

Nutrition for the Term Infant

Breast milk is universally recommended as the preferred source of infant nutrition, in part because of its superior nutrient and immunologic properties. Successful breast feeding requires nursing on demand, prevention of sore nipples and convenient access to medical advice. For mothers relying on bottle feeding, cow's-milk-based formula is the preferred choice. Because soy-based formulas are lactose-free, they may be tolerated by infants who are allergic to cow's-milk protein. Protein hydrolysate formulas should be used only in infants who cannot tolerate cow's-milk-based or soy-based formulas. Low-iron formulas and whole cow's milk should not be used during the first year. Breast-fed infants rarely require vitamin supplementation. Fluoride supplementation is no longer recommended for infants less than six months of age.

Benefits of Breast Feeding

Breast milk is universally recognized as the preferred source of infant nutrition, and the nutritional advantages of breast milk have been well documented. Colostrum, the first milk produced after delivery, provides an initial dose of enzymes that promote gut maturation, facilitate digestion and stimulate passage of meconium. Colostrum is also high in protein, primarily because of high levels of immunoglobulins and secretory IgA. The protein in human milk is ideal not only for absorption, but also for utilization, especially by the rapidly developing infant brain. Human milk also contains predominantly polyunsaturated fats with stable amounts of cholesterol, an important constituent of brain and nerve tissue.

Human milk also protects against infection by providing cellular immunity through macrophages and humoral factors, such as antibodies. Numerous studies have verified that breast-fed infants have a lower incidence of bacterial and viral illnesses than bottle-fed infants. This low incidence is of particular clinical significance in developing nations? Ongoing research suggests that breast feeding may provide immunologic protection against diabetes mellitus, cancer and lymphoma. Finally, breast feeding has been found to provide protection from allergic diseases, including eczema, asthma and allergic rhinitis. This protection is most likely the result of breast milk decreasing intestinal permeability to large, allergenic molecules.

Recognizing these as well as other advantages, the American Academy of Family Physicians (AAFP) and the American Academy of Pediatrics (AAP) have identified breast milk as the preferred source of infant nutrition. In addition, the U.S. Public Health Service (USPHS) has established a national goal that, by the turn of the century, 75 percent of new mothers will be breast-feeding at the time of hospital discharge. Despite an emphasis on breast feeding by both private and government organizations, only 54 percent of U.S. mothers initiate breast feeding, and fewer than half of these mothers continue nursing for at least six months. Clearly, all health care providers should actively promote breast feeding if the goal set by the USPHS is to be accomplished.

To successfully promote breast feeding, family physicians should consider the influence of marketing campaigns aimed at expectant and new mothers by the manufacturers of infant formulas. Historically, their dogged marketing efforts have included the distribution of free cases of infant formula to expectant mothers, as well as the inclusion of formula samples in commercial hospital discharge packs designed for breast-fed infants. Physicians must work proactively to weigh the risks and benefits of promotional materials and develop appropriate policies governing their distribution in their hospitals or academic institutions.

Counseling Strategies

Breast feeding should be initiated as soon after delivery as possible, and mothers should be encouraged to nurse on demand, usually eight to 10 times a day.

TABLE 1

Signs of Successful Breast Feeding

Audible swallowing

Eight to 10 feedings per day

Six to eight wet diapers per day

Three to five bowel movements per day

Infant regains birth weight by two weeks of age

This strategy enables the milk supply to quickly become well established. Table 1 lists reassuring signs of successful breast feeding, which can be used to assess the infant's nutritional intake as well as to bolster the new mother's confidence in her breast-feeding success. Supplemental formula feedings should be discouraged in the early postpartum period, since they may result in a decreased milk supply or infant confusion between the artificial and maternal nipples?

The first weeks of nursing represent a pivotal time for success or failure of breast feeding. And with the trend toward increasingly abbreviated inpatient stays, nursing mothers will be relying more than ever before on their physicians and office staff to provide much of the breast-feeding counseling that previously took place in the hospital.

To be successful, nursing mothers must learn proper positioning of the infant. Since sore nipples can derail even the best intentions to breast feed, nursing mothers should learn techniques for preventing sore nipples, such as varying the nursing position and using the little finger to break the infant's suction before removing the infant from the breast. Should these efforts fail to prevent soreness, mothers should have quick access to effective treatment regimens.

The ability of the breast-feeding couple to weather difficulties and setbacks can be enhanced by close contact with a responsive physician and office staff. Early physician visits, home nursing visits and even telephone contacts can provide opportunities to offer support and guidance to nursing mothers? For example, a staff member might routinely call nursing mothers the day after hospital discharge. The physician's office environment can be structured to allow privacy and comfort for nursing mothers. Often this can be accomplished by simply making an examination room available.

Once nursing is well established, the physician should encourage the mother to continue nursing throughout the infant's first year of life. Physicians should avoid recommending unnecessary disruptions in breast feeding. Recent guidelines on the management of hyperbilirubinemia in the healthy term newborn, for example, discourage the interruption of breast feeding and, instead, provide the option of frequent breast feeding.

If the mother must take medication, breast feeding should not be arbitrarily suspended, since many drugs have been found to be compatible with nursing. Other medications, such as radioactive compounds, are contraindicated during nursing. If such medications are taken for a short time only, the mother can use a breast pump to maintain milk production and resume nursing when the compound has been eliminated. The AAP periodically updates a list of medications compatible with breast feeding. This list provides valuable information for physicians wishing to maximize breast-feeding continuity without risk to mother or infant?

The family physician also should be prepared to counsel the mother who is planning to return to work. Many options are available to these women, including using a breast pump, creating flexible work schedules, arranging to unite the baby and the mother for feedings and part-time nursing. Even if the employed mother does not plan to continue nursing when she returns to work, both mother and infant can benefit from breast feeding during the early weeks of life, and the mother should be encouraged to nurse for as long as she can.

Bottle Feeding

Mothers who choose to bottle feed also need counseling about infant nutrition. Although all commercial formulas use human milk as their model, none reproduce the immunologic and digestive properties of human milk. Formulas are available in three forms: ready-to-feed, liquid concentrates and powders. While ready-to-feed formula needs no preparation, it is the most expensive. Concentrates must be diluted with water and are intermediate in price. The most economical option is the powdered form, which is prepared by thoroughly dissolving one scoop of powder in 2 oz of water? All three forms of the same brand are nearly identical nutritionally, although slight differences may exist.

The need for sterilization of bottles, nip-pies and water used in preparing formula is currently a matter of debate. Formula manufacturers recommend sterilization. Others argue that if the water is sanitized and bottles are prepared one at a time, sterilization is not needed. Unsanitized water, such as well water, should be boiled for 5 minutes. When tap water is used, cold water should be allowed to run for approximately 2 minutes, to clear standing water from the pipes and minimize possible lead contamination. Partially consumed formula should always be discarded.

The most common types of formulas are cow's-milk-based, soy-based and protein hydrolysate. Cow's-milk-based formula is the preferred Choice, since it has been tested extensively to provide nutritional support for the healthy infant when used exclusively. Differences in composition between cow's-milk-based formula and human milk are summarized in Table . 2 Lactose is the major carbohydrate source in cow's-milk-based formula. The calorie content is 20 kcal per oz, which is identical to that of breast milk.

Soy-based formulas contain soy protein and are lactose-free. They comprise approximately 20 percent of infant formulas and represent a nutritionally sound alternative to cow's-milk-based formula? Soy formulas may be used by vegetarians and infants with lactose deficiency or galactosemia. Soy formulas also may be used in the postdiar-rheal period although, in a recent meta-analysis, routine use of lactose-free formula was not found to be justified, especially when oral rehydration therapy and early feeding with solid foods are employed? Infants with an IgE reaction to cow's-milk protein often do well on soy formula; however, some infants who are allergic to cow's-milk protein also have allergies to soy formulas.²³ Minor signs of intolerance to cow's-milk-based formula, such as colic, loose stools and spitting up, may occasionally lessen or disappear after a switch to soy formula, although most of these problems are unrelated to the type of formula used.²⁰

Protein hydrolysate formulas are used for infants who cannot tolerate cow's-milk-based formulas or soy-based formu-

TABLE 2

Major Nutrients in Infant Formulas Compared with Human Milk

Nutrient	Mature	Similac with iron	Enfamil with iron	Isomil with iron	Prosobee with iron
	human milk				
Fat (g per L)	39	36.5	38.0	36.9	36.0
Oil mixture		Soy, coconut	Coconut, soy	Soy, coconut	Soy, coconut
Protein (g per L)	10.5	14.5	15.2	18.0	20.0
Whey:casein	70:30	18:82	100:0	*	*
Carbohydrate (g per L)	72	72.3	70.0	68.3	68.0
Source	Lactose	Lactose	Lactose	Sucrose, corn syrup	Corn syrup
Selected minerals					

Calcium (rag per L)	280	493	470	710	640
Phosphorus (mg per L)	140	380	320	510	500
Iron (mg per L)	0.3	12.0	12.8	12.0	12.0
Sodium (mEq per L)	7.8	8.0	8.0	13.0	10.4
Selected vitamins					
Vitamin D (IU per L)	20	410	430	410	430
Vitamin K (ug per L)	2.1	54	58	100	106
Vitamin C (mg)	40	60	55	60	60

Whole Cows Milk

In the past, whole cow's milk was considered an adequate replacement for iron-fortified formula in infants more than six months of age who were getting at least one-third of their calories from supplemental food. Recently, this recommendation has been re-examined. Infants fed whole cow's milk after six months of age have been found to have poorer iron status than infants who are fed iron-fortified formula. Other studies have shown substantial enteric blood loss in infants more than six months of age who are fed whole cow's milk. Also, questions have arisen regarding the bioavailability of the iron in infant cereals, which are often used to provide supplemental iron. Based on this and other evidence, whole cow's-milk and low-iron formulas should not be used during the first year of life. Ideally, infants should be breast-fed for the first six to 12 months of life, with iron-fortified formula being the only acceptable alternative during the first year.^{25,27}

Vitamins

Vitamin K is effective prophylaxis against hemorrhagic diseases of the newborn because it minimizes the postnatal decline of vitamin K-dependent coagulation factors. Therefore, regardless of the method of feeding, all infants should receive 0.5 to 1.0 mg of intramuscular vitamin K or 1.0 to 2.0 mg orally in the immediate newborn period?° Although breast milk contains only 5 to 10 percent of the vitamin K contained in infant formula, no adverse effects have been demonstrated with breast feeding, and vitamin K supplementation of exclusively breast-fed infants beyond the initial dose has not been recommended?

Although human milk contains low levels of vitamin D, the term infant of a well-nourished mother is not likely to need vitamin D supplementation as long as the infant receives adequate exposure to sunlight. Daily supplements of vitamin D (5 to 7.5 ug) can be given to infants receiving insufficient exposure to sunlight. As an alternative, increasing maternal vitamin D intake increases the vitamin D content in breast milk and may be the best method of ensuring adequate vitamin D for the infant.

Vitamin B content of human milk also depends on maternal dietary intake. As a result, vegetarian mothers are at risk for vitamin B₆ and B12-deficient milk unless they supplement their diets with these vitamins. Conversely, human milk is rich in vitamins A, C and E, so no supplementation of these vitamins is needed for breast-fed infants?

Because infant formulas are fortified with vitamins and minerals, formula-fed term infants do not require vitamin and mineral supplements during the first six months of life, except the initial postnatal dose of vitamin K. If formula is combined with solid food after six months of age, infants can continue without vitamin and mineral supplements?

Iron

Although human milk contains only 0.3 mg iron per L, it is approximately 50 percent absorbed. Iron from breast milk helps delay depletion of neonatal iron stores; however, breast-fed infants need iron supplementation at six months of age, usually in the form of iron-fortified cereal? To ensure adequate iron for the term infant who is not receiving human milk, the AAP Committee on Nutrition has

recommended that only iron-fortified formulas be used for all formula-fed infants.

Despite this recommendation, approximately 20 percent of formula-fed infants receive low-iron formulas. This fact is especially alarming because low-iron formulas have been associated with iron deficiency and have not been associated with fewer adverse gastrointestinal reactions than iron-fortified formulas. Low-iron formulas simply have no role in any infant's nutritional program?

Fluoride

Fluoride supplements for children have recently been reassessed because of an increasing incidence of dental fluorosis. Dental fluorosis is caused by excess fluoride ingestion, leading to enamel protein retention, hypomineralization of the dental enamel and destruction and disruption of crystal formation. Although teeth remain resistant to caries, fluorosis causes cosmetic dental changes ranging from barely perceptible white striations to brownish-gray stains.

For infants, the main sources of fluoride include fluoridated water, toothpaste and fluoride supplements. Unfortunately, water is not uniformly fluoridated throughout the United States, and infants ingest variable, though significant, amounts of fluoride from toothpaste. Since fluoride from both of these sources cannot be easily quantified or readily controlled, recommendations for fluoride supplements have been modified to decrease the risk of fluorosis. These new recommendations are outlined in Table 3. It is important to note that fluoride supplementation is no longer recommended for infants under six months of age.

TABLE 3

Recommended Daily Doses of Fluoride Supplementation

Age	Fluoride in water (ppm)		
	<0.3	0.3 to 0.6	>0.6
Birth to 6 months	0 mg	0 mg	0 mg
6 months to 3 years	0.25 mg	0 mg	0 mg
3 to 6 years	0.50 mg	0.25 mg	0 mg
6 to 16 years	1.00 mg	0.50 mg	0 mg

Since ready-to-feed formulas are manufactured with water low in fluoride, infants more than six months of age who rely predominantly on these formulas may require fluoride supplementation. Similarly, both spring water and distilled water often contain little fluoride, so infants fed formula or drinks prepared from these types of water also may need fluoride supplements.