I had been told that most babies ate every three or four hours and slept the rest of the time. Not mine! She wanted to nurse every two hours, and sometimes more often than that. Sometimes she would sleep for an hour, sometimes for fifteen minutes. I loved her, but I also felt consumed by her needs. It was hard to adjust to the fact that I couldn’t get anything finished, whether it was an article I was reading or folding the laundry. At the end of the day I would realize I hadn’t accomplished anything. Once I accepted the fact that I was not going to function at my old efficient rate (at least for a while) and stopped feeling guilty about what I wasn’t getting done, I felt free to enjoy the time I was spending with my baby.

∼ The New Our Bodies, Ourselves ∼

OBJECTIVES

1. Compare the nutritional value and composition of breast milk and formula preparations.
2. Discuss the advantages and disadvantages of breastfeeding and formula-feeding for both mother and newborn.
3. Develop guidelines for helping both breastfeeding and formula-feeding mothers to feed their infants successfully.
4. Delineate nursing responsibilities for client teaching regarding infant feeding issues.
5. Incorporate knowledge of newborn nutrition and normal growth patterns into parent education and infant assessment.
6. Recognize the influence of cultural values on infant care, especially feeding practices.

KEY TERMS

Colostrum 904
Foremilk 904
Hindmilk 904
La Leche League International 919
Let-down reflex 904
Mature milk 904
Milk/plasma ratio 902
Oxytocin 904
Prolactin 903
Transitional milk 904

MEDIA LINK

Additional resources for this content can be found on the Prentice Hall Nursing MediaLink DVD-ROM and on the Companion Web Site at http://www.prenhall.com/davidson. Click on “Chapter 31” to select the activities for this chapter.
Early nutrition has a significant impact on the present and future health and well-being of the infant because this is a period of rapid growth and brain development. Good nutrition fosters physical growth and helps maintain a healthy immune system. In addition, infant feeding itself is an important component of newborn socialization that promotes cognitive and emotional development.

Whether choosing to breastfeed or use infant formula, parents find feeding their newborn an exciting, satisfying, but often worrisome task. Meeting this essential need of their new child helps parents strengthen their attachment to their baby and fosters their self-images as nurturers and providers. It is important that the nurse is well informed about infant nutrition and feeding methods, because the parents look to the nurse for this guidance. Parents need accurate and consistent information from the nursing staff. They need to learn the skills to feed their infant successfully. Through each interaction with the parents, there is an opportunity for the nurse to support the parents and promote the family’s sense of confidence.

In this chapter an emphasis is placed on feeding the full-term healthy infant of normal birth weight during the neonatal period. We will look at the nutritional needs of the newborn in the context of both breast milk and formula composition, discuss feeding methods, explore community-based nursing care, and finally look at a nutritional assessment of the newborn.

**NUTRITIONAL NEEDS AND MILK COMPOSITION**

The newborn’s diet must supply all the nutrients required by the body in the proper quantities to meet the rapid rate of physical and neurologic growth and development. A neonatal diet should provide adequate hydration and sufficient calories and include protein, carbohydrates, fat, vitamins, and minerals. Exclusive breast milk and/or iron-fortified 20-calorie/ounce formula are sufficient as sole sources of nutrition to meet the dietary needs of the newborn from birth up to 6 months of age. Complementary solid foods are introduced in the second half of the first year, and the infant continues to receive breast milk and/or formula until at least 12 months of age (American Academy of Pediatrics [AAP] Section on Breastfeeding, 2005).

This next section discusses the nutritional requirements of the newborn and how these are met by breast milk and cow’s milk-based formula. There are three categories of commercial infant formulas: (1) standard cow’s milk-based formulas, (2) soy protein-based formulas, and (3) specialized or therapeutic formulas. Further information on the latter two may be found in the section “Specialty Formula.”

**Dietary Reference Intakes**

Before discussing the nutritional needs of the infant, the nurse should note that the new title dietary reference intake (DRI) is an updated generic term that replaces the well-known nutritional reference term recommended dietary allowances (RDAs). The term RDA previously served as a benchmark for nutritional adequacy in the United States, but it reflected primarily disease prevention from nutrient deficiency. The term DRI encompasses four aspects of nutrient-based reference values: (1) estimated average requirement (EAR), (2) RDA, (3) adequate intake (AI), and (4) tolerable upper intake level (UL). The DRIs represent a framework that links nutrition and health across the lifespan (Gregory, 2005).

**Growth**

It is normal for both breastfed and formula-fed infants to lose weight in the first 3 to 4 days of life. Formula-feeding infants generally lose up to 3.5% of their birth weight; breastfeeding infants should not exceed a weight loss greater than 7% of their birth weight (Association of Women’s Health, Obstetric and Neonatal Nurses [AWHONN], 2000; International Lactation Consultant Association, 2005, MacDonald, Ross, Grant, et al., 2003). Infants lose weight with the passage of meconium and because their fluid intake is normally low in the first few days while transitioning to enteral feedings. This loss is normal and does not result in dehydration, as infants draw on their extracellular water reserves (Biancuzzo, 2003). Infants should begin gaining weight by day of life 5 or sooner and should be at or above birth weight by 10 to 14 days of age. Weight gain during the first 4 weeks should be about 10 g/kg/day or 5 to 7 oz/week (Riordan, 2005).

Breastfed and formula-fed babies have different growth rates. This is understandable because the compositions of breast milk and formula are different. See Table 31–1 to compare breast milk and formula compositions. Most physicians (as well as formula companies) consider breastfeeding as the “gold standard” from which to compare nutritional outcomes (AAP, 2005; Lawrence & Lawrence, 2005).

Formula-fed infants tend to regain their birth weight earlier than breastfed infants because the formula-fed infant has a greater fluid intake early on. The breastfeeding infant’s fluid intake depends on mother’s milk supply and breastfeeding efficiency. It is noteworthy that breastfeeding infants born to multiparous mothers often do not lose as much weight as infants born to primiparous mothers, because the multiparous mother’s milk typically “comes in” quicker (Lawrence & Lawrence, 2005). If a healthy full-term infant with normal birth weight has a weight loss exceeding 7%, then a feeding evaluation is indicated. If an infant has a weight loss of 10% or greater, then an evaluation, an intervention, and a follow-up is indicated to make certain that the infant receives sufficient fluid and calories. In this case, a follow-up weight check is recommended to ascertain if the feeding problem is resolved.

Growth rates for breastfed and formula-fed infants are somewhat different once feedings are established. Exclusively breastfed infants have the same or slightly higher weight gain than their formula-fed and mixed-fed peers in the first 3 to 4 months. Thereafter, formula-fed and mixed-fed infants have a greater weight gain pattern compared with breastfed infants. This characteristic weight gain pattern results in a leaner body build in the breastfed group by the latter half of the first year of life (Riordan, 2005). Measurements of length and head circumference are the same for both groups. An infant typically grows...
Length is a greater indicator of growth than is weight. Infants generally double their birth weight by 5 months, triple their birth weight by 1 year of age, and quadruple their birth weight by 2 years (Riordan, 2005). Growth charts for tracking an infant’s weight, length, and head circumference can be downloaded from the Centers for Disease Control and Prevention (CDC) Web site.

**Clinical Tip**

Following are newborn caloric and fluid needs:

- Caloric intake: 45.5 to 52.5 kcal/lb/day or 100 to 115 kcal/kg/day
- Fluid requirements: 64 to 73 mL/lb/day or 140 to 160 mL/kg/day
- First 6 months weight gain: Formula fed—1 oz/day; Breastfed—0.5 oz/day

**Fluid Requirements.** Fluid requirements during the neonatal period are high (140 to 160 mL/kg/day) because of the newborn’s decreased ability to concentrate urine and increased overall metabolic rate. Although the infant’s total body water content is high (75% to 80%) compared with an adult’s (60%), the infant has an increased surface area to mass ratio and decreased renal absorptive capacity that makes the infant more susceptible to dehydration from insufficient fluid intake or increased fluid loss due to diarrhea, vomiting, or other source of fluid loss. Parents and caretakers should be aware of the signs of dehydration. Dry or chapped lips, dry oral cavity, decreased urine output, concentrated urine, general weakness, lethargy, poor skin turgor, sunken eyes, and

### Table 31-1 COMPARISON OF SELECTED NUTRIENTS IN MILK

<table>
<thead>
<tr>
<th>Nutrients per 30 mL</th>
<th>Human Milk</th>
<th>Similac Advance®</th>
<th>Enfamil Lipil®</th>
<th>Whole Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>Protein, grams</td>
<td>0.31</td>
<td>0.41</td>
<td>0.42</td>
<td>1.1</td>
</tr>
<tr>
<td>% of cal</td>
<td>6%</td>
<td>8%</td>
<td>8%</td>
<td>22%</td>
</tr>
<tr>
<td>Source</td>
<td>Human milk</td>
<td>Nonfat milk, whey protein</td>
<td>Nonfat milk, whey protein</td>
<td>Cow’s milk</td>
</tr>
<tr>
<td>Whey: casein</td>
<td>90:10 greater than 50:50*</td>
<td>52:48</td>
<td>60:40</td>
<td>20:80</td>
</tr>
<tr>
<td>Fat, grams</td>
<td>1.15</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>% of cal</td>
<td>52%</td>
<td>49%</td>
<td>49%</td>
<td>49%</td>
</tr>
<tr>
<td>Source</td>
<td>Human milk (contains DHA, ARA, etc.)</td>
<td>Safflower, soy, coconut, DHA, ARA**</td>
<td>Palm, soy, coconut, sunflower, DHA, ARA**</td>
<td>Butterfat</td>
</tr>
<tr>
<td>Carbohydrate, grams</td>
<td>2.1</td>
<td>2.2</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>% of cal</td>
<td>42%</td>
<td>43%</td>
<td>43%</td>
<td>31%</td>
</tr>
<tr>
<td>Source</td>
<td>Lactose (human milk)</td>
<td>Lactose (nonfat milk)</td>
<td>Lactose (nonfat milk)</td>
<td>Lactose (whole milk)</td>
</tr>
<tr>
<td>Linoleic acid, mg</td>
<td>110</td>
<td>200</td>
<td>172</td>
<td>26</td>
</tr>
<tr>
<td>Calcium, mg</td>
<td>8.2</td>
<td>15.6</td>
<td>15.6</td>
<td>39</td>
</tr>
<tr>
<td>Phosphorus, mg</td>
<td>4.2</td>
<td>8.4</td>
<td>10.6</td>
<td>30.4</td>
</tr>
<tr>
<td>Iron, mcg</td>
<td>8</td>
<td>360</td>
<td>360</td>
<td>16</td>
</tr>
<tr>
<td>Copper, mcg</td>
<td>7.4</td>
<td>18</td>
<td>15</td>
<td>4.2</td>
</tr>
<tr>
<td>Selenium, mcg</td>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>Sodium, mg</td>
<td>5.2</td>
<td>4.8</td>
<td>5.4</td>
<td>16</td>
</tr>
<tr>
<td>Potassium, mg</td>
<td>15.6</td>
<td>21</td>
<td>21.6</td>
<td>49.8</td>
</tr>
<tr>
<td>Chloride, mg</td>
<td>12.4</td>
<td>13</td>
<td>12.6</td>
<td>32.8</td>
</tr>
<tr>
<td>Solute load, mOsm</td>
<td>2.9</td>
<td>3.7</td>
<td>3.8</td>
<td>10</td>
</tr>
<tr>
<td>Osmolality, mOsm/l</td>
<td>286</td>
<td>300</td>
<td>300</td>
<td>285</td>
</tr>
<tr>
<td>Vitamin A, international unit</td>
<td>66</td>
<td>60</td>
<td>60</td>
<td>41</td>
</tr>
<tr>
<td>Vitamin D, international unit</td>
<td>0.6</td>
<td>12</td>
<td>12</td>
<td>13.4</td>
</tr>
<tr>
<td>Vitamin E, international unit</td>
<td>0.12</td>
<td>0.3</td>
<td>0.4</td>
<td>0.02</td>
</tr>
<tr>
<td>Vitamin K, mcg</td>
<td>0.06</td>
<td>1.6</td>
<td>1.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Folate, mcg</td>
<td>1.4</td>
<td>3</td>
<td>3.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*Whey:casein ratio in human milk changes after birth.

**Docosahexaenoic acid (DHA), arachidonic acid (ARA) additives derived from algae, mycotic sources.

sunken fontanelle are some of the signs of dehydration. The infant’s fluid intake will need to be increased above the baseline fluid needs when the infant has a fever or is in a warm environment for an extended period of time. For infants under 6 months of age, increased fluid requirements should be met with additional breast milk or formula, rather than water.

Milk Composition. Breast milk and formula contain almost 90% water, which meets the infant’s water needs. Feeding supplemental water is not recommended routinely for infants under 6 months of age who are still on an exclusively milk diet (breast milk or formula), because the increased water can cause hyponatremia and may result in seizures if water consumption is excessive. In some cases in which the infant has become more severely dehydrated or will not tolerate increased breast milk or formula, a physician may recommend use of a water/electrolyte solution for initial rehydration.

Energy

Requirements. The basal metabolic rate (BMR) refers to the energy needed for thermoregulation, cardiorespiratory function, cellular activity, and growth. The healthy full-term infant’s BMR is about twice that of an adult’s, based on body weight (Rolfes, Pinna, & Whitney, 2006). A newborn requires 100 to 115 kcal/kg/day at 1 month and 85 to 95 kcal/kg/day from 6 to 12 months of age. When infants do not receive sufficient calories, they risk losing weight, may experience tissue breakdown, and are at risk for delayed growth and development (Gregory, 2005).

Milk Composition. Healthy full-term newborns derive about half of their required calories from fat (breast milk 52%, formula 49%). The remaining calories are derived from carbohydrates (breast milk 42%, formula 43%) and to a lesser extent from protein (breast milk 6%, formula 8%) (Mead-Johnson Nutritional, 2004; Ross Products Division, 2004). Often, calories derived from protein are not counted in the total daily caloric intake as there is a metabolic cost to breaking down protein that at least partially negates the caloric benefits.

Fats

Requirements. As noted, infants receive approximately 50% of their calories from fat. Fats also help the body absorb the fat-soluble vitamins A, D, E, and K. Fats are a precursor of prostaglandins and other hormones. Essential fatty acids and their derivatives docosahexaenoic acid (DHA) and arachidonic acid (ARA) are associated with improved visual acuity and cognitive ability (Riordan, 2005).

Milk Composition. Triglycerides make up 98% to 99% of milk fat. Triglycerides break down to free fatty acids and glycerol. The lipid fraction of breast milk provides essential fatty acids, including linoleic acid and linolenic acid, as well as their longer chain derivatives DHA and ARA. In 2001 the Food and Drug Administration (FDA) approved the addition of DHA and ARA to infant formula. Fat content is the most variable component in breast milk, ranging from 30 to 50 grams/liter. It is influenced by maternal parity, duration of pregnancy, the stage of lactation, diurnally, and even during a single feeding. Multiparous mothers produce milk with a lower content of fatty acids. Mothers of preterm infants have a greater concentration of long-chain polyunsaturated fatty acids (LCPUFAs) in their milk compared with mothers of term infants. Phospholipids and cholesterol levels are higher incolostrum compared with mature milk, although overall fat content is higher in mature breast milk compared with colostrum. Fat content is generally higher in the evening and lower in the early morning. Within a single feeding session an infant initially receives the low-fat foremilk before receiving the higher calorie, high-fat hindmilk.

Finally, the fat content of breast milk is also affected by maternal diet and maternal fat stores. Mothers on low-fat diets have increased production of medium chain fatty acids (C6-C10), and mothers with high levels of body fat produce breast milk with a higher fat content (Lawrence & Lawrence, 2005).

The fats in the milk-based formulas are modified to parallel the fat profile of breast milk by removing the butterfat from cow’s milk and adding vegetable oils. There are quite a few differences in the fat sources and amounts used among the major formula brands (see Table 31–1). The different blends of fats all provide a fatty acid profile in the end that is similar to breast milk in terms of amount of saturated, monounsaturated, and polyunsaturated fats present. In 2002, the formula companies in the United States added long-chain polyunsaturated fatty acids (LCPUFAs), namely, DHA for brain development and ARA for visual acuity (AAP, 2002).

Carbohydrates

Requirements. Carbohydrates (sugars) serve as the other main source of energy for the infant, providing about 40% of the calories in the infant’s diet. By weight, both breast milk and formula contain more carbohydrates than fat, but the caloric value of carbohydrates is 4 calories/gram, whereas fat provides 9 calories/gram.

Milk Composition. In breast milk, the primary carbohydrate is lactose. In addition to providing energy, lactose also functions to enhance the absorption of calcium, magnesium, and zinc (Lawrence & Lawrence, 2005). Breast milk also contains trace amounts of other carbohydrates such as glucosamines and nitrogen-containing oligosaccharides (Biancuzzo, 2003). Glucosamines are one of the building blocks for connective tissues and help strengthen and hold together ligaments and tendons. Oligosaccharides promote the growth of Lactobacillus bifidus, which promotes an
intestinal acidic environment, creating a hostile environment for bacteria to thrive (Riordan, 2005).

In comparing carbohydrates among the milk-based formulas, both Enfamil® and Similac® provide all of their carbohydrate calories from lactose. Carnation Good Start® uses a blend of 70% lactose and 30% maltodextrin (a table sugarlike carbohydrate) (Sears, n.d.).

Protein

Requirements. Proteins are the building blocks for muscle and organ structure. They are key to just about every metabolic process in the body, including energy metabolism, cell-signaling, growth, and immune function. Some dietary proteins are absorbed intact, although the majority are broken down into component amino acids and utilized by the infant to build new proteins to support rapid growth and repair of body cells. The protein requirement for an infant is about 0.8 to 0.9 gram per deciliter (Riordan, 2005).

Milk Composition. Milk proteins are often grouped into whey and casein. Casein is the major phosphoprotein found in milk. It is not easily denatured and is relatively insoluble in water. It is the predominant protein that forms the curds seen when milk interacts with acid or the enzyme renin in the stomach. Whey proteins are the remaining proteins suspended in the liquid portion of milk after curds are formed. Cow’s milk contains a high amount of casein (a low ratio of whey to casein—approximately 20:80) compared with human milk (60:40 whey:casein). Because of its tendency to form curds, milk with high amounts of casein is less easily digested. Cow’s milk-based formulas are usually modified to get closer to the whey:casein ratio of human milk. For example, the whey:casein ratio in Enfamil® is 60:40. Although Similac® has a ratio of 48:52, the company claims this produces an amino acid profile in the blood that is closer to that found in the breastfeeding infant. Carnation Good Start® contains hydrolyzed whey protein, which the company states decreases the incidence of constipation, but which makes comparison difficult (Sears, n.d.). It should also be noted that the whey and casein components in breast milk are not static and change over time to meet the needs of the growing infant. In early lactation, the whey:casein ratio is 90:10. As lactation progresses, the whey:casein ratio in mature breast milk is 60:40. Finally, during late lactation, the whey:casein ratio is 50:50 (Riordan, 2005).

Whey protein in breast milk is composed of five major components: (1) alpha-lactalbumin, (2) serum albumin, (3) lactoferrin, (4) immunoglobulins, and (5) lysozyme. The latter three components are involved in immunologic activities. Breast milk contains many other kinds of proteins as well. These include enzymes, growth modulator, and hormones (Riordan, 2005). The major whey components in cow’s milk-based formula are beta-lactoglobulin and alpha-lactalbumin. The former can trigger allergic reactions in some infants (Groenewald, 1996; Vonlanthen, 1998).

Vitamins, Minerals, and Trace Elements

VITAMINS

Requirements. Vitamins can be grouped into fat-soluble and water-soluble vitamins. The fat-soluble vitamins are vitamins A, D, E, and K and are found in both cow’s milk-based formula and breast milk. Vitamin K is also synthesized in the infant’s intestinal tract by bacteria that are colonized there. After absorption via the lymphatic system, vitamins enter the blood and are transported to the various tissues where they are needed. Excess fat-soluble vitamins are stored in adipose tissue and the liver (Rolfes et al., 2006). Excessive amounts of fat-soluble vitamins may result in toxicity, and there is general agreement that no routine fat-soluble vitamin supplementation is needed with the exception of vitamin D. To prevent rickets the AAP recommends that all infants receive 200 international units of oral vitamin D drops daily during the first 2 months of life, and the infants should continue to take the vitamin supplement until feeding at least 500 mL per day (about 16.6 oz/day) of vitamin D-fortified formula or milk. Most healthy, full-term formula-feeding infants of average birth weight will receive sufficient vitamin D intake before they are 2 months old and, therefore, may not require vitamin D supplementation. However, the breastfeeding infant should continue to take vitamin D until weaned to the recommended minimum 500 mL per day of vitamin D-fortified formula or milk (AAP, 2003).

Milk Composition. Breast milk is naturally low in vitamin D (25 international units per liter or less) and may be of concern particularly among breastfeeding infants who have limited sunlight exposure. Factors that place an infant at high risk for vitamin D deficiency include: having increased skin pigmentation, living in a geographic location where there is little sunlight, having one’s skin consistently covered with clothing or sunscreen, not spending much time outdoors, living in an area that consistently has heavy pollution that blocks sunlight, and having a mother who is vitamin D deficient. Some breastfeeding advocates argue that infants require only a few minutes of sunlight exposure per day to stimulate vitamin D production in their skin to protect them from vitamin D deficiency (Mohrbacher & Stock, 2003). The AAP contends that it is difficult to know what is adequate sunlight exposure for an individual, and it also recommends against direct sunlight exposure of infants (AAP, 2003).

The vitamin B complex and vitamin C are water-soluble vitamins that pass readily from serum to breast milk. However, mothers who follow a strict vegetarian diet or macrobiotic diet may have insufficient vitamin B12 in their milk. In that case the exclusively breastfed infant...
should receive vitamin B<sub>12</sub> supplementation. Formula is fortified with adequate amounts of the water-soluble vitamins to meet the DRI. Unlike fat-soluble vitamins, any excess water-soluble vitamins ingested are simply excreted and the threat of toxicity is low (Lawrence & Lawrence, 2005).

**MINERALS**

*Requirements.* Minerals have diverse regulatory functions throughout the body. For example, calcium is important in the clotting mechanisms; phosphorus is a component in adenosine triphosphate (ATP), deoxyribonucleic acid (DNA), ribonucleic acid (RNA), and phospholipids; calcium and phosphorus are necessary for bone formation; sodium is involved in fluid balance; calcium, sodium, and potassium are needed for nerve and muscle function; chlorine is involved in acid-base balance; cobalt works with vitamin B<sub>12</sub> to form blood cells; copper and iron aid in extracting energy from the citric acid cycle and are also involved in blood production; iodine is needed for thyroid hormone synthesis; and magnesium, manganese, and zinc are needed to help with many enzymatic processes (Thibodeau & Patton, 2005).

Iron is an important mineral required by the body to make hemoglobin and is needed for neurologic function. Neurotransmitters require adequate iron levels to function properly, and, therefore, infants with chronic anemia are at risk for cognitive and developmental delays. Infants deficient in iron may look pale, appear sleepy or tire easily while feeding, and be tachycardic or tachypneic at rest. The infant’s iron status is affected by the amount of iron accumulated in utero, the infant’s diet after birth, and the general health of the infant. The amount of iron transferred to the fetus during the third trimester of pregnancy is influenced by maternal iron status (O’Brien, Zavaleta, Abrams et al., 2003).

*Milk Composition.* Both breast milk and infant formulas contain several major and trace minerals to satisfy the needs of the growing infant. The mineral content of breast milk does not appear to be influenced by maternal diet. The vitamins and minerals among the three formulas being compared are essentially the same, although all generally contain higher levels of minerals than breast milk to compensate for their lower bioavailability.

Much has been written about iron content of breast milk and formula and its bioavailability to the infant. The AAP does not advocate the use of low-iron fortified formulas because of the increased risk for anemia associated with their use (AAP, 1999). Low-iron formula is fortified with only 2 mg of iron per liter compared with “iron-fortified” formula, which is fortified with 12 mg of iron per liter. It should be noted that the iron concentration in breast milk is 0.5 to 1 mg per liter, which is considerably lower than in iron-fortified formulas. However, the iron in breast milk is much more completely absorbed—the infant receiving breast milk absorbs 50% to 80% of the iron in breast milk compared with less than 12% of the iron in formula. Researchers continue to study iron nutrition to determine the best level of iron fortification in infant formula. Healthy term infants with normal birth weights receiving breast milk or an iron-fortified infant formula during the first 5 to 6 months of life are unlikely to develop iron-deficiency anemia because these infants have sufficient iron stores to sustain them until they start solid feedings in the second half of the first year of life (Riordan, 2005).

Nurses have a responsibility to educate parents who have a misconception that infants fed iron-fortified formula are likely to have constipation. The iron added to formula is in an ionic form and does not cause constipation (Katz, Levin, Cotton et al., n.d.). The casein in formula (which is different from the casein in breast milk) creates large, rubbery curds that are slow to metabolize and have been associated with constipation in formula-fed infants. In addition, there is evidence that palm olein oil (an additive to some formulas) also may contribute to constipation. Palm olein oil is added to some formulas to provide palmitic acid in an attempt to match the natural palmitic acid profile in breast milk. However, the chemical arrangements are different. Palmitic acid derived from olein oil is poorly absorbed. The unabsorbed palmitic acid in formula reacts with calcium to create insoluble soaps during digestion. Research reveals that there is a correlation between the amount of insoluble soap present and the hardness of the stools (Lloyd, Halter, Kuchan et al., 1999).

**TRACE ELEMENTS**

New additives to formulas not yet mentioned include nucleotides (building blocks for DNA and RNA that appear to enhance the immune system, among other things), carnitine (derived from the amino acid lysine and functioning in part to transport fatty acids to the mitochondria for oxidation), and taurine (a conditionally essential nonprotein sulfur amino acid with a number of functions, including a role in growth, and in central nervous system (CNS) and auditory function development). There are many other breast milk components not yet duplicated in formula (and many will never be because of the cost). Also, not all components in breast milk have been identified. In general, though, formula companies are always striving to improve their products to develop the best “humanized” milk possible. There is no question that formulas today are far superior to formulas from the past.

**Specialty Formula**

If an infant has medical problems related to inability to metabolize components of breast milk or standard formula, or if the parents are vegans, the family should consult with the baby’s healthcare provider to discuss the issue of supplements or switching their infant to another infant formula.

Soy protein-based formulas (e.g., Enfamil Prosobee LIPIL®, Isomil®, Isomil Advance®, Isomil DF®, and Good
Start Supreme Soy® do not contain any bovine protein or lactose. Soy protein-based formulas use a soy protein harvested from soybeans and supplemented with methionine (an essential amino acid), carnitine, and taurine. Because soy protein-based formulas do not contain lactose, the formula is usually sweetened with corn syrup or sucrose. The latter may cause dental decay after teeth have erupted. Phytates present in soy formulas decrease the absorption of iron, calcium, and zinc, so greater concentrations of minerals and vitamins are added to soy formulas.

Soy protein-based formula is not intended as a first-choice formula except for infants with primary lactase deficiency or galactosemia and for term infants of formula-feeding vegan parents. The AAP Committee on Nutrition (1998) recommends against the use of soy protein-based formula for preterm infants who weigh less than 1800 grams or infants with renal failure because of the high aluminum level in soy formulas. Breast milk contains 4 to 65 ng/mL of aluminum; soy protein-based formulas contain 600 to 1300 ng/mL.

The AAP states that the “isolated soy protein-based formulas are safe and effective alternatives to provide appropriate nutrition for normal growth and development” for term infants whose nutritional needs are not being met from breast milk or cow’s milk-based formulas. However, there is no advantage to using soy protein-based formula over cow’s milk-based formula as a supplement for breastfeeding babies. According to the AAP (1998), there is no proof that soy protein-based formula will prevent or lessen the symptoms of colic or prevent atopic disease, and infants who have a sensitivity to cow’s milk protein may have a sensitivity to soy protein as well. Therefore, the AAP does not recommend routinely switching an infant from cow’s milk-based formula to soy-based formula (AAP, 1998).

Infants with an allergic response to standard formulas may require a hypoallergenic “hydrolysate” formula. Hydrolyzed formulas (i.e., Nutramigen®, Alimentum®, and Pregestimil®) are sometimes referred to as “predigested” formulas because the dietary proteins have been broken down in a process that mimics digestion (hydrolysis). The simple protein compounds are usually too small to be recognized by the infant’s immune system as an antigen, thereby decreasing the infant’s allergic response. These formulas are also used in infants who have difficulties with normal digestion or absorption.

The other group of hypoallergenic formulas is the elemental amino acid-based formulas, such as Neocate® and Elecare®. The proteins in these formulas have been completely broken down to their amino acid constituents. These formulas are the most hypoallergenic formulas available and virtually eliminate the possibility of allergic reaction. They are intended for severely allergic infants with multiple dietary protein intolerances or infants with severe absorption disorders.

Other specialized formulas are intended for infants with particular medical conditions and should be fed to infants only under a physician’s supervision. There are specific specialized formulas intended for infants born prematurely to promote rapid growth. There are other specialized formulas for infants with heart disease, kidney disease, malabsorption syndromes, metabolic diseases, and allergies. These formulas vary in caloric content, nutrient composition and ingredients, digestibility, taste/odor, and cost.

**After the First Year**

Parents frequently ask when their child can begin feeding cow’s milk or soy milk (whole milk, low-fat, or skim). Parents need to be informed that it is recommended that the infant receive breast milk or formula for 12 months, before weaning to whole milk. The protein content in cow’s milk is markedly higher than both breast milk or modified cow’s milk used for formulas and is much less easily digested. The high alpha-casein content in cow’s milk also decreases iron absorption. Therefore, cow’s milk is a poor source for iron. Some infants experience microscopic gastrointestinal bleeding while on cow’s milk and this can further lead to anemia. Cow’s milk, compared with breast milk or formula, has higher levels of calcium, phosphorus, sodium, and potassium, which increase the renal solute load and result in greater obligatory water loss. It is also deficient in vitamin C, zinc, and essential fatty acids. When switching to cow’s milk at 12 months the infant should start off on whole milk. Low-fat milk and skim milk lack adequate calories, fat content, and essential fatty acids necessary for proper neurologic development. Nutritionists advise waiting until a toddler is 2 years of age to give low-fat milk (2% or 1% milk) or skim milk, and then only provided the child is growing well.

**CHOICE OF FEEDING: BREAST VERSUS BOTTLE**

**The Evolution of Formula**

Finding an acceptable breast milk substitute following maternal death, infant abandonment, low milk supply, and other situations has been a challenge for centuries. Although there are no written records describing infant feedings from ancient times to the Renaissance period, there is physical evidence of societies using alternative feedings dating back to 2000 BC. Throughout Europe spouted feeding cups and other feeding receptacles have been found in the graves of infants. Records from written works show that from 1500 to 1700, “wet nurses” (a lactating woman whose purpose of employment was to nurse another woman’s infant, sometimes abandoning her own infant to gain employment) were hired at foundling homes (orphanages) and by wealthy European women, because it was customary for noblewomen to delegate all physical work, including infant care (Lawrence & Lawrence, 2005).

By the 19th century wet-nursing was falling out of favor, and “dry-nursing” was attempted. Dry-nursing is the practice of feeding an infant milk obtained from another mammal (goats, cows, mares, donkeys, etc.) (Schuman, 2003). Cow’s milk was most commonly used because of its availability, not because it was closer in composition to human milk. This practice was used in foundling homes and was associated with very high infant mortality (Lawrence & Lawrence, 2005).

Recognizing the need for an improved alternative breast milk substitute, a few physicians continued attempts to develop a “humanized” animal milk substitute. In the late 1830s, a Ger-
man scientist published a report of the content of human milk and cow’s milk. This served as the basis for a number of “formulas” for modifying cow’s milk to make it more like human milk. Around the 1860s, the first commercially available baby food and infant formula was developed in Europe and became available in the United States by the 1870s. The first formula was comprised of only malt, cow’s milk, and wheat flour and required reconstitution with water (Schuman, 2003). Between 1860 and 1920 there were additional scientific discoveries that contributed to overall infant survival among nonbreastfeeding infants. These included the discovery of the germ theory and subsequent development of pasteurization of milk, the invention of the bottle and rubber nipple to replace feeding devices that required skill to use and were difficult to clean, and the invention of the “ice box” to refrigerate the baby milk (Baumslag & Michels, 1995).

Two of the biggest commercial advances in milk science were the invention of sweetened condensed milk in the 1830s and evaporated milk in 1883. Condensed milk was made by boiling milk and permitting it to evaporate to one-fourth its original volume, and then adding 6 ounces of sugar per pint to the milk as a preservative (Baumslag & Michels, 1995). The invention of sweetened condensed milk and evaporated milk meant that for the first time in history, a family did not have to have access to a cow in order to feed their infant milk (if not breastfeeding). From evaporated milk, a home-made evaporated milk formula recipe was created and made available to the public. The evaporated milk formula was a simple mixture of evaporated milk, water, and sugar or corn syrup. The evaporated milk formula gained acceptance because it was affordable, widely available, and appeared to support growth equal to that of breastfed infants. It is estimated that by 1960 about 80% of bottle-fed infants were being fed with evaporated milk formula and given supplements of vitamins and iron. However, poor infant outcomes were still being observed.

In the 1960s proprietary commercial formulas began to gain acceptance because parents were impressed with the advances in science and wanted to raise their children scientifically “by the book.” Using formula seemed to be a progressive idea to embrace. By this time more and more women were working outside the home than ever before. “Modern women” saw formula use as more convenient than breastfeeding. Formula companies appealed to these women. In addition to a changing social climate in America, advances in agriculture created a surplus of cow’s milk and offered a new marketing opportunity for global commercialization of formula (Baumslag & Michels, 1995).

Artificial baby milk that was originally intended as a life-saving product for extreme situations was now being aggressively marketed as a food for all infants. To this end formula companies began an aggressive marketing campaign. One of their marketing tactics was to provide free formula to hospitals, enabling hospitals to phase out their formula preparation rooms. Mothers viewed commercial formula as an acceptable breast milk substitute that appeared to have medical endorsement, it was easy to use and affordable, and it freed her up to do other things such as work outside the home. By 1972, formula use peaked and breastfeeding rates in the United States plummeted (only 25% of women were breastfeeding at hospital discharge) (Schuman, 2003). Again, the public was led to believe that commercial formula was as good as, if not better than, breast milk.

Research efforts beginning in the 1970s showed that breast milk was unquestionably superior to evaporated milk and proprietary infant formulas as evidenced by a significant rise in infant morbidity and mortality, especially in developing countries (Baumslag & Michels, 1995). The revelation of the research findings from the 1970s up to the present has led to a resurgence in breastfeeding. By 2003, 66% of mothers in the United States were breastfeeding at hospital discharge. However, only 33% of infants were still receiving some breast milk at 6 months of age (Ross Products Division, 2004).

Over the last 50 years or so, considerable time, effort, and money have been allocated to the development of commercial infant formulas in an attempt to better imitate the content and performance of human milk. In 1954, the executive board of the AAP established a Committee on Nutrition to set the standards for nutritional requirements and feeding practices for infants, children, and adolescents. This committee makes recommendations for nutritional requirements in infant formulas to the federal FDA. In 1971 the FDA created the first regulation for commercial formula, which established minimum requirements for fat, protein, linoleic acid, and vitamins and minerals (Schuman, 2003). In 1980 Congress passed the Infant Formula Act, which was later amended in 1986. The safety and nutritional quality of formula are now significantly regulated.

Although breastfeeding is increasing in popularity, formula-feeding continues to be a viable and nurturing choice, particularly in developed countries, and meets the goal of successful growth of the baby. The closeness and warmth that can occur during breastfeeding is also an integral part of formula-feeding. An advantage of formula-feeding is that parents can share equally in this nurturing, caring experience with their baby.

**Advantages of Breast Milk**

In its breastfeeding policy statement, the AAP recommends exclusive breastfeeding as the preferred feeding for all infants, with a few exceptions, for the first 6 months and continued breastfeeding during the introduction of solids until the infant is 12 months old or older, as desired. There is overwhelming scientific evidence that shows that breastfeeding provides newborns and infants with specific nutritional, immunologic, and psychosocial advantages over formula-feedings (AAP, 2005).

**NUTRITIONAL ADVANTAGES**

Human milk provides optimum nutrition for the human infant because it is species specific. The macronutrients such as protein, fat, and carbohydrates (lactose) are synthesized by the mother in the alveoli of the breasts by specialized secretory cells. Micronutrient elements such as vitamins and minerals derive from the circulating maternal plasma. There are more than 200 distinct components in breast milk, with more remaining to be identified (Lawrence & Lawrence, 2005).

As noted earlier, lactose is the primary carbohydrate in mammalian milk and plays a crucial role in the nourishment of
Lactose intolerance is defined as a “deficiency of the intestinal mucosa heals. Following a severe bout of diarrhea, transient lactose intolerance: (1) congenital lactose deficiency, (2) secondary lactose intolerance, and (3) developmental or acquired lactose intolerance (Marks, 2003).

Congenital lactase deficiency is common in premature infants because of inability to produce the enzyme lactase until they have matured, but it is exceedingly rare in term infants, with fewer than 50 cases known (Jarvela, Sabri, Kokkonen et al., 1998). Secondary lactose intolerance occurs as a result of damage to the mucosal lining of the small intestine, where the lactase enzyme is produced. Any condition that causes gastroenteritis, especially if prolonged, can create this condition. Following a severe bout of diarrhea, transient lactose intolerance may persist for a brief time until the brush border of the intestinal mucosa heals.

The most common cause of lactose intolerance is developmental or acquired. Many parents will assume that their infant has lactose intolerance because they or the child’s older sibling has lactose intolerance. However, this is an age-related condition that develops after 2 to 5 years of age and therefore not a common condition affecting newborns. Its prevalence and onset varies by ethnicity. Nearly 100% of Asians, 80% to 100% of Native Americans, up to 80% of African Americans and Latinos,
and up to 20% of American Caucasians acquire lactose intolerance during their lifetime (Marks, 2003; Swagerty, Walling, & Klein, 2002).

Infants with symptoms similar to those of lactose intolerance are more likely to be reacting to cow’s milk protein (mostly because of the beta-lactoglobulin component in cow’s milk) or to some other antigen. This can occur even with exclusively breastfed infants who are allergic to bovine protein, as some of the cow’s milk protein antigens consumed by the mother can pass into her breast milk. Elimination of the antigen from the mother’s diet may resolve the problem.

Approximately 98% of the human milk fat is in the form of triglycerides, and a very small but clinically significant amount is from cholesterol. Some researchers believe that the cholesterol in breast milk may play a role in myelination and neurologic development. Cholesterol levels in breast milk may also stimulate the production of enzymes that lead to more efficient metabolism of cholesterol, thereby reducing its harmful long-term effects on the cardiovascular system (Biancuzzo, 2003).

Fatty acids are another key component to brain development. Prenatally, fatty acids transfer across the placenta. Postnatally, they are obtained from the diet. Omega-3 and omega-6 fatty acids are two classes of essential fatty acids found in breast milk, although the level can vary with maternal diet. Fish is a rich source of these kinds of fatty acids.

DHA and ARA are LCPUFAs derived from linoleic acid and α-linolenic acid. They are major components of the cell membranes of the retina, brain, and other neural tissues. Along with oleic acid, these LCPUFAs are needed for myelination of the spinal cord and other nerves, and they have an impact on visual acuity and cognitive and behavioral functions. Since 2002 some infant formulas have been supplemented with DHA and ARA. However, breast milk still contains 167 other fatty acids of uncertain function and that are absent from formula (Lawrence & Lawrence, 2005). It seems reasonable that many of these will turn out to be important as well.

Another advantage of breast milk is that its composition varies according to gestational age and stage of lactation. For example, the milk of a mother who delivers a preterm infant has a greater concentration of DHA and ARA than does the milk of a mother who gives birth to a full-term infant. Babies born prematurely miss receiving the continuous placental transfer of DHA and ARA while developing during the third trimester. By receiving breast milk, these preterm infants receive the increased concentrations of DHA and ARA intended for the preterm infant (Lawrence & Lawrence, 2005).

Breast milk provides newborns with minerals in more appropriate doses than do formulas (Blackburn, 2003). As mentioned earlier in this chapter, the iron found in breast milk, even though much lower in concentration than that of prepared formulas, is much more readily and fully absorbed and appears sufficient to meet the infant’s iron needs for the first 6 months. Additional iron that is not absorbed may increase the growth of pathogenic bacteria as well as cause cellular oxidative injury. In addition, formula does not contain lactoferrin, an iron-binding protein that scavenges iron in the gut and enhances its absorption (Lawrence & Lawrence, 2005).

There is research supporting additional health advantages for the breastfed infant. Breastfed infants have a reduced risk of developing type 1 or type 2 diabetes mellitus, lymphoma, leukemia, Hodgkin’s disease, obesity, hypercholesterolemia, and asthma. Finally, the mother who breastfeeds has health advantages as well. After delivery there is decreased postpartum bleeding and more rapid uterine involution. The breastfeeding mother also burns additional calories making milk (quicker return to prepregnancy weight), has a decreased risk of developing breast cancer and ovarian cancer, and may have a decreased risk of developing postmenopausal osteoporosis (AAP, 2005).

IMMUNOLOGIC ADVANTAGES

The immunologic advantages of breast milk include varying degrees of protection from respiratory tract and gastrointestinal tract infections, necrotizing enterocolitis, urinary tract infections, otitis media, bacterial meningitis, bacteremia, and allergies (AAP, 2005). Transplacental passage of maternal immunoglobulin gradually diminishes over the first 6 months of life until the infant can begin to produce his or her own immunoglobulins. Breast milk-derived immunologic protection helps supplement this protection.

Secretory IgA, an immunoglobulin present in colostrum and breast milk, has antiviral, antibacterial, and antigenic-inhibiting properties, specifically across mucosal surfaces such as the intestinal tract. Secretory IgA plays a role in decreasing the permeability of the small intestine to help prevent large protein molecules from triggering an allergic response. Other constituents of colostrum and breast milk that act to inhibit the growth of bacteria or viruses are Lactobacillus bifidus, lysozymes, lactoperoxidase, lactoferrin, transferrin, and various immunoglobulins (Biancuzzo, 2003).

Some mothers wonder if there are special considerations for breastfed infants regarding immunizations, in particular the oral polio virus (OPV) vaccination because it is a live virus vaccine. These mothers worry that their antibodies will inactivate the live polio virus. The CDC recommends that all babies be on the same schedule; there is no indication for withholding breastfeeding in relationship to OPV administration, and no extra doses of the vaccine are indicated. Furthermore, breastfed babies actually have better antibody responses to parenteral and oral vaccines than formula-fed infants (Lawrence & Lawrence, 2005).

PSYCHOSOCIAL BENEFITS OF BREASTFEEDING

The psychosocial advantages of breastfeeding are primarily those associated with maternal-infant attachment. For some mothers the attachment process begins when the decision to become pregnant is made. The hormonal changes associated with pregnancy strengthen that bond. Events that occur during pregnancy, such as hearing the fetal heart beat, feeling the fetus move within her, and watching her abdomen grow bigger, further promote the bonding. At delivery there may be intense bonding. For other mothers bonding develops over the next few days (Lawrence & Lawrence, 2005). Some hospital practices inadvertently interfere with the attachment process. Rooming-in and breastfeeding have been shown to increase maternal-infant attachment.
When a mother chooses to breastfeed, she often has more frequent direct skin-to-skin contact with her infant than if she were bottle feeding (bottle-feeding parents should be encouraged to have frequent skin-to-skin contact too, however). Infants with skin-to-skin contact have greater physiologic stability, cry less, sleep longer, and tend to breastfeed better. The newborn’s sense of touch is highly developed at birth and is a primary means of communication. The tactile stimulation associated with breastfeeding can communicate warmth, closeness, and comfort. The increased closeness provides both newborn and mother with the opportunity to learn each other’s behavioral cues and needs. Mothers may feel more affectionate toward their newborns, have improved let-down response while pumping, and breastfeed more frequently and for longer periods of time (Klaus, 1998; Mohrbacher & Stock, 2003).

The mother who breastfeeds has a different hormonal state compared with the mother who does not breastfeed. Prolactin levels double each time the infant suckles at the breast, regardless of the age of the infant or duration of lactation (Biancuzzo, 2003). If a mother does not stimulate her breasts by breastfeeding or pumping, her prolactin levels return to prepregnancy levels by 14 days postpartum (Lawrence & Lawrence, 2005). Prolactin increases feelings of relaxation and euphoria (Biancuzzo, 2003). Oxytocin levels also increase with breastfeeding. Oxytocin produces feelings of relaxation and sleepiness, heightens responsiveness and receptivity toward the infant, and increases the frequency of nurturing behaviors (Lawrence & Lawrence, 2005).

Another psychologic advantage to the breastfeeding mother is satisfaction derived from the knowledge that she is providing her infant with the optimal nutritional start in life. For many mothers breastfeeding takes effort, understanding, and an emotional commitment to endure the demands of this lifestyle choice. The mother’s sense of accomplishment in being able to satisfy her baby’s needs for nourishment and comfort can be a tremendous source of personal satisfaction.

There are significant cost savings for the family who chooses breastfeeding. The cost of standard formula is approximately $1,200 annually per infant. There are also healthcare cost savings for families resulting from the decreased incidence of illness in the infant. Because breastfed babies access healthcare resources less often, the family saves money on medical visits and prescription medications and loses less time from work.

Potential societal benefits to breastfeeding include decreased spending on public assistance programs (e.g., Women Infant Children Supplemental Nutrition Program [WIC]), and environmental benefits in terms of use of natural resources and solid waste disposal. Breastfeeding is not dependent on modern technology and can provide the infant with a fresh, clean, naturally warm source of nutrition independent of transportation, supply, electricity, refrigeration, clean water, bottles, nipples, and so on. There are also substantial medical cost savings to society, estimated to be approximately $400 in excess medical costs per never-breastfed infant (Ball & Wright, 1999). With current breastfeeding initiation rates of approximately 66%, this amounts to an additional $544 million per year in potential healthcare costs that could be saved by breastfeeding.

### Potential Disadvantages and Contraindications to Breastfeeding

#### DISADVANTAGES

Following is a list of sometimes cited potential disadvantages to breastfeeding:

1. **Pain with breastfeeding.** Breastfeeding is a natural process but requires a certain knowledge base that formerly was passed on from generation to generation. With the decline in the extended family structure, this source of knowledge and assistance is often missing for the new mother. Nipple tenderness is the most common source of discomfort and is usually related to improper positioning and/or not obtaining a proper attachment of the infant on the breast. Pain can also be related to engorgement or infection. Breastfeeding with proper technique should not hurt and these mothers should be encouraged to seek assistance from a knowledgeable person skilled in lactation.

2. **Leaking milk.** Some women will leak milk when their breasts are full and it is nearly time to breastfeed again or whenever they experience “let-down,” which can be triggered by hearing, seeing, or even thinking of their babies. If this causes concern to the mother, she can be instructed on how to apply gentle pressure directly over her nipple for a minute or so to stop the leaking momentarily. The use of nursing pads (with instructions to change wet pads frequently), wearing printed tops that camouflage small leaks, and reassurance that the problem lessens with time may help alleviate this problem.

3. **Embarrassment.** Some mothers feel uncomfortable about breastfeeding because the mother is modest, or the mother may feel embarrassed because our society views breasts as sexual objects, and/or an unfriendly social environment makes it difficult to breastfeed in public. This is not an easy issue to overcome. Some mothers will feel some reassurance after learning how to breastfeed discreetly while in public.

4. **Stress.** Finding time and feeling tied down to the demands of breastfeeding can be stressful, especially for the mother attending school or working outside of the home. This is a common reason mothers cite for weaning their infant prematurely. Mothers can be offered the option to decrease the frequency of pumping rather than quitting altogether. Of course this will decrease the mother’s milk supply, but there are numerous studies showing that babies who receive some breast milk are still healthier than babies who do not receive any breast milk at all.

5. **Unequal feeding responsibilities/fathers left out.** Some parents want feedings to be a shared responsibility. The parents should be informed that it is advisable for the father to wait to bottle feed the baby with expressed breast milk until after breastfeeding is established. In the meantime, encourage the father to be supportive of the
breastfeeding mother, to have a lot of skin-to-skin contact with his infant, and to share the responsibilities of all other aspects of infant care (bathing, dressing, diapering, burping, rocking, etc.).

6. Diet restriction. Some mothers think that they have to give up eating certain foods when they breastfeed. This is, for the most part, a myth. Generally, mothers can still eat all the foods they are accustomed to eating. There are rare instances in which some infants are intolerant to something in the mother’s milk. The most common problem comes from dairy products. In this case switching to cow’s milk-based formula will not help as the infant will react to the cow’s milk proteins in the formula. Often these infants will have cross-reaction to other types of proteins and will not tolerate soy-based formulas either. These babies may need to be on an expensive specialty formula such as a “predigested” hydrolysate formula if the mother quits breastfeeding. Again, this is not a common problem, but when it comes up, it is advisable to refer the mother to a lactation consultant for its management.

7. Limited hormonal birth control options. Some mothers think that they cannot use a hormonal method of birth control while breastfeeding. Mothers should be informed that using birth control pills containing progesterone and estrogen can cause a decrease in milk volume and may affect the quality of breast milk. It is preferred that the mother who wants to use a hormonal birth control method consider using the progestin-only minipill (i.e., Micronor®, Nor-QD®, Aygestin®, or Norlutate®); receive Depo-Provera®, a progestin-only injection administered every 90 days; or have a progestin-only implant. Although progestin-only hormonal birth control is compatible with lactation, they should not be started at the time of discharge. It is recommended that the mother wait 6 to 8 weeks before taking the hormonal medication to ensure a good milk supply (ACOG, 2000). Mothers can be reassured that barrier methods of birth control and natural family planning do not interfere with lactation at all and are good options to consider as well.

8. Vaginal dryness associated with breastfeeding. Some mothers experience vaginal dryness related to a low level of estrogen while lactating. Mothers can be given reassurance that this is only a temporary side effect while breastfeeding. A water-based lubricant such as K-Y® jelly or Astroglide® can be used during intercourse until she weans and estrogen levels increase again.

9. Medications and breastfeeding. Some mothers are concerned about the safety of breastfeeding while they are taking medications. Mothers can be reassured that most prescription and over-the-counter medications are safe for the breastfeeding infant. However, the mother needs to inform her healthcare provider and her infant’s healthcare provider that she needs to take a medication for a period of time. The healthcare provider has a responsibility to research the medication, look at alternatives if indicated, and inform the mother whether the medication is compatible with breastfeeding. If the medication is not compatible with breastfeeding but is needed for only a short time, the mother can use a breast pump to maintain lactation and discard the milk. For additional information on medications and their compatibility with breastfeeding, see the list of resources at the end of the chapter.

POTENTIAL CONTRAINDICATIONS

There are some instances when breastfeeding is or may be contraindicated:

- Mother who is positive for the human immunodeficiency virus (HIV) or has acquired immunodeficiency virus syndrome (AIDS) is counseled against breastfeeding except in countries where the risk of neonatal death from diarrhea and other disease (excluding AIDS) is high (Jackson, Chopra, Witten et al., 2003).
- Mother uses illicit drugs (e.g., cocaine, heroin).
- Mother is an alcoholic.
- Maternal smoking can result in breastmilk concentrations of nicotine of 1.5 to 3 times the maternal plasma concentration. Although there is no documented infant health risk related to breastfeeding and smoking, smoking cessation is urged for maternal health reasons (Thureen, Deacon, Hernandez et al., 2005).
- Specific medications (e.g., radioactive isotopes, antimetabolites, chemotherapy drugs, and a few others). A mother with a diagnosis of breast cancer should not breastfeed so that she can begin treatment immediately.
- Mother has active, untreated tuberculosis.
- Infant has galactosemia.
- Mother has active herpes on her breast—the infant may still feed on the unaffected side only until the lesion has healed.
- Mother has varicella.
- Mother is human T-cell leukemia virus type 1–positive (HTLV1).
- Mother has another illness, on a case-by-case basis.

In addition concern is expressed about whether women with breast implants should breastfeed or are able to breastfeed. Some research on breast augmentation using the periareolar approach suggests increased incidence of lactation insufficiency (inadequate expressed milk volume and/or infant growth). Factors that may influence the ability of a mother with breast augmentation to breastfeed include: the surgical approach used, alterations in nipple sensation, amount of breast tissue present, and lack or little breast changes during pregnancy with little or no postpartum engorgement (Hill, Wihelm, Aldag et al., 2004).

Another concern is related to the possible toxicity of the silicone in some breast implants. The silicone concentrations in formula and cow milk is higher than that found in the milk of mothers with implants; therefore, silicone breast implants are not a contraindication to breastfeeding (Thureen et al., 2005).
MEDICATIONS

It has long been recognized that medications taken by the breastfeeding mother may penetrate breast milk to some degree. Over the past 20 years, numerous studies have been published providing a better understanding of the kinetics of drug entry into breast milk, as well as factors influencing its bioavailability to the nursing infant. Understanding medications in breast milk and the implications to the infant is important, because use of medication has been identified as a barrier to breastfeeding and a major reason women cite for discontinuing it (Hale, 2004).

It should be noted that although most drugs penetrate into breast milk to some degree (usually less than 1% of the maternal dosage), very few drugs are contraindicated for breastfeeding women. (See the reference list at the end of the chapter for resources on medications in breast milk) (AAP Committee on Drugs, 2001; Briggs, Freeman, & Yaffe, 2005; Hale, 2004; and Lawrence & Lawrence, 2005).

Characteristics of a drug that influence its passage into breast milk include the following:

1. **Degree of protein binding.** Unbound drugs are more likely to enter the breast milk.
2. **Degree of ionization.** Drugs tend to cross into breast milk in un-ionized form.
3. **Molecular weight.** Drugs with lower molecular weight are more likely to cross.
4. **Degree of solubility in fat and water.** Lipid-soluble drugs pass more easily into breast milk across the alveolar epithelium, although all drugs pass more easily during the initial days postpartum when there are larger gaps between the alveolar epithelial cells.
5. **Mechanism of transport.** Most drugs enter breast milk by simple diffusion, but occasionally active transport or carrier-mediated diffusion may be involved.
6. **The pH.** Breast milk, which is acidic, attracts drugs that are weak bases.
7. **Half-life.** Rates of absorption, metabolism, and excretion determine a drug’s half-life, or how fast it leaves the body. The longer the half-life, the greater the risk of accumulation in breast milk.

The net measurement of these effects determines the milk/plasma ratio, which relates the concentration of the drug in the breast milk to the concentration in the maternal plasma. For drugs that have equivalent dosing levels for the mother and equivalent safety profiles in the infant, it is preferable to use the drug with a lower milk/plasma ratio. Also, for any particular drug, it is preferable to use the lowest effective dose in the mother. Finally, the route and timing of the maternal dosing affects the maternal plasma level and therefore also the amount of drug seen by the baby.

The mother should be advised to inform her healthcare provider that she is breastfeeding when a drug is prescribed for her. In counseling the breastfeeding mother, the healthcare provider should weigh the benefits of the medication against the possible risk to the infant and its possible effects on the breastfeeding process. The potential risk to the infant must also be weighed against the effect of interrupting breastfeeding. Table 31–2 compares several factors for parents to consider when choosing between breastfeeding and formula-feeding.

THE FEEDING PROCESS

Breast Milk Production

**BREAST ANATOMY**

The female breast is divided into 15 to 20 lobes, separated from one another by fat and connective tissue, and interspersed with blood vessels, lymphatic vessels, and nerves. These lobes are subdivided into lobules composed of small units called alveoli where milk is synthesized by the alveolar secretory epithelium. The lobules have a system of lactiferous ductules that join larger ducts and eventually open onto the nipple surface. Mothers are often surprised to see milk coming out of multiple nipple pores when they express their milk. See Figure 31–1 to view the anatomy of the breast.

**LACTOGENESIS**

During pregnancy, increased levels of estrogen stimulate breast duct proliferation and development, and elevated progesterone levels promote the development of lobules and alveoli in preparation for lactation. Prolactin levels rise from approximately 10 ng/mL prepregnancy to 200 ng/mL at term. However, lactation is suppressed during pregnancy by elevated progesterone levels secreted by the placenta. Once the placenta is expelled at delivery, progesterone levels fall and...
the inhibition is removed, triggering milk production. This occurs whether the mother has breast stimulation or not. However, if by the third or fourth day breast stimulation is not occurring, prolactin levels begin to drop. By 2 weeks postpartum, prolactin levels will be back to prepregnancy levels and milk production will cease.

### PHYSIOLOGIC CONTROL OF BREASTFEEDING

Initially, lactation is under endocrine control. The hormone prolactin is released from the anterior pituitary in response to breast stimulation from suckling or the use of a breast pump. Prolactin stimulates the milk-secreting cells in the alveoli to produce milk, then rapidly drops back to baseline. If more than

<table>
<thead>
<tr>
<th>Table 31–2 COMPARISON OF BREASTFEEDING AND FORMULA-FEEDING</th>
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<tbody>
<tr>
<td><strong>Breastfeeding</strong></td>
</tr>
<tr>
<td><strong>Infant Nutrition</strong></td>
</tr>
<tr>
<td>Species specific. An ideal balance of nutrients, efficiently absorbed. High bioavailability of iron leaves lower iron for bacterial growth, cell injury.</td>
</tr>
<tr>
<td>Composition varies according to gestational age and stage of lactation, meeting changing nutritional needs.</td>
</tr>
<tr>
<td>Long-term decreased incidence of gestational age and stage of lactation, meeting changing nutritional needs.</td>
</tr>
<tr>
<td>Contains unsaturated fats. Infants determine the volume of milk consumed. Frequency of feeding is determined by infant cues. May feed more frequently as milk digestion is faster.</td>
</tr>
<tr>
<td><strong>Immunologic Properties</strong></td>
</tr>
<tr>
<td>Contains immunoglobulins, enzymes, and leukocytes that protect against pathogens. Nutrients promote growth of Lactobacillus, protective bacteria. Lower rates of urinary tract infections, ctitis media, and other infectious diseases. Anti-infective properties present in the milk permit longer storage duration. Breast milk is hypoallergenic, with minimal risk of protein allergy/intolerance.</td>
</tr>
<tr>
<td><strong>Maternal Health</strong></td>
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<tr>
<td>Faster return to prepregnancy weight.</td>
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<tr>
<td>Breastfeeding associated with lower risk of breast, ovarian cancer.</td>
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<tr>
<td><strong>Psychosocial Aspects</strong></td>
</tr>
<tr>
<td>Skin-to-skin contact enhances bonding. Hormones of lactation promote maternal feelings and sense of well-being. The value system of modern society can create barriers to successful breastfeeding. Some mothers may feel ashamed or embarrassed. Breastfeeding after returning to work may be difficult.</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
</tr>
<tr>
<td>Healthy diet for mother. Savings for infant medical costs: approximately $400 average in first year of life. Ancillary costs: nursing pads, nursing bras. A breast pump may be needed. Refrigeration is necessary for storing expressed milk.</td>
</tr>
<tr>
<td><strong>Convenience</strong></td>
</tr>
<tr>
<td>Milk is always the perfect temperature. No preparation time is needed. The mother must be available to feed or will need to provide expressed milk to be given in her absence. If she misses a feeding, the mother must express milk to maintain lactation. The mother may experience slight discomfort in the early days of lactation.</td>
</tr>
</tbody>
</table>
vitamin B6 deficiency, history of previous breast surgery, insufficiency, polycystic ovary syndrome, retained placenta fragments, called autocrine control. This process is key to understanding emptied, the lower the level of FIL and the faster milk is produced. On the other hand, the more often the breasts are breast for a longer period of time, the more milk production is negative feedback loop. FIL is present in breast milk and functions whey protein called feedback inhibitor of lactation (FIL) has 10 ng/mL (Neville, 1999) yet milk production continues. A milk high in protein and low in fat (1% to 2%). This is milk that has trickled down from the alveoli between feedings to fill the lactiferous ducts. It is low-fat milk because the fat globules made in the alveoli stick to each other and to the walls of the alveoli and do not trickle down. In addition to prolactin release, stretching of the nipple and compression of the areola signal the hypothalamus to trigger the posterior pituitary gland to release oxytocin. Oxytocin acts on the myoepithelial cells surrounding the alveoli in the breast tissue to contract, ejecting milk, including the fat globules present, into the ducts. This process is called the milk-ejection reflex, better known in lay terms as the “let-down” reflex. The average initial let-down response occurs about 2 minutes after an infant begins to suckle, and there will be 4 to 10 let-down responses during a feeding session. The milk that flows during let-down is called hindmilk. As noted, hindmilk is rich in fat (can exceed 10%) and therefore high in calories. In a sample of expressed breast milk, the average total fat concentration is about 4% and the total caloric content is about 20 calories/ounce.

By 6 months of breastfeeding prolactin levels are only 5 to 10 ng/mL (Neville, 1999) yet milk production continues. A whey protein called feedback inhibitor of lactation (FIL) has been identified as influencing milk production through a negative feedback loop. FIL is present in breast milk and functions to decrease milk production. The more milk that remains in the breast for a longer period of time, the more milk production is decreased. On the other hand, the more often the breasts are emptied, the lower the level of FIL and the faster milk is produced. This mechanism of regulating milk at the local level is called autocrine control. This process is key to understanding how a mother maintains or loses her milk supply (Edgar, 2005).

There are a number of factors that can delay or impair lactogenesis. Maternal factors include cesarean birth, postpartum hemorrhage, diabetes type 1, untreated hypothyroidism, obesity, polycystic ovary syndrome, retained placenta fragments, vitamin B6 deficiency, history of previous breast surgery, insufficient glandular breast tissue, and significant stress (Mohrbacher & Stock, 2003; Riordan, 2005). Other factors that can interfere with breastfeeding include smoking and use of alcohol and some prescription and over-the-counter medications (e.g., antihistamines, combined birth control pills).

**STAGES OF HUMAN MILK**

During the establishment of lactation there are three stages of human milk: colostrum, transitional milk, and mature milk.

**Colostrum** is the initial milk that begins to be secreted during midpregnancy and is immediately available to the baby at delivery. It provides the infant with all the nutrition required until the mother’s milk becomes more abundant in a few days. No routine supplementation of other fluids is necessary unless there is a medical indication. Colostrum is a thick, creamy yellowish fluid with concentrated amounts of protein, fat-soluble vitamins, and minerals, and it has lower amounts of fat and lactose compared with mature milk. It also contains antioxidants and high levels of lactoferrin and secretory IgA. It promotes the establishment of *Lactobacillus bifidus* flora in the digestive tract, which helps to protect the infant from disease and illness. Colostrum also has a laxative effect on the infant, which helps the baby pass meconium stools, which in turn helps decrease hyperbilirubinemia.

Between day 2 and day 5, maternal milk production normally becomes noticeably more abundant. The milk “coming in” is called transitional milk. **Transitional milk** has qualities intermediate to colostrum and mature milk. It is still light yellow in color but is more copious than colostrum and contains more fat, lactose, water-soluble vitamins, and calories. By day 5, most mothers are producing about 500 mL/day.

**Mature milk** is white or slightly blue-tinged in color. It is present by 2 weeks postpartum and continues thereafter until lactation ceases. Mature milk contains about 13% solids (carbohydrates, proteins, and fats) and 87% water. Although mature human milk appears similar to skim cow’s milk and may cause mothers to question whether their milk is “rich enough,” mothers should be reassured that this is the normal appearance of mature human milk and that it provides the infant with all the necessary nutrients. Although gradual changes in composition do occur continually over periods of weeks to accommodate the needs of the growing newborn over time, in general the composition of mature milk is fairly consistent with the exception of the fat content as noted previously. Milk production continues to increase slowly over the first month. By 6 months postpartum a mother produces about 800 mL/day (Hartmann, 1987; Hartmann & Prosser, 1984).

**Timing of Newborn Feedings**

The timing of newborn feedings is ideally determined by physiologic and behavioral cues rather than a set schedule.

**INITIAL FEEDING**

The nurse should assess for active bowel sounds, absence of abdominal distention, and a lusty cry that quiets and is replaced with rooting and sucking behaviors when a stimulus is placed near the lips. These signs indicate that the newborn is hungry and physically ready to tolerate the initial feeding.

If there are no complications at the birth and the mother is not overly sedated, the infant may be placed on the mother’s chest after birth. Throughout the first 2 hours after birth, but especially during the first hour of life, the infant is usually alert and ready to breastfeed. Because colostrum is not irritating if aspirated (which may occur because of the newborn’s initial uncoordinated sucking and swallowing abilities) and is readily absorbed by the respiratory system, breastfeeding can usually begin immediately after birth. The mother benefits psychologi-
cally from early breastfeeding through enhancement of maternal-infant bonding and physiologically by the release of oxytocin, which helps contract the uterus, expelling the placenta and decreasing the risk of postpartum hemorrhage. Early feedings benefit the newborn because they help prevent hypoglycemia, promote the passage of meconium, provide the newborn receives the immunologic protection of colostrum, and begin to stimulate further maternal milk production, helping prevent later feeding difficulties.

If the mother plans to bottle-feed, she and her newborn can still enjoy skin-to-skin contact initially. Formula-feedings are not typically initiated in the birthing room. Formula-feeding newborns are offered formula as soon as they show interest/feeding cues or per hospital policy. For both breastfed and formula-fed infants, early feeding stimulates peristalsis, helping to eliminate the by-products of bilirubin conjugation (which decreases the risk of jaundice), and enhances maternal-infant attachment.

Assessment of the newborn’s physiologic status is a primary and ongoing concern to the nurse throughout the first feeding. Extreme fatigue coupled with rapid respiration, circumbal cyanosis, and diaphoresis of the head and face may indicate cardiovascular complications and should be assessed further.

The first feeding also provides an opportunity for the nurse to assess the effectiveness of the newborn’s suck, swallow, and gag reflexes. The nurse should also remain alert to the possibility of medical problems during this time, including respiratory disorders, congenital cardiovascular problems, or more rare disorders such as tracheoesophageal fistula and esophageal atresia (see Chapter 32). Findings associated with esophageal anomalies include maternal polyhydramnios and increased oral mucus in the infant. In cases of esophageal atresia, the feeding is taken well initially, but as the esophageal pouch fills, the feeding is quickly regurgitated unchanged by stomach contents. If a fistula is present, the infant gags, chokes, regurgitates mucus, and may become cyanotic as fluid passes through the fistula into the lungs.

It is not unusual for the newborn to regurgitate some mucus and water following a feeding, even if it was taken without difficulty, because of initial uncoordinated suck and swallow abilities. It is important to observe the newborn closely and position the baby on the side after the feeding to aid drainage and facilitate gastric emptying. Once the infant is tolerating feeding, the normal position after feeding is on his or her back.

**ESTABLISHING A FEEDING PATTERN**

An “on-demand” feeding program facilitates each baby’s own rhythm and helps a new mother establish lactation. The newborn rapidly digests breast milk and may want to nurse 8 to 10 times in a 24-hour period. After the initial period of alertness and eagerness to suckle, the infant progresses to light sleep, then deep sleep, followed by increased wakefulness and interest in breastfeeding. As wakefulness and interest in nursing increase, the infant will often cluster 5 to 10 feeding episodes over 2 to 3 hours, followed by a 4- to 5-hour deep sleep. After this cluster of minifeeds and deep sleep, the infant will feed frequently but at more regular intervals. Crying is considered a late feeding cue. Often newborn arousal from sleep is the first sign of hunger.

Early feeding cues include rooting, smacking, or attempting to suck on anything near his or her mouth (especially the hand). Although people often accept crying as normal and healthy behavior for newborns, it may actually delay the transition to extrauterine life. Crying involves a Valsalva maneuver that increases pulmonary vascular pressure, which may cause unoxigenated blood to be shunted into systemic circulation through the foramen ovale and ductus arteriosus. If no one has responded to the newborn by this time, then the infant may begin to fuss and eventually work up to a full cry. A newborn who is left to cry and not given the opportunity to feed at this point may subsequently become very disorganized and have a difficult time latch on to the breast or coordinating his or her suck correctly.

Certain hospital practices/policies may contribute to delays in feeding by prolonging the feeding intervals and even decreasing the number of feedings in a 24-hour period. **Couplet care** or rooming-in practices promote cue-based feedings. Therefore, it may be advantageous for the baby to be in the room with the mother; she will respond to the baby’s needs more quickly than the nursery staff may be able to, resulting in less infant crying.

Couplet care permits the mother to learn about and respond to her infant’s early feeding cues. Early cues that indicate a newborn is interested in feeding include hand-to-mouth or hand-passing-mouth motion, whimpering, sucking, and rooting (Mulford, 1992). Satiety behaviors can include withdrawal of head from the nipple, falling asleep, relaxation of hands, and relief of body tension. When couplet care is not available, a supportive nursing staff and flexible nursery policies allow the mother to feed her infant on cue. It is very frustrating to a new mother to attempt to feed a newborn who is sound asleep because he or she is either not hungry or exhausted from crying.

Feeding intervals are counted from the time of the start of one feeding to the start of the next feeding. Breastfeeding babies typically feed every 1.5 to 3 hours (8 to 12 times in a 24-hour period), but often in an irregular pattern known as “cluster feeding,” in which the infant feeds as frequently as every hour for a few feedings followed by a longer sleep period. The normal newborn sleeps a total of 16 to 18 hours per day, but generally with no more than one sleep stretch of up to 5 hours in length. It is more important to focus on the number of feedings in 24 hours than the exact feeding interval time. Formula-fed infants generally eat every 3 to 4 hours and typically 6 to 8 times per day. It is important that families are taught about the normal feeding/sleeping pattern of a newborn. Many parents are distressed by their infant’s early erratic feeding pattern. Parents need to be informed that their infant will have a more predictable sleep and feeding pattern when he or she is 2 to 4 months of age.

Maternal medications received during labor may affect newborn feeding behavior by delaying these early cluster feedings. Delays in normal feeding patterns depend on the specific drug and its half-life. Newborns whose mothers received epidural analgesia have been noted to be irritable and demonstrate reduced motor organization, poor self-quieting skills, and decreased visual skills and alertness (Biancuzzo, 2003). Because breastfeeding infants generally have only one long sleep stretch in a 24-hour period, parents can help their infant to take the long sleep stretch at night if they attempt to awaken their infant during the day when the infant is in a light state of sleep.
and has already slept longer than 3 hours. Parents can attempt to encourage cluster feedings during the day, and, after awhile, the infant may sleep a 5-hour sleep stretch at night. In the meantime, the mother can be encouraged to take “cat naps” during the day while her infant is sleeping. At night the mother can keep stimulation down (lights low, noise low, and diaper change only when necessary).

Both breastfeeding and formula-feeding infants have the same fluid requirements, but because they have different diets, their rates of digestion are different. Digestion of formula produces large, rubbery curds that take about 4 hours to digest compared with the softer, smaller curds produced by breast milk. For this reason formula-fed newborns generally sleep longer at a stretch and awaken to feed every 3 to 4 hours. It is not uncommon that formula-fed newborns may take one or two 5-hour sleep stretches in a 24-hour period. As a result they will often take a larger volume at each feed. Babies may begin skipping the night feeding about 8 to 12 weeks after birth. The need for a night feeding is individual and depends on the size and development of the infant.

Satiety behaviors are the same for formula-fed babies as for breastfed babies. These behaviors include longer pauses toward the end of the feeding, noticeable total body relaxation (the baby lies limp with hands down at his side and unclenched), the infant may release his mother’s nipple or the bottle nipple, and many fall asleep. If a baby is satiated and content following feedings, is meeting daily output expectations, and is gaining weight as expected, then feedings are going well.

Both breastfed and formula-fed infants experience growth spurts at certain times and require increased feeding. The breastfeeding mother may meet these increased demands by nursing more frequently to increase her milk supply. It takes about 72 hours for the milk supply to increase adequately to meet the new demand (Biancuzzo, 2003). A slight increase in feedings meets the formula-fed infant’s needs.

Some mothers may find fixed feeding schedules attractive. These mothers should be informed that although strict feeding schedules may work for some babies, they often do not work for all babies because they do not take into account differences among breastfeeding women and differences among infants. There are documented cases of infants diagnosed with failure to thrive, poor weight gain, dehydration, breast milk supply failure, and involuntary early weaning associated with this feeding method (Aney, 1998). The AAP released a media alert in April 1998 reaffirming its position that “the best feeding schedules are ones babies design themselves. Scheduled feedings designed by parents may put babies at risk for poor weight gain and dehydration.”

Nourishing her newborn is a major concern of the new mother. Her feelings of success or failure may influence her self-concept as she assumes her maternal role. With proper instruction, support, and encouragement from professionals, feeding becomes a source of pleasure and satisfaction to both the parents and infant.

**Client Education: Feeding Technique**

**BREASTFEEDING POSITION AND LATCHING**

Breastfeeding is not instinctive, it is learned. It is a natural process, but it takes “know-how.” Ideally, each breastfeeding mother should have a breastfeeding evaluation to determine any knowledge deficits, acknowledge any concerns, provide instructions, and assist with breastfeeding.

**Positioning.** There are many breastfeeding positions, but only the four classic breastfeeding positions are discussed here. In addition, there are minor variations of hand placement and body position even among the four classic positions. The four positions discussed here include (1) modified cradle position, (2) cradle position, (3) football (or clutch) hold position, and (4) side-lying position (Figures 31–2 through 31–5). After a mother has fed using one position, encourage her to try a different position when she offers her second breast. Alternating positions facilitates drainage of the breasts and changes the pressure points on the breast. This will provide some relief to the mother with sore nipples.

- Have mother sit comfortably in upright position using good body alignment. Use pillows for support (may use Boppy, body pillow, or standard bed pillows). Lap pillow should help bring baby up to breast level so mother does not lean over baby.
- Place baby on mother’s lap and turn baby’s entire body toward mother (baby is in side-lying position). Position baby’s body so that the baby’s nose lines up to the nipple. Maintain baby’s body in a horizontal alignment.
- To feed at left breast, mother supports baby’s head with her right hand at nape of baby’s neck (allow head to slightly lag back), mother’s right thumb by baby’s left ear, and right forefinger near baby’s right ear.
- With mother’s free left hand, she can offer her left breast.

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**Figure 31–2** ◆ Modified cradle position.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.
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- Have mother sit comfortably in upright position using good body alignment. Use pillows for support (may use Boppy, body pillow, or standard bed pillows). Lap pillow should help bring baby up to breast level so mother does not lean over baby.
- Place baby on mother’s lap and turn baby’s entire body toward mother (baby is in side-lying position). Position baby’s body so that the baby’s nose lines up to the nipple. Maintain baby’s body in a horizontal alignment.
- If feeding from the left breast, have mother cradle baby’s head near the crook of her left arm while supporting her baby’s body with her left forearm.
- With mother’s free right hand, she can offer her left breast.

**Figure 31–3**  ◆ Cradle position.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.

- Have mother sit comfortably and use pillows to raise baby’s body to breast level. If using a Boppy and the Boppy is in “normal” position on mother’s lap, turn it counterclockwise slightly (if feeding at left breast) to provide extended support for baby’s body resting along mother’s left side and near the back of mother’s chair.
- If feeding at left breast, place baby on the left side of mother’s body, heading baby into position feet first. Baby’s bottom should rest on the pillow near mother’s left elbow.
- Turn baby slightly on her side so that she faces the breast.
- Mother’s left arm clutches baby’s body close to mother’s body. Baby’s body should feel securely tucked in under mother’s left arm.
- Have mother support baby’s head with her left hand. With mother’s free right hand, she can offer her breast. (Good position for mother with c-section).

**Figure 31–4**  ◆ Football hold position.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.

- Have mother rest comfortably lying on her side (left side for this demonstration). Use pillows to support mother’s head and back, and provide support for mother’s hips by placing a pillow between her bent knees.
- Place baby in side-lying position next to mother’s body. Baby’s body should face mother’s body. Baby’s nose should line up to mother’s nipple. Place a roll behind baby’s back, if desired.
- With mother’s free right hand, she can offer her left breast. After baby is securely attached, mom can rest her right hand anywhere that is comfortable for her.

**Figure 31–5**  ◆ Side-lying position.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.
**CLINICAL TIP**

The cradle position is challenging, especially when attempted during early lactation by inexperienced mothers because the mother is attempting to support her baby’s head near the crook of her arm. This makes it difficult to control the head position and may allow the baby’s head to bend forward (chin toward chest), making attachment difficult. It is better to have the infant’s head lag slightly backward (chin tilted slightly upward) so that the infant leads into the breast chin first. Some mothers find it easier to start in the modified cradle position and then switch into the cradle position.

**Latching On.** It is important to have the mother and baby positioned properly in order to achieve an optimal attachment. If, for example, the infant is lying flat on his or her back (supine position) to feed in the modified cradle position, cradle position, or side-lying position, the infant can obtain only a shallow latch (not attached far back onto the areola). The infant’s shoulder becomes an obstacle putting distance between the infant’s mouth and the mother’s breast. Anything that contributes to a shallow latch is going to cause sore nipples and other complications. Nipple trauma, although relatively common, is not normal. See Chapter 36 for discussion of breastfeeding with inverted or flat nipples.

The infant needs to attach his or her lips onto the breast, or rather more accurately, far back onto the areola, not on the nipple. If the infant attaches just to the nipple, the mother will have sore nipples and pain may inhibit the let-down reflex. To obtain a deep latch, the mother needs to be taught how to elicit the infant’s rooting reflex, stimulating the infant to open his or her mouth as widely as possible (like a big yawn). Once the infant does this, the mother should quickly but gently draw her baby in toward her. During the first few days of life, the newborn typically only opens his or her mouth widely for a second or so, and then begins to close the mouth again. If the mother misses her chance to get her baby latched on, she needs to simply start over again.

Figures 31–6 through 31–11 demonstrate various positions and techniques used in latching on.

To be ready to draw baby’s mouth onto mother’s breast, as soon as the baby opens her or his mouth widely enough, the mother needs to have her hand supporting her breast in ready position. She can use various hand holds, but she needs to keep her fingers well behind the areola. One such hand position is called the “C-hold.” In this hold, the thumb is placed on top of the breast near 12:00 o’clock position and the other four fingers are placed on the underside of the breast near at the 6:00 o’clock position (depends on mother’s hand size and length of fingers). The key point is in keeping the fingers at least 1½ inches back from the base of the nipple as the fingers support the breast. Mothers are not often aware of where they place their fingers, especially on the underside of the breast. If the fingers are too far forward (too close to the nipple), then the infant cannot grasp a large amount of areola in her or his mouth and this results in a “shallow” latch. A shallow latch is associated with nipple pain and ineffective drainage of the breast.

An alternate hand hold not shown is a “U-hold” hand position. The thumb and forefinger are near the 3:00 o’clock and 9:00 o’clock positions on the breast again with fingers at least 1½ inches back from the base of the nipple; the body of the hand rests on the lower portion of the breast. Using this hand hold, the mother’s arm position is down at her side rather than sticking outward as it is when supporting the breast using in the C-hold position.

The scissor hold is often discouraged because mothers (especially mothers with small hands) have a difficult time keeping their fingers off the areola or at least 1½ inches back from the base of the areola. Here, the mother is able to support her breast well without letting her fingers encroach onto the areola.

The mother should be instructed to gently support the breast and not press too deeply, which can obstruct the flow of milk through the ducts.
Before eliciting the rooting reflex, it is important to have the baby in good alignment. When the infant opens her or his mouth to latch on, the goal is to achieve a deep, asymmetric latch attachment. The goal is not to center the nipple in the baby’s mouth. The rationale for this is to optimize oral-motor function. The jaw is a hinge joint. The upper jaw is immobile; the lower jaw compresses the breast. The breast is efficiently drained if more areola is drawn into the baby’s mouth from the inferior aspect of the breast and a smaller amount drawn in from the superior aspect of the areola. Aligning the infant to the mother with baby’s nose facing mother’s nipple permits the jaw to be in a lower position. The next step is to let the infant drop his or her head back (head in “sniff position”), so that the infant leads into the breast with the chin.

To trigger the rooting reflex, teach the mother to use her nipple to stroke downward in a vertical motion across the middle of baby’s lower lip. Initially, the infant may respond by licking or smacking. This is a normal response to the stimulus. Encourage the mother to keep stimulating the infant’s lower lip until the infant finally opens her or his mouth widely. If the infant is not responding at all, then the infant is probably too sleepy and may need help waking up. After trying wake up techniques, the infant may be ready to try breastfeeding again.

Teach the mother to be patient and wait for the infant’s mouth to gape open as widely as possible. Here the infant needs to open the mouth even wider before the mother draws her baby toward the breast. The mother should be encouraged to continue stroking the infant’s lip until the infant opens the mouth wider.
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Once baby has latched onto the breast, the mother should check that baby is latched on properly. The infant’s chin should be embedded into the mother’s breast. The infant’s nose should be very close but not actually touching the breast. The nose should be centered. If the mother feels a little pinch on her areola, she can slowly release the hand supporting her breast so she can have a free hand to attempt to move her baby’s jaw gently downward. To do this maneuver, the mother needs to place her thumb or forefinger of her free hand (the hand that just released the breast) on baby’s lower jaw (there is a horizontal groove to use as leverage—the groove on baby’s chin is parallel with the baby’s lips). With gentle downward pressure the mother should feel relief of any persistent tenderness. This procedure opens the jaw wider and it also helps to roll out the infant’s lower lip that may have been inadvertently drawn into the baby’s mouth. As the baby begins to suckle, there should be no dimpling of the infant’s cheeks and no smacking or clicking noises.

Figure 31–11  Baby is latched-on.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.

### CLINICAL TIP
As you assist new mothers with breastfeeding, it is important to create a relaxed environment and approach to breastfeeding. Encourage the mother to get into a comfortable position, well supported with pillows. Remind her to bring the baby to her breast rather than leaning forward to the baby.

### BREASTFEEDING ASSESSMENT
During the birthing unit stay, the nurse must carefully monitor the progress of the breastfeeding pair. A systematic assessment of several breastfeeding episodes provides the opportunity to teach the new mother about lactation and the breastfeeding process, provide anticipatory guidance, and evaluate the need for follow-up care after discharge. Criteria for evaluating a breastfeeding session include maternal and infant cues, latch-on, position, let-down, nipple condition, infant response, and maternal response. The literature provides various tools to guide the assessment and documentation of the breastfeeding efforts. The LATCH Scoring Table is one example (Figure 31–12 ◆). Table 31–3 identifies signs of successful breastfeeding.

### CLINICAL TIP
With a sleepy baby, unwrap the baby, encourage lots of skin-to-skin contact between mother and baby, have the mother rest with baby near her breast so that the baby can feel and smell the breast. Encourage the mother to watch for feeding cues, such as hand-to-mouth activity, fluttering eyelids, vocalization but not necessarily crying, and mouthing activities.

### BOTTLE-FEEDING BREAST MILK (EXPRESSION, PUMPS, STORAGE)
There are a number of different reasons for bottle-feeding breast milk. The nurse should evaluate the indications in order to recommend the best technique for the mother and her particular need. Some mothers prefer to hand express their milk rather than use a breast pump, and many find that in the immediate postpartum period hand expression of milk may be a more effective method of removing drops of colostrum than using an electric breast pump. Nurses should teach all mothers the skill of hand expressing breast milk as it is possible the mother will find herself in a situation without a breast pump but needing to relieve herself from engorgement.

To hand express breast milk, have the mother follow steps 1 through 4 of the pumping instructions provided in Table 31–4. Next the mother should use the Marmet technique of hand expression described next. It is important that the mother take care to place her hands exactly as directed. The steps are as follows:

1. The mother will position her thumb at the 12:00 o’clock position on the top edge of the areola (about 1 to 1½ inches back from the tip of her nipple) and her forefinger and middle finger pads at the 6:00 o’clock position on the bottom edge of the areola (about 1 to 1½ inches from the tip of her nipple). If positioned correctly, a line between the thumb and fingers will cross the nipple. See Figure 31–13 ◆.
2. Next the mother will stretch her areola back toward her chest wall without lifting her fingers off her breast.

### Table 31–3 SUCCESSFUL BREASTFEEDING EVALUATION

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indication</th>
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<tbody>
<tr>
<td>Babies are probably getting enough milk if:</td>
<td></td>
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<tr>
<td>• They are nursing at least eight times in 24 hours.</td>
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<tr>
<td>• In a quiet room, their mothers can hear them swallow while nursing.</td>
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<tr>
<td>• Their mother’s breasts appear to soften after breastfeeding.</td>
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<tr>
<td>• The number of wet diapers increases daily until the fourth or fifth day after birth, and there are at least six to eight wet diapers every 24 hours after day 5.</td>
<td></td>
</tr>
<tr>
<td>• Their stools are beginning to lighten in color by the third day after birth, or have changed to yellow no later than day 5.</td>
<td></td>
</tr>
<tr>
<td>• Offering a supplemental bottle is not a reliable indicator because most babies will take a few ounces even if they are getting enough breast milk.</td>
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</table>
3. Now she should roll her thumb and fingers simultaneously forward. This action compresses the ducts beneath the areola and stimulates the breast to empty the breast both manually and by triggering the let-down reflex.

4. The mother should repeat the sequence multiple times to completely drain her breasts. She should try to maintain a steady rhythm, cycling 45 to 60 times/minute. It is also more effective if the mother repositions her fingers to other positions on the same breast (3 and 9 o’clock, 1 and 7 o’clock, etc.) when the milk flow slows.

5. You should sit up straight or lean slightly forward (perhaps even place a pillow behind your back so that your posture is tilted slightly forward), as gravity aids in the flow of your milk.

6. Pump your milk into glass or plastic bottle containers. Mothers of healthy infants may also use bottle bags/liners intended for breast milk storage to collect and store their milk. (Because of the loss of antibodies that can occur with bottle bags/liners, mothers of preemies and fragile infants should probably avoid using these.) Do not fill containers more than 3/4 full, because milk expands during freezing.

7. Feed freshly expressed breast milk when breastfeeding is not an option/choice. If the expressed breast milk is not needed immediately, store the expressed breast milk in the refrigerator if it is likely to be used within 5–8 days. (The sooner it is used, the greater the quality of the milk.) Otherwise, freeze the expressed breast milk. Avoid placing breast milk in the freezer door or on the bottom of a self-defrosting freezer because the temperature fluctuates more in those areas.

8. Store expressed breast milk in volumes your infant is likely to feed at a single feeding or in a volume your infant will consume in a day.

9. Frozen breast milk can be thawed safely using one of two methods. To quickly thaw breast milk, remove the frozen bottle of breast milk from the freezer, place the bottle in a bowl in the sink, and run warm water over it. To thaw out more slowly, take the frozen bottle of breast milk, place it in the refrigerator and let it thaw out over several hours. The time it takes to do this depends on the volume in the bottle. Note that breast milk that has been sitting will normally separate. To remix it, simply swirl the bottle until the milk is evenly mixed. If the amount in the bottle is more than you will use in one feeding, pour the amount you want into a clean bottle, and put the rest back in the refrigerator. Take the bottle for feeding, place it in a bowl in the sink, and run warm water over it before feeding. The bottle should remain upright and not float in the bowl. The water level in the bowl should remain below the lid of the bottle/milk container. Note: never use a microwave oven to thaw or warm breast milk.

10. Thawed breast milk is good in the refrigerator for 24 hours.
will need assistance in learning this technique initially. Reassure the mother that it is a skill that is learned, and with practice, she can become an expert at hand expression.

Although hand expression can be efficient, many mothers will choose to use a mechanical breast pump to express their milk. Not all breast pumps are of the same quality, even within the same category (see Table 31–5, Figure 31–14 ◆, Figure 31–15 ◆). Pumps generally cycle from low to high suction at a frequency similar to that of a breastfeeding infant (about 45 to 60 cycles per minute). However, differences in the quality of the pump motor or the presence or absence of controls over suction pressure mean that some pumps will generate inadequate pressure or cycle too slowly to be effective, whereas others may exert too high a suction that can cause injury. Flange size, proper fit, and comfort are other variables to consider. The nurse should refer the mother to a lactation consultant or other person knowledgeable regarding different breast pumps.

**Table 31–5  TYPES OF BREAST PUMPS AND INDICATIONS FOR USE**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Manual Breast Pump (Figure 31–14)</th>
<th>Small Battery/Electric Breast Pump</th>
<th>Individual Double Electric Breast Pump</th>
<th>Hospital-Grade Multiuser Double Electric Breast Pump (Figure 31–15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A missed feeding</td>
<td>□</td>
<td>▲</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An evening out</td>
<td>□</td>
<td>▲</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working part-time</td>
<td>□</td>
<td>▲</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convenience—occasional use</td>
<td>□</td>
<td>▲</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working full-time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premature/hospitalized infant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low milk supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sore nipples/engorgement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latch-on problems/infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawing out flattish nipples</td>
<td>□</td>
<td>▲</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Good ▲ Better * Best

Modified from the Medela Breastfeeding Information Guide Tips and Products. (2002). Table: Which Breast pump Is Best for You? (p. 3). McHenry, IL: Medela, Inc. Copyright © Medela, Inc. All rights reserved.
and bottle without obvious difficulty, but for other infants, it is a

tip of the tongue to block the flow of milk, which otherwise drips

bottle-feeding, the infant keeps the tongue retracted and uses the

ple and drawing it from back to front in a milking motion. With

open his or her mouth very wide in order to latch on. To transfer

bottle-feeding are different. In breastfeeding, the infant has to

some babies, causing them to develop an incorrect sucking tech-

nology of the breastfeeding infant. These include delayed lacto-

genesis, unavailability of the mother because of severe illness or

paration, primary lactation failure, hypoglycemia, significant
dehydration, weight loss of 8% to 10% with exclusive breast-

feeding, delayed passage of stool (presence of meconium on
day 5), hyperbilirubinemia related to poor intake, prematurity,
or low birth weight, and refusal of or ineffective breastfeeding.

For those times when supplementation is indicated, the first
choice is to use the mother’s own milk (fresh, previously ex-

ressed, or frozen/thawed). If maternal breast milk is not avail-
able, pasteurized donor milk is the next choice, and then

formula. Supplementation can also be administered using a bottle

or one of the following alternative feeding methods: cup-

feeding, spoon-feeding, eyedropper- or syringe-feeding, or a

nursing supplementer. The method chosen is based on the par-
ticular situation and parental preference.

There are different guidelines for storage of expressed breast

milk (EBM) depending on whether the infant is a healthy

full-term infant or a premature or sick infant in the hospital. The
guidelines in Table 31–6 are intended as a resource for the

mother of a healthy, full-term infant.

### SUPPLEMENTARY BOTTLE-FEEDING

Supplementary bottle-feedings for the breastfeeding infant after

birth are not recommended routinely. Routine supplementation
has been strongly implicated in early breastfeeding termination
(Hall, Mercer, Teaslet et al., 2002). Routine supplements are not

only unnecessary, they can also contribute to maternal and in-

fant health problems, including delayed early maternal milk
production, maternal engorgement after her milk production has

increased, infant milk-protein intolerance, and difficulties with

learning to breastfeed.

“Nipple confusion” or “nipple preference” can occur in

some babies, causing them to develop an incorrect sucking tech-
nique, or to simply refuse to breastfeed again. This potential
problem occurs because the techniques for breastfeeding and

bottle-feeding are different. In breastfeeding, the infant has to

open his or her mouth very wide in order to latch on. To transfer

milk the baby has to extend the tongue forward, cupping the nip-

ple and drawing it from back to front in a milking motion. With

bottle-feeding, the infant keeps the tongue retracted and uses the

tip of the tongue to block the flow of milk, which otherwise drips

rapidly. Some babies can switch back and forth between breast

and bottle without obvious difficulty, but for other infants, it is a

problem. To reduce this possibility, experts in the field of lacta-
tion recommend introducing the bottle when the infant is be-

between 3 and 6 weeks of age and breastfeeding is well established.

Parents are often concerned because they have no visual as-

surance of the amount of breast milk consumed. The mother

should be taught to observe the infant for effective breastfeed-

ing. The infant should have a rhythmic sucking pattern (the slight
pause between jaw compressions on the breast permits the

mouth to fill with milk before swallowing). To note if the jaw
compressions are strong enough, the mother should observe or

feel if there is movement at the bilateral temporomandibular

joints located in front of the infant’s ears. The infant should

maintain a rhythmic feeding pattern with only brief pauses (last-
ing only seconds, not minutes) between spurts of active feeding,

with the feeding session typically lasting for 10 to 20 minutes

on the first breast: the infant may feed only a few minutes on the

second breast or not at all. The mother should visually observe

for swallowing, and, later, as her milk is abundant, she will hear

the infant’s swallows. Discourage the mother from watching the

clock to determine when the infant needs to switch breast sides

but rather encourage her to watch the newborn’s feeding pattern
to note when active feeding ceases. When satiated, the infant

will either pull away from the breast or fall asleep. The infant

will be extremely relaxed at the end of the feeding and will sleep

until the next feeding is due (at least an hour). As the infant ma-
tures, the feeding intervals will lengthen. Another indicator of

breastfeeding efficiency is softening of mother’s breasts, al-

though this is not a reliable indicator in the first few days post-

partum while breast milk volume is low. Within a week, however,
this is a good indicator of milk transfer.

The infant who feeds well will have a characteristic output. See

Figure 31–16 for breastfeeding intake and output expecta-
tions. The infant should also have the characteristic weight loss
followed by weight gain pattern discussed earlier in this chapter.

Finally, the most reliable measurement of effective breast-

feeding is measuring the breast milk that actually transfers. This

is done by obtaining pre- and postbreastfeeding weight checks

using an accurate infant scale. The difference in prefeed and post-

feed weights is the amount of milk transferred to the infant and

may be useful with assessing weight gain in near-term infants.

At times there are valid medical indications for supplemen-
tation of the breastfeeding infant. These include delayed lacto-

genesis, unavailability of the mother because of severe illness or

paration, primary lactation failure, hypoglycemia, significant
dehydration, weight loss of 8% to 10% with exclusive breast-

feeding, delayed passage of stool (presence of meconium on
day 5), hyperbilirubinemia related to poor intake, prematurity,
or low birth weight, and refusal of or ineffective breastfeeding.

For those times when supplementation is indicated, the first
choice is to use the mother’s own milk (fresh, previously ex-

ressed, or frozen/thawed). If maternal breast milk is not avail-
able, pasteurized donor milk is the next choice, and then

formula. Supplementation can also be administered using a bottle

or one of the following alternative feeding methods: cup-

feeding, spoon-feeding, eyedropper- or syringe-feeding, or a

nursing supplementer. The method chosen is based on the par-
ticular situation and parental preference.

<table>
<thead>
<tr>
<th>Table 31–6</th>
<th>STORAGE GUIDELINES FOR BREAST MILK AND FORMULA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Milk</strong></td>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>Breast milk or formula, opened/reconstituted</td>
<td>Being fed</td>
</tr>
<tr>
<td>Breast milk or formula, opened/reconstituted</td>
<td>Environment greater than 79°F</td>
</tr>
<tr>
<td>Breast milk or formula, opened/reconstituted</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Breast milk or formula, opened/reconstituted</td>
<td>Cooler pack less than 59°F</td>
</tr>
<tr>
<td>Thawed breast milk</td>
<td>Refrigerator</td>
</tr>
<tr>
<td>Formula, opened/reconstituted</td>
<td>Refrigerator</td>
</tr>
<tr>
<td>Fresh breast milk</td>
<td>Refrigerator</td>
</tr>
<tr>
<td>Formula powder, opened can</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Fresh breast milk</td>
<td>Freezer</td>
</tr>
<tr>
<td>Formula/powder in sealed container</td>
<td>Avoid excessive heat</td>
</tr>
<tr>
<td>Thawed breast milk</td>
<td>Freezer</td>
</tr>
<tr>
<td>Formula</td>
<td>Freezer</td>
</tr>
</tbody>
</table>

Breastfeeding Intake and Output Expectations

- Baby should breastfeed 8 to 12 times/day and appear satisfied after feeding.
- Colostrum is all that the newborn needs in the first few days of life in most cases.
- It is normal for the infant to lose up to 7% (or between 5% and 10%) of birth weight in the first few days of life.
- Baby should gain 10 grams/kg/day after the milk is abundant (about day 4 of life).
- Baby should be back to birth weight by 2 weeks of age.
- Baby’s stool should change in color, consistency, and frequency during the first few days of life. The color of stools changes from tarry black to dark greenish-black to greenish-brown, to brownish-yellow, to light greenish-yellow, to bright yellow or yellowish-orange. The consistency of stools changes from tarry-sticky to thinner consistencies to curdy or seedy and “explosive.” Volume of stool increases as volume of intake increases.

Day 1 and Day 2

Minimum Output:

On day 1, the infant should produce at least one wet diaper and one meconium stool by 24 hours of age.

On day two, the infant should produce at least two wet diapers and 2 meconium stools. The stools may be thinning but remain dark (tarry black to greenish-brown).

Day 3 and Day 4

On day 3, the infant should produce at least three wet diapers and three transitional stools.

On day 4, the infant should produce at least four wet diapers and three to four transitional stools. The transitional stools are greenish-brown to greenish-yellow. Some infants will have transitioned to bright yellow milk stools by now.

Day 5

On day 5, the infant should produce at least five wet diapers and three to four yellow milk stools.

Hereafter, breastfeeding babies will always produce at least six well-saturated wet diapers per day. They typically produce at least 3 to 4 stools per day (not uncommon to have up to 10 stools per day) for the first month of life. After a month of age, breastfeeding infants may drastically reduce the number of stools per day, even skipping several days.

Because stools are an indicator of caloric intake, low stool output (especially in the first couple of weeks of life) warrants a weight check and evaluation.

Figure 31–16  ◆ Breastfeeding intake and output expectations.
SOURCE: Courtesy of Brigette Hall, MSN, IBCLC.
BOTTLE-FEEDING TECHNIQUE

With more attention placed on promoting and assisting breastfeeding mothers, the teaching needs of the mother who is formula-feeding may inadvertently get overlooked. Nurses may assume that families can simply follow the formula preparation instructions on the side of the formula containers. However, research shows that these parents also need teaching, counseling, and support. In one study the authors found that “33% of mothers mixed formula with warm tap water and up to 48% heated bottles in a microwave,” both of which are not recommended (Fein & Falci, 1999). In a systematic review of five studies from developed countries looking at how parents prepare formula, all the studies revealed “errors in reconstitution with a tendency to over-concentrate feeds, although under-concentrating also occurred” (Renfrew, Ansell, & Macleod, 2003). Parents need to learn about the feeding pattern for a formula-feeding infant. They need to know intake and output expectations, the recommended type of formula for their infant, how to prepare and store formula, what equipment they will need, the feeding technique, and safety precautions.

Commercial formulas are available in three forms: powder, concentrate, and ready-to-feed. There are situations in which one formula may be better to use than another, but, in general, convenience and cost usually influence the parents’ decision.

- **Powdered formula** is the least expensive type of formula. This formula can be made up one bottle at a time, or multiple bottles can be prepared, but they must be used within 24 to 48 hours. Standard powdered formula is made by adding one level scoop of powdered formula to 60 mL of water (the powder is added to the water). Powdered formulas are not sterile. Powdered formula is made from pasteurized liquid that is then freeze-spray dried into a powder; contamination with microorganisms can occur in the final stages of production. Preparation of any infant formula, but especially powdered formulas, requires careful handling to avoid contamination with microorganisms.

- **Formula concentrate** is more expensive than powder but is not as expensive as ready-to-feed formula. Formula concentrate is commercially sterile. This formula requires being diluted with an equal part of water. By adding boiled water that has been cooled, sterility can be maintained.

- **Ready-to-feed** formula is the easiest to use because it is does not require any mixing; however, this convenience comes at a cost—it is the most expensive formula. It is indicated for use when adequate water is not available, when the infant is immunocompromised and requires commercially sterile (pasteurized) formula, when an inexperienced babysitter will be feeding the infant, and for convenience.

Whatever the type of formula chosen, the nurse should underscore the importance of proper preparation and prompt refrigeration. Parents will need to be briefed on safety precautions during formula preparation. A primary concern is proper mixing to reconstitute formula. Parents need clear instructions to avoid unintentional harm to their infant. Parents should be instructed to follow the directions on the formula can label precisely as written. They should know that adding too much water during preparation dilutes the nutrients and caloric density. This contributes to undernourishment, insufficient weight gain, and, possibly, water intoxication, which can cause hyponatremia and seizures. Not adding enough water concentrates nutrients and calories and can tax an infant’s immature kidneys and digestive system as well as cause dehydration (Morin, 2005). See Table 31–6 for storage guidelines for breast milk and formula.

Some recommended sanitary precautions and additional safety precautions are listed here:

- Check the expiration date on the formula container.
- Ensure good handwashing before preparing formula; never dip into the can without clean hands.
- Clean bottles, nipples, rings, disks, and bottle caps.
  a. Washing in a dishwasher when available (small items and heat-sensitive items on top rack secured in a basket), or
  b. Boiling briefly (1 to 2 minutes) in a pot of water, or
  c. Cleaning using a microwave sterilization kit, or
  d. Cleaning using very warm soapy water and a nipple and bottle brush
- Wash the top of the formula container before piercing the lid.
- Shake the liquid formulas well before pouring off desired amount.
- Shake prepared milk that has been sitting in the refrigerator before feeding.
- Allow tap water to run for 1 minute before obtaining water to use for mixing—this helps clear any lead standing in the pipes. Also, always use cold tap water as warm water tends to contain higher levels of lead as well. Water should be warmed (or cooled after boiling) before being added to the formula.
- Use only the scoop supplied in the can of formula when formula preparation instructions call for a “scoop” of powdered formula.
  a. A scoop should not be “packed” and should be leveled off (e.g., with the back of a knife).
- Do not add anything else to the bottle, except under direction of baby’s healthcare provider.
- Warm up milk in a bottle by placing the bottle in a bowl of warm tap water. Do not fill the bowl with water higher than the rim of the bottle. (Babies can take cold formula but most young infants will prefer it warm.)
- Do not freeze formula.
- Allow freshly prepared (unused) formula to sit out at room temperature for no longer than 2 hours; use an insulated pack to transport formula. Milk left over in the bottle after a feeding should be discarded.
- In warm weather, transport reconstituted or formula concentrate from an open can in an insulated pack with frozen gel packs.
- Travel with water and formula separated—carry premeasured water bottles and carry bottles with premeasured amounts of powdered formula, or carry...
premeasured commercially prepared formula packets, or have the can of formula available.

- Inspect and replace bottle nipples as soon as they show wear—worn nipples can break apart and can become a choking hazard.
- Holding the infant during feeding (even when the infant can hold the bottle for himself or herself) promotes bonding and prevents supine feedings.
- Do not allow the infant to bottle-feed in a supine position because this increases the risk of otitis media and dental caries in the older infant.
- Never prop a bottle—this is a choking hazard.
- Allow infants to take what they want and to stop when they want. Overfeeding can lead to obesity.

Parents also need guidance about what kind of water to use to reconstitute formula (see Table 31–7 to review types of water sources) and should discuss with their infant’s healthcare provider whether to boil the water before use. If boiling is used, parents need to be instructed to heat the water until it reaches a rolling boil, continue to let the water boil for 1 to 2 minutes, and, most importantly, to allow the water to cool before using it to reconstitute the formula. Parents should also be instructed not to let the water boil down to a low level in the pan because this can cause minerals in the water to become concentrated.

Use of distilled bottle water and filtered tap water raises concerns with regard to fluoride. The AAP recommends that no fluoride supplements should be given to an infant before 6 months of age, but does recommend supplementary fluoride for infants and children aged 6 months to 3 years of age if the water source contains less than 0.3 ppm (AAP, 2005). Parents should be encouraged to read the labels on bottled water to see if fluoride has been added and to determine if the water source is suitable for their infant depending on his or her age (Table 31–7).

Parents often have questions about the kind of bottles and nipples to purchase. Plastic, glass, or disposable bottle bags may all be used based on preference. Mothers who bottle-feed expressed breast milk may want to avoid the use of bottle liners/bottle bags, especially if they have a fragile infant. Research shows that up to 60% of secretory immunoglobulin A (SIgA) found in breast milk binds to the polyethylene material used in these and is therefore lost to the infant (Lawrence & Lawrence, 2005). There are no human antibodies in formula so this is not a concern for bottle-feeding formula.

There are many different bottle nipples on the market. Parents will want to consider a slow-flow nipple for all newborns and for older breastfeeding babies learning to bottle-feed—over time the infant will graduate to medium-flow and high-flow nipples. Nipples come in different shapes. Generally, nipple shape plays a greater importance for breastfeeding babies receiving expressed breast milk or supplemental formula in a bottle. Breastfed babies transition best going from breast to bottle and back to breast again when using a bottle nipple that has a relatively wide base (to help maintain a wide-open latch) and a medium to long nipple length. Another variable to consider is nipple construction. Nipples are generally made from either rubber or silicone. Families with a sensitivity to latex are advised to use silicone nipples. Silicone nipples also have less of an odor, which may be an issue for some infants who are breastfed.

Many newly designed bottles are marketed to lessen air intake while an infant feeds. There is not a particular bottle design that is best for all babies. Different families find different bottles and nipple assembly products better than others. A key point to emphasize to the families is feeding technique. Parents should try to avoid situations in which an infant is crying for a prolonged time. Crying results in increased ingestion of air even before the infant has started feeding. Infants who are very hungry also gulp more air. For these situations, instruct the parents to burp their infant frequently to prevent the infant from having a large emesis (Figure 31–17). The parent may even want to attempt to pat the baby’s back briefly before starting the feeding to calm the infant and and possibly burp as well. Another tip to avoid excessive ingestion of air is to have the parent hold his or her infant cradled in the arms while bottle-feeding and have the parent tilt the baby’s bottle at a 45-degree angle (at least) in order for fluid to cover the nipple. This prevents the infant from sucking in air and swallowing it. See Figure 31–18 to view this technique.

To know if an infant is bottle-feeding well, the nurse needs to observe a bottle-feeding session. Parents should be informed that if the infant is sucking effectively, the parents should observe bubbles rising in the fluid (except if they are using plastic-lined bottles which contract as they empty). If the parent unintentionally placed the bottle nipple under the infant’s tongue, preventing him or her from sucking, the infant may make sucking efforts but will not receive any fluid and no bubbles will be visualized. Infants who persistently leak milk from the side of the mouth may be getting fluid too quickly. The nurse could suggest using a slower flowing nipple. If symptoms persist, the in-

### Table 31-7 WATER SOURCES

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distilled water</td>
<td>Minerals and most other impurities have been removed. It will not contain any fluoride. An acceptable water source for reconstituting formula.</td>
</tr>
<tr>
<td>Filtered tap water</td>
<td>Some minerals and impurities removed during filtration, including fluoride. This is an acceptable water source for reconstituting formula.</td>
</tr>
<tr>
<td>Natural mineral water</td>
<td>Comes from protected ground water and by law cannot be treated. Naturally contains high levels of minerals and sodium and so is not suitable for infants or for reconstituting formula.</td>
</tr>
<tr>
<td>Spring water</td>
<td>Comes from a single nonpolluted ground water, but unlike natural mineral water, it can be further treated. Because there is no regulation requiring the mineral content to be printed on the bottle label, it is best to avoid this water source for reconstituting formula.</td>
</tr>
<tr>
<td>Tap water</td>
<td>Water from the municipal water supply and regulated by drinking water regulations. It is treated and considered safe for use in reconstituting formula.</td>
</tr>
<tr>
<td>Well water</td>
<td>Needs to be tested before use. Higher risk of nitrate poisoning. Untested water is not recommended for use in reconstituting formula.</td>
</tr>
</tbody>
</table>
fant should have an oral evaluation. The infant could have a short lingual frenulum (tongue-tie) and not be able to properly cup his tongue under the nipple and channel fluid to the back of the throat, or the infant may have an oral-motor dysfunction and need speech therapy or occupational therapy evaluation.

**CLINICAL TIP**

Parents should be instructed not to put honey or corn syrup on their infant’s pacifier to encourage an infant to accept it. Honey and possibly corn syrup may be contaminated with Clostridium botulinum, a bacterium that causes infantile botulism. This is not a risk for the older child. Botulism is rare, but when it occurs it causes serious illness.

**COMMUNITY-BASED NURSING CARE**

**Promotion of Successful Infant Feeding**

To promote a supportive hospital environment for breastfeeding, some hospitals have applied for Certificates of Intent to become “Baby Friendly.” The World Health Organization (WHO) and the United Nations Children’s Emergency Fund (UNICEF) have collaborated to create a global program, the Baby-Friendly Hospital Initiative (BFHI), to recognize hospitals and birthing centers that offer optimal lactation services (WHO/UNICEF, 1994). Only hospitals that have been certified as complying with the 10 steps outlined in Table 31–8 have been awarded the designation as “Baby Friendly.” Baby-friendly status is not easy to achieve. One obstacle, among many, is having to agree not to accept free or low-cost formula. There are approximately 53 hospitals in the United States with Baby-Friendly designation as of May 2006, according to an update on the Baby-Friendly Hospital Initiative USA Web site (BFHI USA, 2006).

Childbirth and the beginning of motherhood are critical times in a woman’s life, so physical, psychologic, and social supports are of paramount importance. The nurse needs to explore the family’s social support base. The father or other partner is the

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**Table 31–8 BABY-FRIENDLY REQUIREMENTS**

<table>
<thead>
<tr>
<th>Baby Friendly 10 Steps to Successful Breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Have a written breastfeeding policy that is routinely communicated to all healthcare staff.</td>
</tr>
<tr>
<td>• Train all healthcare staff in skills necessary to implement this policy.</td>
</tr>
<tr>
<td>• Inform all pregnant women about the benefits and management of breastfeeding.</td>
</tr>
<tr>
<td>• Help mothers initiate breastfeeding within one half-hour of birth.</td>
</tr>
<tr>
<td>• Show mothers how to breastfeed and maintain lactation, even if they should be separated from their infants.</td>
</tr>
<tr>
<td>• Give newborn infants no food or drink other than breast milk, unless medically indicated.</td>
</tr>
<tr>
<td>• Practice rooming in—that is, allow mothers and infants to remain together 24 hours a day.</td>
</tr>
<tr>
<td>• Encourage breastfeeding on demand.</td>
</tr>
<tr>
<td>• Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.</td>
</tr>
<tr>
<td>• Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.</td>
</tr>
</tbody>
</table>

most important support person for her, although the baby can also provide some support in the form of positive feedback. However, extensive family support systems may not be available. The mother, mother-in-law, sisters, and other females who could mentor and care for the new mother may live at a distance or work full-time.

Many families will have adequate income, a good knowledge base, and good coping skills to handle problems. Some families will have support from a large extended family group, friends, church, or other organization. However, that is not the case for everyone; as evidenced by the frequent discontinuing of breastfeeding in the early postpartum weeks, there is a need for assistance and follow-up in this area. When inadequate support is identified, it may be beneficial to request a referral for the family to have an outpatient case manager involved to make sure the mother knows how to access the community resources and is making a good adjustment. Nurses, dietitians, childbirth educators, certified nurse-midwives, lactation consultants, mother-to-mother support groups, and physicians must collaborate to provide consistent, timely information and support and to attend to the new mother’s special needs.

Breastfeeding mothers who work outside the home and are supported in their decision tend to breastfeed their infants for longer periods than mothers who work but do not receive support. A baby-friendly workplace needs to be seen as another item in a benefit package offered by a company. Families and nurses who believe in breastfeeding need to be part of the solution to breastfeeding and workplace issues by educating employers in their communities (Rojjanasrirat, 2004). With a national nursing shortage and the trend toward earlier discharge from the birthing center, there is limited time for inpatient education. Teaching moments, when they occur, may not be optimal because of the distraction of visitors and the mother’s being sleep deprived, uncomfortable, or feeling the effects of an analgesic. It is important that parents receive verbal and written instructions and community resource information to which they can later refer. See also Chapter 36 for a complete discussion of self-care measures the nurse can suggest to a woman with a breastfeeding problem after discharge from the birthing center.

When parents leave the birthing center, the center staff need to have the name and phone number for both mother and baby’s

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**TEMPORAL CHANGES IN THE DETERMINANTS OF BREASTFEEDING INITIATION**

**What is this study about?** Breastfeeding is universally considered the optimal way to feed an infant for the first 6 months of life. It is encouraging that the rate of breastfeeding has increased in most countries. However, the prevalence of breastfeeding is variable across the international community, and so identification of the factors that predict a woman’s infant feeding choice is important. Determining which women are unlikely to pursue breastfeeding can help the nurse plan interventions to encourage breastfeeding. These determinants, though, are likely not static over time. This study had as its purpose the comparison of determinants of breastfeeding at discharge from the hospital in 2002/2003 with those reported for 1992/1993.

**How was this study done?** Both studies were conducted at two regional hospitals in Australia. The studies were conducted 10 years apart, and the same methodology was employed in both studies. Women were considered eligible if they delivered a live infant with no serious health conditions. The women agreed to complete a baseline questionnaire while in the hospital or shortly after discharge. The instruments used in the two studies were the same and included questions about the mother’s body mass index, smoking history, and attitude about infant feeding. These variables were then used to identify the determinants of any breastfeeding and exclusive breastfeeding at discharge from the hospital. In the earlier study, 556 women participated, and 587 participated in the most recent study.

**What were the results of the study?** There was a significant increase in the proportion of women breastfeeding at discharge from the hospital. In 1992/1993, 83.8% of the women left the hospital breastfeeding, and this increased to 93.8% by 2002/2003. In both studies, psychosocial factors, such as the mother’s perception of her partner’s and her own mother’s attitude toward breastfeeding, were strong predictors of breastfeeding at discharge. These factors were stronger than any of the sociodemographic and biomedical factors considered. The factors were studied as a group and for any individual effects. The strongest independent predictor of breastfeeding at discharge was the father’s infant feeding attitude, as reported by the mother. Women who perceived their partners to prefer breastfeeding were more likely to be breastfeeding at discharge than women who perceived their husbands preferred formula-feeding or were ambivalent about feeding methods. However, although these factors were the strongest predictors of making the decision to breastfeed, biomedical conditions—such as delivery method and infant health problems—were stronger predictors of exclusive breastfeeding at the time of discharge.

**What additional questions might I have?** What were the primary influences for single mothers or for mothers with no significant male partner? What interventions might be effective to influence the paternal attitude about breastfeeding as well as the mother’s?

**How can I use this study?** The decision to initiate breastfeeding appears to be influenced by family considerations, particularly the attitude of the infant’s father. Future interventions should aim to influence these modifiable factors. In particular, fathers play an important role in the infant feeding decision-making process. The nurse should seek ways to include the father in breastfeeding discussions. Fathers should be encouraged to attend antenatal classes that allow time for explanation of the supportive role fathers play in feeding decisions.

healthcare providers and know the indications to contact them. The breastfeeding mother needs a list of lactation resources available in the community. If no resource handout is available, the mother should be given the phone number to La Leche League International or the International Lactation Consultant Association (see MediaLink), which can provide assistance with finding the closest lactation support. Many hospitals around the country have a lactation program and may provide lactation services for a fee to anyone seeking services. Some cities have outpatient lactation centers that provide comprehensive lactation services, including consultation services, breastfeeding classes, and an infant scale for assessing baby’s weight, as well as telephone-based lactation advice. Some cities have lactation consultants in private practice who have an outpatient office or may do home visits. The WIC may have a lactation consultant on staff or may have a contract with a lactation consultant in private practice in the community. Another potential resource is a home health agency. Some home health agencies provide outpatient lactation services in the patient’s home. Some military facilities provide lactation services to their service members and dependents. The local library is also an excellent resource, and there are many books available commercially. Finally, the Internet can be a tremendous resource, although the quality of information cannot always be ensured. It is very helpful to have a handout listing some good sites that have been reviewed for accuracy.

Both breastfeeding and formula-feeding mothers who may be eligible for WIC should be encouraged to enroll themselves and their infants in the WIC nutrition program. WIC provides a specific number of cans of powdered formula to eligible mothers free of charge. The number of cans the mother receives is based on an agreement in the current government contract that WIC has with one of the two major formula companies (Mead Johnson, the maker of Enfamil®, or Ross, the maker of Similac®) and whether a mother is partially breastfeeding (in this case she usually receives 4 cans per month) or entirely formula-feeding (usually receives 9 to 10 cans per month, depending on the formula ordered and how many ounces of formula the can provides). The breastfeeding mother can also receive additional food vouchers for herself. The amount of formula the mother receives does not increase as the infant grows and the parents need to understand that 10 cans will not be sufficient over time and that they will need to purchase the difference when the infant’s needs exceed the amount supplied. Mothers with an extremely low income and who lack family support may need the numbers for emergency food assistance programs in the area. These might include local food banks, local churches (including the Salvation Army), and United Way programs. Low-income mothers also need to be reminded to enroll their infant in the Food Stamp Program so they can receive additional food vouchers each month.

**Cultural Considerations in Infant Feeding**

All groups of people are influenced by their cultural background. Every culture shares a set of values, beliefs, behaviors, and a language unique for that group. These are learned characteristics shared among their members. A person’s culture influences every aspect of their life. By learning about other cultures, the nurse will gain an understanding of the “context,” or unspoken assumptions that influence behavior, thus avoiding misunderstanding and improving the nurse’s ability to communicate with the person. Of course, it is also true that not all individuals within a particular cultural group subscribe to each of the values, beliefs, and behaviors characteristic of that group. People need to be seen as individuals within the context of their culture.

Within the United States, many people agree that breastfeeding is the optimum infant feeding method. However, breast exposure is often viewed in a sexual context, leading to disapproval of the mother attempting to breastfeed in public. Although this norm may be changing, it is important for the nurse to recognize that not only do “others” often hold these views, but the mother herself may feel this way. It is therefore important to determine the attitudes of the mother—based on her feelings, it may be very important or not important at all to spend time discussing methods of breastfeeding discreetly.

With regard to the feeding of colostrum, although many recognize that it has properties uniquely suited to the newborn, there are people who consider colostrum “unclean” and do not offer it to their newborns. This belief is found among some groups of Hispanics, Navajo Indians, Filipinos, and Vietnamese (Galanti, 2004). In a situation like this, in which a cultural custom is harmful or denies the infant benefits, it is the nurse’s responsibility to try to educate the family about the value of colostrum. A possible approach to this situation is as follows. First, reinforce the parents’ desire to protect their baby from infection. Next, validate the assumption that because colostrum looks similar to pus from a wound, it makes sense that one might think it is also unclean. Next, point out that the reason pus looks the way it does is because of the white cells that the body sends to fight infection. Last, explain that as in the case of a wound, colostrum is one of the body’s ways of helping fight infection—only in this case it is sending the white cells to the baby even before there is an infection. This last point again reinforces the initial validation of the parents’ concern for infection but now uses that concern as motivation to feed the colostrum, rather than to avoid it.

In these cultures and in some countries (Guinea, Pakistan, Bangladesh), breastfeeding begins only after milk flow is established (Riordan, 2005). In many Asian cultures, the newborn is given boiled water until the mother’s milk flows. The newborn is fed on demand, and cries are responded to immediately. If the crying continues, evil spirits may be blamed and a priest’s blessing may be sought. Although many of the Hmong women of Laos combine breastfeeding with some formula-feeding, they usually find expressing their milk or pumping their breasts unacceptable. Thus other methods of providing relief should be suggested if breast engorgement develops. Most Muslim mothers breastfeed because the Qur’an (Koran) encourages it until the child is 2 years old (Ott, Al’Khadhuri, & Al-Junaibi, 2003). Japanese women are returning to breastfeeding as the method of feeding for the baby’s first year.

Language is one of the most culturally sensitive behaviors and the source of much confusion. African Americans may refer to their infant as “greedy,” which may be interpreted as a
concern that the infant is taking too much. However, rather than an expression of concern, this term is often used as an expression of approval of the infant’s vigorous feeding. African American culture tends to emphasize plentiful feeding, and solid foods are introduced early—possibly even added to the infant’s formula. If the nurse misinterprets the expression, he or she may think that the mother is limiting the baby’s feeding and may attempt to convince the mother that she should be encouraging higher intake, which could lead to overfeeding. African American mothers view frequent feeding as an expression of hardiness and a positive behavioral characteristic for their children for the future (Biancuzzo, 2003). For traditional Mexicans, a fat baby is considered healthy and infants are fed on demand. “Soiling” is encouraged.

These are but a few of the multitude of cultural influences related to feeding. (See Developing Cultural Competency: Breastfeeding in Other Cultures.) When faced with an infant care practice different from the ones to which they are accustomed, nurses need to evaluate the effect of the practice. Different practices are not necessarily inferior. The nurse should intervene only if the practice is actually harmful to the mother or baby.

**Complementary and Alternative Practices**

**HERBS**

Herbs have been used since antiquity and are still commonly used worldwide. However, during the 20th century as the medical model was embraced in this country, herb use fell out of favor in the United States. Recently there has been a growing interest in herb use among women of childbearing age. Nurses working with this population should become familiar with common herbal preparations used by these women. It is also important to remember that most herbs are classified as dietary supplements and therefore are not bound by the same regulations as medications (Born & Barron, 2005).

Herbs of interest to lactating women include a group of herbs called galactagogues. Galactagogues are commonly used to increase a mother’s milk production when her supply is decreased, to assist in reestablishing a milk supply after weaning, and to assist in initiating lactation such as when an adoptive mother desires to nurse her infant. Herbal galactagogues include fenugreek, goat’s rue, milk thistle, anise, basil, blessed thistle, fennel seeds, and marshmallow, to name a few (Academy of Breastfeeding Medicine [ABM], 2004). Before taking a galactagogue, women are advised to consult with a knowledgeable healthcare provider first. The healthcare provider will want to obtain a thorough lactation assessment so that the cause of an underlying problem can be determined (e.g., the reason for the low milk supply), guidance and support (including follow-up) can be offered for the management of the problem, and contraindications to any galactagogue can be considered. Most of the herbal galactagogues are taken as a tea, although capsules are also available. Fenugreek is probably the most commonly used herbal galactagogue because it seems to have the fewest adverse side effects. Women who drink it as a tea generally drink 2 to 3 cups per day. The tea is made by adding ½ teaspoon of fenugreek seeds steeped in 8 ounces of water for 10 minutes. Women who take the capsules generally take one to four capsules (580 to 610 mg capsules) three to four times per day (ABM, 2004). Mothers usually notice an increase in their milk production in 2 to 3 days. Goat’s rue, fennel seed, or milk thistle (not blessed thistle) tea is made with 1 teaspoon of dried leaves steeped in 8 ounces of water for 10 minutes; women usually have two to three cups of tea per day (ABM, 2004; Wagner, Graham, & Hope, 2004).

There are also antigalactagogues (e.g., sage, parsley, and peppermint) that may or may not be used in combination with cabbage leaves and ice to decrease severe engorgement, to diminish an oversupply, and to “dry up” when weaning an infant from the breast (Humphrey, 2003). The type of herb, the dosage, and the method of administration are variable depending on the problem to resolve and personal preference.
CLINICAL TIP
To treat severe engorgement that may occur on days 3 and 4, some mothers find relief applying chilled, green cabbage leaves. The mother applies cleaned cabbage leaves (rinsed and dried) after first “crunching” the “veins” in the leaves to help release a chemical to aid in decreasing the swelling. The prepared cabbage leaves are applied topically to the swollen breasts. The cabbage leaves are spread over the breasts (excluding the nipples) and secured in place with a bra. The leaves are changed out every couple of hours when they have become wilted or when the mother awakens during the night. This remedy is discontinued as soon as the mother notices the breast swelling has decreased.

DIETARY SUPPLEMENTS
To treat recurrent breast plugs or mastitis, it is suggested that mothers replace saturated fats with polyunsaturated fats in their diet and consider taking a dietary supplement of lecithin. Lecithin is a natural nutrient present in dairy products, meat, egg yolks, fish, and soybeans. (However, note that meat and dairy products contain saturated fats.) Lecithin is also a liquid constituent of breast milk (Lawrence & Lawrence, 2005).

Lecithin is commonly used as an additive in foods as an emulsifier—for example, it is used in chocolate to make it smooth and is used as an ingredient in no-stick cooking spray to prevent food from sticking on baking cookware. Lecithin is available at health food stores and can be purchased in the form of granules, liquids, or capsules. In the liquid form, lecithin can be used as an oil on salads (Lawrence & Lawrence, 2005).

Women with current breast plugs sometimes take lecithin daily to prevent future bouts with this problem. “Suggested dosages are one tablespoon per day” (Lawrence & Lawrence, 2005) and “one tablespoon three to four times a day or one to two capsules (1200 mg each) three or four times per day” (Mohrbacher & Stock, 2003; Newman & Pitman, 2005).

HOMEOPATHY
This type of alternative therapy utilizes minute doses of a drug to treat a particular disease or problem; the particular drug chosen is the same drug that, if administered in massive amounts, would actually produce symptoms of the disease or problem for which it is being used to treat. Therefore, homeopathic remedies are used with the smallest dose required to relieve symptoms and for the shortest duration possible. Homeopathic remedies come in a variety of forms, such as mother tincture (strongest form), ointments, suppositories, and pills or tablets (also called pellets). Pellets are not handled with fingers because the remedy is on the outside of the pellet. Pellets are administered by being placed on or under a person’s tongue to dissolve. The strength of a remedy is designated (noted weakest to strongest) as follows: 6x, 30x, 6c, 30c, 200c, L, and M. An example of a homeopathic remedy is Lac Caninum; it is used to treat engorgement (Humphrey, 2003).

ESSENTIAL OILS
Essential oils are derived from aromatic plants through a distillation process. Water, alcohol, and other plant parts are separated during this process and what is left behind is the fragrant essence of the plant. The oils that are derived are highly concentrated and require being diluted with a base oil (e.g., a vegetable oil) before being applied to the skin, ingested, or used in aromatherapy (Humphrey, 2003).

Essential oils are used for their antiseptic, calming, stimulating, and soothing properties, but care must be taken when using them. Because essential oils are potent and can be toxic, mothers are advised to consult with a knowledgeable aromatherapist who will inform her as to which essential oils to avoid and how to safely use them. It is suggested that breastfeeding mothers avoid using essential oils on or near her breasts because even if wiped away, the oil may leave a residue on her skin. Essential oils are potentially allergenic, irritating, and hazardous depending on the type of oil, how it is diluted, and how it is applied (Humphrey, 2003).

NUTRITIONAL ASSESSMENT
A nutritional assessment is an integral part of a thorough health appraisal and is commonly performed by the infant’s primary care provider, a nurse, a lactation consultant, a registered dietitian, or a
speech therapist. The nutritional assessment will include all or some of the following parameters to measure wellness:

- Nutritional intake (i.e., breast milk, type of formula, other foods)
- Anthropometric measurements (i.e., measurements of weight, length, and head circumference)
- Biochemical status (i.e., the newborn metabolic screening, iron level, etc.)
- Physical examination (i.e., vital signs, total body examination, developmental milestones)
- Sociodemographic data (i.e., parity, maternal age, impact of cultural practices on feeding)

Parents will be asked to present a feeding diary for the provider to review, or the parents will need to recall the infant’s feeding pattern over the last 24 to 48 hours. The parents will also be asked to describe the infant’s urine and stool output, including quantity and quality. The healthcare professional is interested in the infant’s behavior pattern, especially during and immediately after feeding. If the newborn is not gaining sufficient weight, the infant’s feeding history must be examined more closely. If the infant is breastfeeding, a relevant maternal history is needed to determine if the mother is having breastfeeding difficulties and to help determine the root cause of the problem. If the infant is formula-feeding, the healthcare professional will first want to investigate the family’s formula-feeding practices (including formula preparation technique). While gathering these data, the healthcare professional should be sensitive to the family’s cultural practices. However, if a cultural practice has harmful effects, then the provider needs to tactfully educate the family to that fact.

The provider should plot the infant’s measurements for length, head circumference, and weight on a growth chart, denoting the infant’s individual percentile measurement compared with the general population. Because there are variations among infants at the same age, it is important to monitor the infant’s individual growth pattern over time. Ideally, the provider wants to see an infant track along the same growth curve. A drop of 20% or more on the growth curve is cause for concern.

As the healthcare provider begins the infant’s physical exam, the provider first obtains a subjective impression of the infant’s overall appearance. The provider performs a head-to-toe physical examination, carefully noting any deviations from normal. The physical exam helps identify any nutritional disorders. If the infant’s primary healthcare provider has any concerns about the infant’s nutritional status, the provider may order relevant laboratory studies (i.e., hemoglobin, hematocrit, transferrin, albumin, creatinine, nitrogen, and others), may evaluate the infant’s growth and development, and may see a need to refer the infant to a pediatric gastroenterologist for further evaluation.

With all the infant data available, it is now possible to determine an infant’s nutritional status and potential risks.

The following example shows the effectiveness of these assessments and interventions:

**Scenario:** Baby girl Torres was born at 37 weeks’ gestation to an 18-year-old, G1P0 via cesarean section. Baby Torres is now 76 hours postpartum and she and her mother are expected to go home today. While weighing the infant for a discharge weight, the mother mentions that she does not think her daughter is getting much breast milk when she feeds because her infant keeps falling asleep at the breast during the feeding. Baby Torres weighed 3542 grams at birth and her present weight is 3173 grams. (The difference is 369 grams. 369/3542 = 0.104 X 100 = 10.4% weight loss.) A quick assessment of the mother’s breasts reveal soft breasts and normal-sized nipples, with nipples intact. After contacting the infant’s healthcare provider to report the significant weight loss, the nurse is now ready to formulate a plan of care.

The nurse makes the following nursing diagnoses:

**Ineffective Breastfeeding related to:**
- Mother’s lack of knowledge about breastfeeding
- Mother’s not responding to infant’s feeding cues
- Mother’s inability to facilitate effective breastfeeding

As evidenced by a weight loss of 10.4% in baby.

**Risk for Ineffective Breastfeeding related to:**
- Insufficient knowledge regarding newborn’s reflexes and breastfeeding techniques
- Lack of support by father of baby or other support persons
- Lack of maternal self-confidence
- Maternal fatigue
- Maternal ambivalence
- Poor infant sucking reflex
- Difficulty waking the sleepy baby

**Risk for Imbalanced Nutrition: Less than Body Requirements related to:**
- Mother’s increased caloric and nutrient needs status postcesarean section
- Infant’s inability to correctly latch on and transfer milk

**Expected Outcomes of Care**

The expected outcomes for the infant include:
- Infant will arouse to feed at least every 3 hours and will stay awake until the end of each feeding.
- The infant will correctly latch on to the breasts and effectively breastfeed 8 to 12 times/day.
- The infant will maintain weight and will gain at least 10 g/kg/day.
- The infant will have four wet diapers, three-four bowel movements on day 4; five wet diapers, three-four bowel movements on day 5; and six-eight wet diapers, three-four bowel movements every day thereafter during the first month of life.
• Infant’s stools will transition from black to yellow by day 5 and will change in consistency from thick and sticky to loose and explosive with small curds or seedy appearance.
• Infant will not have any uric acid crystals in her diaper after day 4.
• Infant will be satiated after feeding, as evidenced by relaxed muscle tone and sleepiness.

The expected outcomes for the mother include:
• Mother will verbalize/demonstrate an understanding of breastfeeding technique, including positioning and latch-on, signs of adequate feeding, self-care.
• Mother will breastfeed pain-free.
• Mother will express satisfaction with the breastfeeding experience.
• Mother will consume a nutritionally balanced diet with appropriate caloric and fluid intake to support breastfeeding.

Plan of Care and Interventions
1. Review the mother’s history.
   • Maternal demographics—for example, mother’s date of birth, parity, marital status
   • Pregnancy history—for example, complications during pregnancy, gestation at delivery
   • Complications of delivery—for example, cesarean section, excessive blood loss
   • Current medical issues—for example, hypothyroidism? diabetes?
   • History of breast surgery or radiation—for example, breast reduction, radiation to treat previous breast cancer
   • Use of medications, herbs, alcohol, cigarettes
   • Psychosocial history—maternal support system, hx depression, and so on
   • History of previous breastfeeding experience
   • Assess the breasts and nipples.
   • Obtain a description of lochia drainage.
3. Infant assessment.
   • Obtain the infant’s weight and compare with previous weight measurements. If this were an older infant, then it would be appropriate to obtain head circumference, length, and weight measurements and track the infant’s trend on the growth chart; however, because this infant is only 3 days old, daily tracking of the other growth parameters is not applicable for this situation.
   • Examine the infant, with emphasis on oral anatomy and oral-motor function, infant reflexes, overall behavior, skin color (jaundice).
   • Assess the infant for signs of dehydration.

4. Infant feeding history.
   • Diet
   • Feeding frequency and duration
   • History of supplementation
   • Review elimination pattern
      • Number of wet diapers, quality of urine
      • Number of bowel movements, quality of stool
5. Pre- and postbreastfeeding weight check.
   • Calculate milk transfer during breastfeeding. Postfeed weight minus prefeed weight equals net breast milk transfer. Note: the nurse must use a digital electronic scale accurate within 2 grams. The infant does not have to be naked but the clothing and diaper the infant is wearing cannot be changed during this test measurement.
6. Observation of breastfeeding technique.
   • Positioning and latch-on technique, infant responses, suckling pattern, satiated after feeding
7. Review feeding requirement/caloric requirement based on the infant’s birth weight (3.542 kg).
   • Fluid requirement: 140 to 160 mL/kg/day
     • Should be up to full volume by day 6; should then receive 496 to 567 mL/day. To calculate mL to oz: take 496 mL, divide by 30 mL/oz, this equals to 16.5. The infant should receive 16.5 to 18.9 oz/day.
     • The infant should feed 8 to 12 times/day. If the infant feeds 10 times/day, then the infant should feed 496/10 = 49.6 mL/feeding.
     • On day 3, the infant will not be expected to feed approximately 50 mL/feeding (minimum full volume); the infant may only feed 30 mL/feeding but will be increasing volume daily as tolerated until up to full volume in the next couple of days.
   • Caloric requirement 100 to 115 kcal/kg/day
     • Should be up to full caloric requirement by day 6; should receive 354 to 407 kcal/day. Breast milk has 20 kcal/oz; standard infant formula has 20 kcal/oz. To determine how many ounces the infant will require per day, take 354 kcal/day divided by 20 equals 17.7 oz/day. Note: The infant should be gradually increasing her volume of milk each day and will soon be up to full volume.
8. Assess teaching needs.
   • Review benefits of breastfeeding.
   • Review the process of breastfeeding (principle of supply and demand).
   • Review breastfeeding technique (reading infant cues, positioning, and latch-on).
• Review infant intake and output expectations.
• Review infant weight gain expectations.
• Provide breast pump instructions and review collection and storage.
• Provide information on maternal nutrition and fluid requirements.

• Provide frequent skin-to-skin contact.
• Watch the infant for early feeding cues. If the infant is too dehydrated and weak to exhibit these feeding behaviors, then help the infant to wake up at least every 3 hours.
• Start pumping each time the infant feeds (8 to 12 times/day), if the mother’s breasts are still very soft and light (delay in milk coming in). All expressed breast milk should be fed to the infant. If the mother is not able to express enough milk, then the infant should be supplemented with iron-fortified cow’s milk-based formula unless specified otherwise.

CHAPTER REVIEW

FOCUS YOUR STUDY

• The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for the first 6 months and continued breastfeeding until the infant is 1 year old or older.
• During the first few days after birth, the minimum output expectations for an exclusively breastfeeding infant will be: one wet/one stool on day 1; two wets/two stools on day 2; three wets/three to four stools on day 3; four wets/three to four stools on day 4; five wets/three to four stools on day 5. Thereafter, an exclusively breastfeeding infant has six to eight wet diapers and three to four yellow milk stools each day, generally during the first month of life.
• Infants’ stools start as black and sticky at birth and transition to yellow, curdy, and seedy by day 5 or sooner.
• Formula-feeding infants lose about 3.5% of their birth weight. Breastfeeding infants lose up to 7% of their birth weight. A weight loss of more than 7% is excessive and requires an evaluation and follow-up. Infants should be back to their birth weight by 10 to 14 days of age.
• Growth rate over the lifespan is greatest during infancy. The healthy full-term infant gains approximately 10 g/kg/day for the first month of life. Exclusively breastfed infants have the same or slightly greater weight gain in the first 3 to 4 months of life than mixed-fed and formula-fed infants. Thereafter, formula-fed and mixed-fed infants are heavier than breastfed infants.
• Increases in body length and head circumference between breastfed and formula-fed infants is the same. An infant gains 1 inch per month in the first 6 months, and then 0.5 inch for the following 6 months. Length is a better indicator of growth than is weight.
• Generally, infants double their birth weight by 5 months, triple their birth weight by 1 year of age, and quadruple their birth weight by 2 years.
• The dietary reference intake (DRI) for calories for the newborn is 100 to 115 kcal/kg/day.
• The dietary reference intake (DRI) for fluid intake for the newborn is 140 to 160 mL/kg/day.
• Breast milk has immunologic and nutritional properties that make it the optimal food for the first year of life.
• Mature breast milk and standard commercially prepared formulas provide 20 kcal/oz.
• The breastfed infant’s iron stores in full-term infants are usually depleted by the time the infant is 6 months old.Breastfeeding infants over 6 months of age who are eating supplementary foods rich in iron and infants consuming iron-enriched formula need no other vitamin or mineral supplements.
• There are three types of commercial infant formulas: cow’s milk-based formula, soy milk-based formulas, and specialized formulas including hydrolysated formulas.
• Neither cow’s milk nor soy milk should be given to infants before 1 year of age. The use of skim milk or low-fat cow’s milk is not recommended for children under 2 years old.
• Signs indicating a newborn’s readiness to feed include hand-to-mouth movements, rooting, smacking, fussing, and crying (a late-feeding cue).
• By learning about cultural variations, the nurse will gain an understanding of the “context” or unstated assumptions that influence behavior, thus avoiding misunderstanding and improving the ability of the nurse to communicate with clients.
• Infants should not receive water supplements until they start solid foods.

• Although most maternal medications are transmitted through breast milk, few are actually contraindicated. The bioavailability of transmitted drugs to the infant depends on a variety of factors, including route of administration, protein binding, degree of ionization, molecular weight, timing of the dose with respect to feeding time, and absorption across the infant’s intestinal tract. Mothers should consult with a healthcare provider knowledgeable about medications and lactation.
• Breastfeeding mothers should be taught to use proper positioning and latch-on technique. The mother should be advised to alternate feeding positions periodically to promote efficient drainage of all the ducts in the breast.
• The formula-feeding mother may need help learning about the types of formulas and how to prepare and store formula. Like the breastfeeding mother, she will benefit from understanding feeding cues and proper technique for feeding her infant.
• Nutritional assessment of the infant includes the infant’s dietary history, anthropometric measurements, physical examination, and laboratory tests, if indicated.

EXPLORE MediaLink

http://www.prenhall.com/davidson

NCLEX review questions, case studies, and other interactive resources for this chapter can be found on the Web Site at http://www.prenhall.com/davidson. Click on “Chapter 31” to select the activities for this chapter.

For tutorials including animations and videos, more NCLEX review questions, and an audio glossary, access the accompanying Prentice Hall Nursing MediaLink DVD-ROM in this book.

PRENTICE HALL NURSING MEDIA LINK DVD-ROM
Audio Glossary
NCLEX Review
Breastfeeding Video
Video: Through the Eyes of a Nurse—Welcoming the New Arrival at the Postpartal Visit

COMPANION WEB SITE
Additional NCLEX Review
Case Study: Client Undecided on Formula Feeding or Breastfeeding
Care Plan Activity: Breastfeeding Concerns
CRITICAL THINKING IN ACTION

BREASTFEEDING TECHNIQUES

View the Critical Thinking in Action video for Chapter 31.

Patty Kline, age 28, G1, now P1, delivers a 7.3-pound baby girl by spontaneous vaginal birth over a median episiotomy. The newborn’s Apgar scores are 8 and 9 at 1 and 5 minutes. The infant is suctioned in the nose and mouth and given free-flow oxygen on the mother’s abdomen. Patty received an epidural during her labor and birth. Patty initiated breastfeeding within the first hour after the birth, but at that time the newborn did not latch on. The infant was held to the mother’s breast, rooted, and licked the nipple. You are the nurse caring for the infant at 2 hours of age. The admission assessment is significant for asymmetric head with a 3-cm caput succedaneum. The infant’s temperature is stable. You bring the infant to the mother’s room to assist her with breastfeeding.

1. Describe clues that indicate the infant is ready to breastfeed with the mother.
2. How would you explain how to position the infant at the breast?
3. Explain what to observe for the infant’s proper latch-on.
4. Explain the basics of milk production.
5. Explore helpful measures the mother can attempt in support of breastfeeding.

REFERENCES


