partially hydrolyzed formula, the differences in allergy symptoms were equivocal. The reviewers found no adverse effects from hydrolyzed formulas, and no difference in weight gain or length at 6 months of age.

LIMITATIONS

The trial criteria limited studies to less than a 10% loss to follow-up or dropout rate, which is a strength. Some trials were quasi-randomized, limiting generalizability. Some trials did not address allocation concealment, suggesting the possibility of bias by the clinical allergy assessors. Several trials were sponsored by infant formula manufacturers, suggesting possible conflict of interest.

CONCLUSIONS

For prevention of allergies and many other reasons, breast milk is still best. For high risk infants who cannot breastfeed, the prolonged use of hydrolyzed formula seems to be less allergenic than cow’s milk formula. Partially hydrolyzed formula is more cost-effective than completely hydrolyzed formula, but evidence about their allergenic differences is inconclusive.

IMPLICATIONS FOR PRACTICE

Breastfeeding should be encouraged, especially among infants at risk for allergies. When breastfeeding is not possible, hydrolyzed formula should be used.

IMPLICATIONS FOR FURTHER RESEARCH

Much more research is needed about allergies beyond childhood. Cost, which was not addressed in these trials, can be a daily struggle for parents trying to provide the more expensive hydrolyzed formula. The question of the benefits of partially versus completely hydrolyzed formula persists.

Formulas for preterm infants contain higher caloric concentration (22 to 24 cal/oz) and higher concentrations of some nutrients such as protein, vitamin A, folic acid, and zinc (Morrow, 2004).

**Evaporated milk.** Although evaporated milk is concentrated and less expensive than commercial formula, the mixing of evaporated milk and water to feed a baby is no longer recommended because evaporated milk does not provide adequate nutrition for an infant.

**Unmodified cow’s milk.** Unmodified cow’s milk is not suited to the nutritional needs of the human infant in the first year of life. Specific concerns include the excessive amounts of calcium, phosphorus, and other minerals it contains; an imbalance of calcium and phosphorus; its excessive protein content; the poor absorption of the fat it contains; and its low iron concentration. In addition, its use in infants is apt to cause microscopic hemorrhages that lead to GI blood loss. This blood loss, as well as the low levels of iron in the milk, increases the likelihood of iron-deficiency anemia.

**Formula preparation**

The commercial infant formula must include directions for preparation and use with pictures and symbols for the benefit of persons who cannot read. Some manufacturers are translating the directions into various languages, such as Spanish, French, Vietnamese, Chinese, and Arabic to provide more calories.

Although manufacturers of commercial formula include directions for preparing their products, the nurse should review formula preparation with the parents. It is especially important that formula be mixed properly. The newborn’s kidneys are immature, and giving the infant overly concentrated formula may provide protein and minerals in amounts that exceed the kidney’s excretory ability. In contrast, the formula is diluted too much (sometimes done in an effort to save money), the infant does not consume enough calories and does not grow well (Rentrew, Ansell, & Macleod, 2003).

Sterilization of formula rarely is recommended for those families with access to a safe public water supply. Instead, the formula is prepared with attention to cleanliness. When water from a private well is used, parents should be advised to contact the health department to have a chemical and bacteriologic analysis of the water done before using the water in formula preparation. The presence of nitrates, excess fluoride, or bacteria may be harmful to the infant.

If the sanitary conditions in the home appear unsafe, it would be better to recommend the use of ready-to-feed formula or to teach the mother to sterilize the formula. The two traditional methods for sterilization are terminal heating and the aseptic method. In the terminal-heating method, the prepared formula is placed in the bottles, which are topped with the nipples placed upside down and covered with the caps, and then sealed loosely with the rings. The bottles are then boiled together in a water bath for 25 minutes. In the aseptic method, the bottles, rings, caps, nipples, and any other necessary equipment, such as a funnel, are boiled separately, after which the formula is poured into the bottles. Any formula left in the bottle after the feeding should be discarded because the baby’s saliva has mixed with it. Instructions for formula preparation and feeding are provided in the Teaching Guidelines box.

**Vitamin and mineral supplementation**

Commercial iron-fortified formula has all of the nutrients the infant needs for the first 6 months of life. After 6 months, the only mineral supplementation required is fluoride if the local water supply is not fluoridated.

**Weaning**

The bottle-fed infant will gradually learn to use a cup, and the parents will find that they are preparing fewer bottles. Often the bottle feeding before bedtime is the last one to remain. Babies have a strong need to suck, and the baby who has the bottle taken away too early or abruptly will compensate with nonnutritive sucking on his or her fingers, thumb, a pacifier, or even his or her own tongue. Weaning from a bottle should therefore be done gradually because the baby has learned to rely on the comfort that sucking provides.

**Introducing solid foods**

The infant receives the right balance of nutrients from breast milk or formula during the first 4 to 6 months. It is not true that the feeding of solids will help the infant sleep through the night. Cereal should not be put into the infant’s bottle. Introduction of solid foods before the infant is 4 to 6 months of age may result in overfeeding and decreased intake of breast milk or formula. The infant cannot communi cate feeling full as can an older child, who is able to turn the head away. The proper balance of carbohydrate, protein, and fat for an infant to grow properly is in the breast milk or formula.

The infant’s individual growth pattern should help determine the right time to start solids. The primary health care provider will advise when to introduce solid foods. The schedule for introducing solid foods and the types of foods to serve will be discussed during well-baby supervision visits with the pediatrician or pediatric nurse practitioner.
UNIT SIX

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TEACHING GUIDELINES

FORMULA PREPARATION

- Wash your hands and clean the bottle, nipple, and cap.
- If new nipples seem too firm or stiff, they can be softened by boiling them for 5 minutes with a sewing needle inserted in the hole.
- Read the label on the container of formula and mix it exactly according to the directions.
- Use tap water to mix concentrated or powdered formula unless directed otherwise by your baby’s physician or nurse.
- Test the size of the nipple hole by holding a prepared bottle upside down. The formula should drip from the nipple. If it runs in a stream, the hole is too big and should not be used. If it has to be shaken for the formula to come out, the hole is too small. You can either buy a new nipple or enlarge the hole by boiling the nipple for 5 minutes with a sewing needle inserted in the hole.
- If a nipple collapses when your baby sucks, loosen the nipple ring a little to let in air.
- Opened cans of ready-to-feed or concentrated formula should be covered and refrigerated. Any unused portions must be discarded after 48 hours.
- Bottles or cans of unopened formula can be stored at room temperature.
- If the formula is refrigerated, warm it by placing the bottle in a pan of hot water. Never use a microwave to warm any food to be given to a baby. Test the temperature of the formula by letting a few drops fall on the inside of your wrist. If the formula feels comfortably warm to you, it is the correct temperature.

FEEDING TECHNIQUES AND TIPS

- Newborns should be fed at least 3 to 4 hours and should never go longer than 4 hours without feeding until a satisfactory pattern of weight gain is established. This may take 2 weeks. If a baby cries or fusses between feedings, check to see if the diaper should be changed, and if the baby needs to be picked up and cuddled. If the baby continues to cry and acts hungry, go ahead and feed. Babies do not get hungry on a regular schedule.
- Babies gradually increase the amount of milk they drink with each feeding. The first day or so, most newborns consume 15 to 30 ml (one-half to 1 ounce) with each feeding. This amount increases as the infant grows. If any formula remains in the bottle as the feeding ends, that milk must be thrown away, because saliva from the baby’s mouth can cause the formula to spoil.
- It is a good idea to keep a feeding diary, writing down the amount of formula the baby drinks with each feeding for the first week or so. Also record the wet diapers and bowel movements the baby is having. Take this “diary” with you when you take the baby for the first Pediatrician visit.
- For feeding, hold the baby close in a semireclining position. Talk to the baby during the feeding. This is a great time for social interaction and cuddling.
- Place the nipple in the baby’s mouth on the tongue. It should touch the roof of the mouth to stimulate the baby’s sucking reflex. Hold the bottle like a pencil. Keep the bottle tipped so that the nipple stays filled with milk and the baby does not suck in air.
- It is normal for babies to take a few sucks and then pause briefly before continuing to suck again. Some newborns may take longer to feed than others. Be patient. It may be necessary to keep the baby awake and to encourage sucking. Moving the nipple gently in the baby’s mouth may stimulate sucking.
- Newborns are apt to swallow air when sucking. Give the baby opportunities to burp several times during a feeding. As the baby gets older, you will know better when it is necessary to stop for burping.
- After the first 2 or 3 days, the stools of a formula-fed infant are yellow and soft, but formed. The baby may have a stool with each feeding in the first 2 weeks, although this may decrease to one or two stools each day.

SAFETY TIPS

- Babies should be held and never left alone while feeding. Never prop the bottle. The baby might inhale formula or choke on any that was spit up. Babies who fall asleep with a propped bottle of milk or juice may be prone to cavities when the first teeth come in.
- Know how to use the bulb syringe and how to help a baby who is choking.

COMMUNITY ACTIVITY

Explore the resources in your community for breastfeeding mothers after they are discharged from the hospital. Find out if there are lactation consultants in hospitals, pediatricians’ offices, health departments, or in private practice who are accessible to mothers. What services are provided (e.g., phone consultations, one-on-one consultations)? Is there a charge to the patient for these services? Are there peer counselors for nursing mothers through the local WIC program? Are there nursing support groups in the community, such as La Leche League, where mothers can attend meetings to gain information and support? What supports are available for formula feeding mothers? Are there groups similar to the ones for breastfeeding mothers?
The major priority at this time is to feed the baby. He is at risk 3

b. The sore nipples are likely to be the result of a problem with

Answers Guidelines to Critical Thinking Exercise

Breastfeeding: Engorgement and Nipple Soreness

1. Mary is experiencing a crisis that involves physical discomfort from engorged breasts and sore nipples, physical exhaustion from the demands of a fussy infant who is not sleeping well, frustration in being unable to successfully latch her baby on and provide milk to satisfy him, such that she is questioning her commitment to breastfeeding and considering formula for her infant.

2. a. This mother has experienced the onset of mature milk production at the expected time, approximately 3 days after birth. Her breasts are engorged, the tissues surrounding the milk glands and milk ducts are edematous, and the milk is not flowing well from the breasts because of the compression of the milk ducts. She is producing mature milk, but has a problem with milk transfer to the baby.

b. The sore nipples are likely to be the result of a problem with latching the baby onto the breast. This most likely began during the first 2 days after birth and has grown more severe with the increased pressure in the breasts because of fullness, which tends to flatten the nipple and make it more difficult for the baby to latch on. She is experiencing pain with latching, which can inhibit her milk ejection or let-down reflex.

c. The urinary output and number of stools are signs that the baby has not received sufficient feeding. After the milk has come in, from about the fourth day of life, the baby should have at least six to eight wet diapers and at least three or four bowel movements every 24 hours. His fussiness and lack of sleep are evidence that he is not being satisfied when he nurses; he is hungry and needs more milk to feel satiated.

d. Mary's frustration, fatigue, and mental exhaustion are causing her to question her desire to breastfeed. She is tired and her breasts are painful. The discomfort intensifies when the baby tries to breastfeed on the very sore nipples. She may be wondering, is breastfeeding worth all this?

3. The major priority at this time is to feed the baby. He is at risk of becoming dehydrated because of inadequate intake. If the engorgement can be treated quickly, he may be able to breastfeed. Otherwise, he needs to be fed some infant formula via syringe or slow flow bottle until she can express milk or get him to nurse. Mary needs help with her engorgement; ice packs can be applied to the breasts for 20 minutes to help reduce the tissue swelling. She can also take an anti-inflammatory medication such as ibuprofen. After the ice is applied, Mary can use a hospital grade electric breast pump to try to express milk to begin softening the breasts. Even with the pumping of just a half ounce or so, the nipples may soften enough for the baby to latch on and continue softening the breasts. Ideally, the infant will latch on and the milk will flow sufficiently to provide him with enough milk to feel satisfied and to allow Mary’s breasts to feel more comfortable. If the ice and pumping do not result in milk flow, cabbage leaves may be used on the breasts for 20 minutes, followed by pumping. The cracked, sore nipples need to be treated. Hydrogel pads can be applied after feeding or pumping. If the nipples are too uncomfortable for the baby to nurse, Mary may pump her breasts with an electric breast pump for 24 hours to allow the nipples some time to begin healing; the expressed breast milk can be syringed fed or fed with a slow flow nipple or bottle. As the nipples improve, the baby can be gradually reintroduced to the breast, with a nurse or lactation consultant assisting Mary with proper latch-on technique.

Mary needs emotional support at this time. The nurse can provide her an opportunity to express her frustrations and concerns. It is important that Mary is aware that what she is experiencing is not uncommon; the breasts of many women become engorged. It is a temporary condition, usually lasting no more than 24 to 48 hours. She may be feeling as if she is failing as a mother. Empathetic concern from the nurse can help to boost Mary's self-esteem and increase her confidence as a mother.

4. Yes, according to the AAP (2005) guidelines for breastfeeding, the infant is not receiving adequate feedings. Mary is experiencing primary engorgement, a common problem that is temporary and should resolve with appropriate interventions.

5. Mary could have a history of breast surgery, in which case the milk ducts may have been severed, and there is no outlet for the milk to be emptied from the breasts. The baby may be the source of the latch problem because of some physical characteristic such as a tight frenulum (“tongue-tied”). The baby needs to be assessed to determine if there are factors that may inhibit successful latch-on. In addition, Mary may be lacking in her commitment to breastfeed and may be looking for an excuse to stop. In her mind, the difficulties she is experiencing may provide her with enough reason to switch to formula.
References


