Updates in Infant Nutrition

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Practice Gap

Guidelines for introduction of complementary foods in infants have evolved. New data have led to the development of updated guidelines on the introduction of high-allergy foods, especially with the introduction of peanuts. Pediatricians need to keep up to date with these changes to educate parents on current guidelines.

Objectives

After completing this article, readers should be able to:

1. Educate parents on the introduction of complementary foods, specifically with regard to iron- and zinc-fortified first foods and highly allergenic foods, including peanuts, on the basis of current guidelines.
2. Use the World Health Organization and US Centers for Disease Control and Prevention growth charts correctly.
3. Recognize and treat common medical conditions related to infant nutrition.
4. Describe the differences between common infant formulas.

AUTHOR DISCLOSURE Drs DiMaggio, Cox, and Porto have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

ABBREVIATIONS

AAP	American Academy of Pediatrics
ARA	arachidonic acid
CDC	Centers for Disease Control and Prevention
DHA	docosahexaenoic acid
FDA	Food and Drug Administration
FPIES	food protein–induced enterocolitis syndrome
GER	gastroesophageal reflux
GERD	GER disease
IgE	immunoglobulin E
MCT	medium-chain triglyceride
WHO	World Health Organization

INTRODUCTION

Infancy is a period of rapid growth and development. Parents are often confused about optimal infant nutrition practices. In addition, as new research has emerged, pediatricians have needed to modify the education provided to parents. This article covers common topics about infant nutrition, including normal infant growth, use of breast milk, discussion of formula options, and introduction of complementary foods. Our recommendations are based on current guidelines and research.

NORMAL GROWTH DURING INFANCY

During infancy, children are expected to double their birth weight by 5 to 6 months of age. Children gain weight more rapidly during the first 3 months after birth, and this rate decreases over the first year (Table 1). Height will also increase by 10 inches (25.4 cm), and head circumference will increase by 5 inches (12.7 cm) in the first year.

TABLE 1. **Normal Infant Weight Gain**

AGE	MEAN WEIGHT GAIN
0–3 mo	1 oz or approximately 30 g/d
3–6 mo	1 oz every other d or approximately 15 g/d
6–12 mo	1 oz every 3 d or approximately 10 g/d

A good resource for identifying patterns of excessive weight loss in the first few days to 1 month after birth is the Newborn Weight Tool, or NEWT. It is a nomogram from a Kaiser Permanente database (www.newbornweight.org) that is based on weight patterns in a cohort of more than 100,000 breastfed newborns and more than 7,000 exclusively formula-fed infants who were born at at least 36 weeks of gestational age.

USE OF GROWTH CHARTS

The US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) publish the 2 most commonly used reference growth charts for infants and toddlers. However, currently, the CDC recommends the use of the WHO growth charts for children 0 to 24 months of age, while CDC growth charts should still be used for children 2 years of age and older. WHO growth charts, which were established in 2006, are a better representation of how children should grow in the United States today, as compared to CDC growth charts. (1) Results of a survey of US infants in 2009 showed that 77% of infants were breastfed at least once, 47% were breastfed for at least 6 months, and 26% were breastfed at 12 months. (2) The WHO charts provide a better estimation of growth for children who are breastfed and also include a larger and more diverse sample size (Table 2). Formula-fed infants gain weight more rapidly in the first 3 months after birth, while breastfed infants grow more slowly during the first year. As a result, when a breastfed infant's growth is plotted on a CDC growth chart, it may seem as if the infant is not gaining weight adequately. For this reason, it is recommended that pediatricians always check which growth chart is being used, particularly when using electronic medical record systems in which both forms may be incorporated.

FREQUENCY AND AMOUNT PER FEEDING

Parents are often concerned about whether a newborn is feeding an appropriate number of times per day and whether the newborn is ingesting an adequate quantity at each feeding. The amount a baby will consume will vary for each newborn and between different feedings throughout the day for the same newborn. On average, a full-term newborn will breastfeed on demand approximately every 2 to 3 hours, or 8 to 12 times per day, while formula-fed babies will consume 2 oz every 3 to 4 hours. These feedings should result in an intake of 140 to 200 mL per kilogram of body weight per day, providing 90 to 135 kcal/kg per day for the first 3 months and the expected weight gain of 25 to 30 g per day. (3) By 8 to 12 months, babies will tend to breastfeed 3 to 4 times per day and drink approximately 7 to 8 oz per bottle. Table 3 summarizes an approximate feeding schedule for the first year; however, it is best to respond to an infant's feeding cues and hydration status rather than feed fixed amounts or adhere to a rigid schedule.

Over 12 months, an infant may breastfeed as often as the baby and mom desire, from 1 or 2 times to multiple times per day. If there is no allergy to cow milk, infants who are formula fed may begin drinking whole milk at 1 year of age at a maximum amount of 16 to 24 oz a day. Intake of milk above this recommended amount is associated with increased risk of iron deficiency and subsequent anemia. The American Academy of Pediatrics (AAP) recommends introducing reduced-fat milk between 12 months and 2 years of age in children at risk of being overweight or for those whose families have a history of obesity, heart disease, or high cholesterol.

BREASTFEEDING

The AAP recommends exclusive breastfeeding for approximately 6 months, after which complementary foods are introduced, along with breastfeeding until 1 year of age or later, as long as desired by mother and infant. The benefits of breastfeeding are well documented for both infant and mother and are listed in Table 4. It is not clear, however,

TABLE 2. **Differences between WHO (0–24 months) and CDC (0–36 months) Growth Charts**

CDC	WHO
Approximately 50% of infants were breastfed at least once 33% of infants still breastfed at 3 mo	100% of infants predominantly breastfed for at least 4 mo and at least partially breastfed for 12 mo
US data only	Data from India, California, Ghana, Oman, and Norway
No longitudinal data (4,697 observations)	Longitudinal data (18,973 observations in 882 children)

CDC=Centers for Disease Control and Prevention, WHO=World Health Organization.

TABLE 3. **Approximate Feeding Schedule for the First Year after Birth**

AGE	FORMULA FED	BREASTFED
Full-term newborn	2 oz every 3–4 h	On demand every 2–3 h or 8–12 times per d
1 mo	3–4 oz every 3–4 h	On demand every 2–4 h or 7–8 times per d
2–4 mo	3–6 oz 5–8 times per d	On demand 5–8 times per d
4–6 mo	4–6 oz 4–6 times per d	4–6 times per d
6–8 mo	6–8 oz 3–5 times per d	3–5 times per d
8–12 mo	7–8 oz 3–4 times per d	3–4 times per d
1 y and older	16–24 oz whole milk per d	1–2 times to multiple times per d, as long as mom and baby desire

According to reference 4.

whether exclusive breastfeeding has an effect on the development of allergic rhinitis, food allergies, later childhood asthma, or eczema after the age of 2 years.

CONTRAINDICATIONS TO BREASTFEEDING

Medical contraindications to breastfeeding are few. Infants with a diagnosis of galactosemia cannot breastfeed, they require lactose-free milk, and they are most often started on a soy-based formula. Maternal infection with human T-cell lymphotropic virus type I or II, untreated brucellosis, and, in the United States, HIV, are also contraindications to breastfeeding; in these cases, mothers should neither breastfeed nor provide expressed breast milk to their infants. In mothers with untreated active tuberculosis, expressed breast milk may be provided, and breastfeeding may later begin once a mother receives treatment with antituberculosis drugs for approximately 2 weeks and is proven to no longer be infectious. Mothers with the onset of varicella 5 days before a newborn's birth through 2 days after the birth will be separated from their newborn, but they may provide expressed breast milk; likewise, mothers with H1N1 influenza should be separated from their neonates until they are afebrile, but they can provide expressed milk. Mothers with active herpes simplex lesions on the breast may also provide expressed breast milk.

Although most prescribed medications are compatible with breastfeeding, there are a few classes of drugs, including amphetamines, chemotherapy agents, ergotamines, and statins, for which risks associated with breastfeeding have been identified. When uncertain about compatibility, health care providers may use LactMed (online at https://toxnet.nlm.nih.gov/newtoxnet/lactmed.htm), a resource published by the National Library of Medicine and the National Institutes of Health, for further recommendations.

Maternal substance abuse may not be a contraindication to breastfeeding in all cases; a thorough evaluation should be performed prior to breastfeeding. For instance, HIV-negative mothers who are taking narcotics may breastfeed if they are in a methadone maintenance program; however, breastfeeding is contraindicated in mothers taking phencyclidine, cocaine, and cannabis. Mothers who wish to drink alcohol should drink no more than 0.5 g of alcohol per kilogram of body weight; alcohol consumption should occur soon after nursing the infant to ensure that there is a maximal time until the next feeding—ideally more than 2 hours—to reduce the alcohol concentration in the breast milk.

BREAST MILK STORAGE

It is recommended that breast milk be stored in 2- to 4-oz aliquots to prevent any waste. If a baby drinks from a bottle of breast milk, any remaining breast milk should be consumed within 2 hours, or if it is refrigerated right after a feeding, it may be used for the next feeding. Breast milk can be left at room temperature (up to 77°F or 25°C) for 4 hours, or if very cleanly expressed, up to a maximum of 6 to 8 hours. When refrigerating breast milk, it should be placed in the back of the refrigerator (39°F or 4°C) so it is not exposed to temperature variations with the opening and closing of the refrigerator door and should be consumed within 4 days or up to a maximum of 8 days. If freshly expressed breast milk will not be used within 24 hours, then it should be frozen and stored in the back of a freezer. If the milk is frozen in a refrigerator with a separate freezer door (0°F or −18°C), breast milk may be stored for up to 9 months. If frozen in a chest or deep freezer (−4°F or −20°C), it can be stored for 12 months. After breast milk is thawed, it should be refrigerated and consumed within 24 hours (Table 5).

TABLE 4. **Breastfeeding Benefits for Infant and Mother**

BENEFITS TO THE INFANT	MATERNAL BENEFITS
• Breastfeeding provides complete nutrition. • Breastfeeding reduces the incidence of upper respiratory tract infections, nonspecific gastrointestinal tract infections, otitis media, respiratory syncytial virus bronchiolitis, asthma, obesity, necrotizing enterocolitis, sudden infant death syndrome, inflammatory bowel disease, leukemia, and type 1 diabetes. • Breastfed babies have been linked to having higher intelligence scores.	Short-term effects include the following: • A decrease in postpartum bleeding • More rapid involution of the uterus • A possible decreased risk of postpartum depression Potential long-term effects include the following: • Decreased risk of type 2 diabetes mellitus in mothers without a history of gestational diabetes • Lower risk for rheumatoid arthritis • Decreased incidence of hypertension, hyperlipidemia, and cardiovascular disease • Reduction in breast and ovarian cancer • May help mothers return to their prepregnancy weight • Promotes maternal-infant bonding • Saves money

According to reference 5.

VITAMIN D SUPPLEMENTATION

Cases of rickets secondary to vitamin D deficiency, due to inadequate intake or decreased sunlight exposure, continue to occur in the United States. Maternal vitamin D status affects the vitamin D content of breast milk and therefore can vary, creating concern over whether breast milk provides infants with adequate vitamin D levels. Although breastfed infants of mothers supplemented with 6,400 IU per day of vitamin D have 25-hydroxyvitamin D levels comparable to those in infants receiving 300 to 400 IU of vitamin D per day, more studies are needed before universal supplementation of mothers with high-dose vitamin D is recommended. (6) Current recommendations state that all exclusively breastfed babies should be supplemented with 400 IU of vitamin D per day, starting a few days after birth. Babies should continue taking vitamin D unless weaned to 32 oz of vitamin D–fortified formula (approximately 1 L) or vitamin D–fortified whole milk, which the infant can be transitioned to at 1 year of age. Likewise, if exclusively formula-fed babies are consuming less than 32 oz of formula per day, or if older children are drinking less than 1 L of whole milk per day, they may also need a vitamin D supplement of 400 IU per day, depending on their intake of other dietary sources of vitamin D. (7)

DONOR MILK

Given the benefits of breast milk, both the AAP and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition recommend that premature infants be fed breast milk from their own mother and that breast milk be fortified with either human milk fortifier or infant formula for infants who weigh less than 1.5 kg. (8)(9) Pasteurized donor milk is an acceptable alternative for infants who are unable to receive breast milk from their biological mothers or for temporary feeding of newborns with very low birth weight whose mothers are not yet producing sufficient breast milk. Although it is believed that some components of breast milk, including neutrophils, stem cells, and immunoglobulins, may be reduced by the pasteurization process, donor milk must be pasteurized. It is not recommended, however, that donor milk be obtained from the Internet or directly from an individual. Milk obtained from these sources may not have been safely handled or tested properly for bacteria, viruses (such as HIV, cytomegalovirus, hepatitis), or other sources of contamination. (10) Established human milk banks have standards for screening milk donors and take steps to safely collect, process, test, and store donor milk. Of note, the Food and Drug Administration (FDA) does not oversee or set these standards. The Human Milk Banking Association of North America (or HMBANA, a voluntary professional association for nonprofit donor human milk banks; www.hmbana.org) has guidelines that are used by many states to guide the operation of facilities and distribution of donor milk within the state. In some states, insurance companies may cover the cost of human donor milk, especially if it is being used for premature or other high-risk infants; however, reimbursement is inconsistent between states. (11)

FORMULA

There are a variety of formulas available (Table 6), and new ones are continually being added. The FDA sets guidelines so that all infant formulas contain a set of standard nutrients

TABLE 5. **Breast Milk Storage Guidelines**

ENVIRONMENT	TIME
Room temperature	4 h, with a maximum of 6–8 h if very cleanly expressed
Refrigerator	Up to 4 d, up to 8 d if very cleanly expressed
Freezer (in a refrigerator with a separate freezer door)	Up to 9 mo
Deep freezer	Up to 12 mo

under its own federal law, "the infant formula act." Every infant formula manufacturer is required to test each formula and then submit these results to the FDA to ensure that each formula meets FDA standards. Like breast milk, which contains 18 to 20 calories per ounce, nearly all formulas contain 19 to 20 calories per ounce when mixed as instructed. All formulas are also designed to provide sufficient amounts of vitamins and micronutrients, including iron, linoleic acid, and vitamins C and E. Although formula contains vitamin D, as stated earlier, an infant must drink at least 32 oz of formula per day to meet the daily requirements for this nutrient.

The major differences among formulas include the amount of protein, sugar, and fat sources they contain. Most children will do well on a cow milk protein–based formula. These formulas typically contain lactose as the sugar source and a modified cow milk protein that is easier for an infant to digest. These formulas consist of approximately 80% casein and 20% whey protein, while breast milk contains approximately 70% whey and 30% casein. Partially hydrolyzed protein formulas and low-lactose or lactose-free formulas contain more whey than casein protein to mimic the components of breast milk. Some children, particularly those with allergic proctocolitis, or an allergy to cow milk, will require extensively hydrolyzed protein formula or amino acid–based formulas. These formulas are lactose free, contain glucose (primarily in the form of corn syrup solids), and contain proteins that have been broken down into smaller peptides or amino acids to prevent an allergic response. Partially hydrolyzed formulas may contain larger-sized proteins and are not effective in the treatment of allergic proctocolitis. Soy protein formulas are also lactose free and contain corn syrup solids as their carbohydrate source, contain soy protein, are used in certain metabolic conditions (including galactosemia) and are used by families who are seeking a vegetarian-based diet for term infants.

Fat sources among formulas may vary, but an important factor is the percentage of medium-chain triglycerides (MCTs) and long-chain triglycerides. MCTs are easily absorbed fats that can be helpful in ensuring adequate growth in children with liver disease and short bowel syndrome, as these fats can be absorbed directly in the intestines without bile salts or micelle formation. In general, MCTs make up at least 33% of total fat in most complete protein hydrolysate and amino acid–based formulas.

In addition, over the past 20 years, additional ingredients have been added to some infant formulas. For example, omega-3 fatty acids, including docosahexaenoic acid (DHA) and arachidonic acid (ARA), have been added to most formulas, as they are found naturally in breast milk. Children who are breastfed have higher blood levels of both ARA and DHA, and both, especially DHA, have been associated with eye and brain development in infants. Data on the DHA and ARA in formula are mixed. (12) Other ingredients that have been added to formula to mimic breast milk include lactoferrin, milk fat globule membrane, and prebiotics, including gluco- or fructo-oligosaccharides. Probiotics have also been added to formulas. The benefits of these additives are still under investigation. Finally, organic formulas and formulas with non–genetically modified organisms have become commercially available.

Premature Newborns

Premature newborns may drink breast milk, although they typically need supplementation to ensure adequate amounts of calories, minerals, and vitamins. Breast milk may be fortified with human milk fortifier or infant formula to meet the nutritional needs of premature newborns. Premature infant formulas contain higher levels of protein, sodium, potassium, phosphorus, and calcium. These formulas also contain more calories per ounce and may need to be continued until adequate growth and weight gain are obtained.

In addition, premature newborns may need iron supplementation, depending on how they are fed and the extent of prematurity. The lower the gestational age, the higher the deficit of total body iron. In preterm neonates (<36 weeks' gestation) who are fed breast milk, unless otherwise contraindicated, supplementation with elemental iron at 2 mg/kg per day by 1 month of age until 12 months is recommended. In neonates with very low birth weight (weight less than 1,500 g), higher iron intakes of 2 to 3 mg/kg per day may be needed. (13) Premature newborns who are formula fed may also require iron supplementation, depending on formula intake. (14)

The AAP does not recommend the use of soy formulas in preterm neonates for several reasons. First, osteopenia may be seen in preterm neonates weighing less than 1,800 g who consume soy formula, despite supplementation with both calcium and vitamin D. Also, there is a concern of aluminum toxicity in premature newborns fed soy-based protein formula because of the high aluminum content in these formulas. Increased aluminum deposition can occur in

TABLE 6. **Summary of Different Types of Common Infant Formulas and Uses**

TYPE OF INFANT FORMULA	USES	EXAMPLES
Cow milk protein	The most common formula used Most infants do well on this type of formula Contains choline, DHA, and ARA Some may also contain prebiotics, including gluco-oligosaccharides	Earth's Best Organic[a] Enfamil Infant[b] Similac Advance[c] Similac Non-GMO[c]
Partially hydrolyzed protein	Marketed as being easier to digest	Gerber Good Start[d] Similac Sensitive[c]
Extensively hydrolyzed protein or hypoallergenic	Proteins are completely broken down into small peptides and are lactose free Used in infants with cow milk protein allergy or allergic proctocolitis	Enfamil Nutramigen[b] Gerber Extensive HA[d] Similac Alimentum[c]
Amino acid	Proteins are completely broken down into amino acids Used in infants with cow milk protein allergy or allergic proctocolitis	Alfamino[e] Elecare[c] Neocate[f] Puramino[b]
Soy protein	Lactose-free and contains soy protein; may be useful in metabolic disorders, such as galactosemia, and for vegetarians Contains DHA and ARA	Enfamil Prosobee[b] Gerber Good Start Soy[d] Similac Isomil[c]
Low-lactose or lactose-free	Contains more whey than casein, and whey may be partially broken down Primary lactose intolerance is rare in children; transient lactose intolerance may be seen after gastroenteritis; however, most children will still be able to tolerate traditional formulas	Enfamil Gentlease[b] Similac Sensitive[c]
Premature	More calories per ounce than traditional formula Contains higher levels of protein, minerals, and electrolytes, including sodium, potassium, calcium, and phosphorus	Enfamil Premature[b] Similac Special Care (Hospital only)[c] Enfamil Enfacare (Hospital only)[b] Similac Neosure[c]

According to reference 4. ARA=arachidonic acid, DHA=docosahexaenoic acid, GMO=genetically modified organism, HA=hypoallergenic.
[a]*Manufactured by Hain Celestial Group, Inc, Boulder, CO.*
[b]*Manufactured by Mead Johnson Nutrition, Evansville, IN.*
[c]*Manufactured by Abbott Laboratories, Lake Bluff, IL.*
[d]*Manufactured by Nestlé S.A., Vevey, Switzerland.*
[e]*Manufactured by Nestle HealthCare Nutrition, Inc, Bridgewater, NJ.*
[f]*Manufactured by Nutricia North America, Gaithersburg, MD.*

bone and in the central nervous system, especially if the preterm neonate has reduced renal function. Aluminum competes with calcium for absorption, which may contribute to osteopenia. Soy-based protein formulas also contain about 1.5% phytates, which can bind zinc, phosphorus, and iron and prevent adequate absorption of these nutrients. Soy-based formulas are therefore now fortified with higher amounts of these nutrients to make up for these deficits. (15)

Store-Brand Formulas

Store-brand formulas are also commercially available and are often more affordable, costing nearly half as much as the popular national formula brands. Store-brand formulas are required to meet the same FDA and AAP standards and offer similar and complete infant nutrition. The availability of lower-priced store brand formulas is important because, as shown in 1 survey, approximately 1 in 6 families stated that they diluted or limited the volume of the formula given to their child to help make it last longer. (16) In fact, many parents opted to dilute the more expensive brands of formulas rather than buy the more affordable store-brand equivalents. (17) The potential dangers of diluting formulas include infant malnutrition and water intoxication. Pediatricians need to educate families on these alternatives, so that they realize that the brand-name and store-name formulas are nearly identical.

European Formulas

The European Food Safety Authority dictates guidelines for infant formulas made in Europe. Some of these guidelines

differ from the FDA guidelines for the safety and nutritional content of infant formulas made in the United States. For example, the European Food Safety Authority limits the use of sucrose as a sugar source in standard infant formulas but permits its use in hypoallergenic formulas. (18) Sucrose is used in standard infant formulas in the United States, including organic varieties. If a parent in the United States decides to use an imported infant formula, it is important that the formula meets FDA standards and has nutritional content comparable to that of formula manufactured in the United States. Most, if not all, of these formulas are not available for sale in the United States and are typically purchased through secondary stores online. Pediatricians should explain to parents the potential risks of using a formula purchased through the Internet.

Special Formulas

Although the treatment of cow milk allergy with either complete protein hydrolysate or amino acid–based formulas may be medically necessary, other formulas are available that are geared toward additional conditions that manifest in infancy. Formulas with added rice are marketed for gastroesophageal reflux (GER). Formulas marketed to treat colic include those supplemented with prebiotics and probiotics, those that are lactose free or lactose limited, and those that contain a higher whey-to-casein ratio. Prebiotics are also added to formula and marketed to help regulate bowel movements. The data on the use of these formulas are limited, and most children will not benefit from or need to transition to these formulas. Typically, though, if an infant has been started on one of these formulas and is doing well, the formula can be continued.

Differences among Powdered, Ready-to-Feed, and Concentrated Formulas

Formulas may come in powdered, ready-to-feed, and concentrated forms. Concentrated and powdered formulas should be mixed with water per their specified instructions, while ready-to-feed formula does not require additional mixing and is ready as is. Most powdered formulas are mixed at a 2:1 ratio to achieve the standard caloric content, which means adding 2 oz of water to the bottle, followed by 1 scoop of formula. There are exceptions to this rule, since some amino acid–based formulas are mixed at a 1:1 ratio. It is important to review mixing instructions with families. With the help of a dietitian, formula can be concentrated to as much as 30 kcal/oz to help in the management of failure to thrive and to decrease the volume of feedings for infants with poor growth due to GER disease (GERD). Inappropriately concentrated formula may lead to symptoms of vomiting, constipation, and excessive weight gain, and the high protein content may cause renal dysfunction. Formula that is diluted may lead to diarrhea, slow weight gain, and electrolyte imbalances, including hyponatremia that can lead to seizures.

Fluoride

Fluoride is recommended beginning at 6 months of age. It is important to ask parents how they are preparing their infant's formula to help determine fluoride exposure. Fluoride has been added to approximately two-thirds of community tap water in the United States, and the American Dental Association states that fluoridated tap water may be used in the preparation of formula from powder or concentrate.

For infants in households with fluoride-free tap water, for those being fed ready-to-feed formulas, and in instances where families are using fluoride-free bottled spring or distilled water to prepare formula, providing fluorinated water in a sippy cup or fluoride supplementation may be given, starting from 6 months of age.

In addition, it is now recommended that fluoride toothpaste be used as soon as the first tooth erupts. Under 3 years of age, a smear of fluoride toothpaste or a grain of rice–sized amount should be applied, while over 3 years of age, a pea-sized amount should be used twice a day to brush the teeth. Small children should expectorate without first rinsing with water to reduce the likelihood of swallowing the toothpaste. Fluoride varnish should also be applied every 3 to 6 months after tooth eruption. (19)

Formula Storage

A prepared bottle made from any type of formula can be kept at room temperature for 1 hour. If a baby drinks from the bottle, the contents should not be saved for later use and should be discarded within 1 hour. Unused concentrated or ready-to-feed formula may be stored in the refrigerator and used within 48 hours, while unused formula prepared from powdered formula should be refrigerated and used within 24 hours, since powdered formula is not 100% sterile. A can of powdered formula, once opened, should be used within 30 days or be discarded.

TIMING FOR INTRODUCTION OF SOLIDS

Recommendations for the optimal time for complementary food introduction vary. The AAP Section on Breastfeeding and WHO recommend exclusive breastfeeding until 6 months of age, after which breastfeeding is continued along with the introduction of complementary foods. (20) The US Department of Agriculture states that children are developmentally ready to start solids between 4 and 6 months of age, while the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition recommends that exclusive breastfeeding for about 6 months is desirable, but complementary feeding should be introduced no earlier

than 17 weeks of age and no later than 26 weeks. (21)(22) In addition, since there is no evidence that suggests food allergy can be prevented by delaying solid food introduction beyond 4 to 6 months, the American Academy of Allergy, Asthma, and Immunology recommends 4 to 6 months of age for the introduction of complementary foods. (23) Starting solids before 4 months may interfere with an infant's ability to acquire the appropriate nutrients needed in breast milk or formula, and in babies fed formula, feeding complementary foods prior to 4 months is associated with increased odds of obesity at 3 years of age. (24) Starting solids later than 6 months may lead to inadequate iron and zinc intake, particularly in children who are exclusively breastfed, and may lead to rejection of foods by an infant accustomed solely to sucking from a breast or bottle. (21)

DEVELOPMENTAL SIGNS OF READINESS

Babies may be introduced to complementary foods at approximately 4 to 6 months of age or when they display signs of developmental readiness. Signs of readiness include good head control, ability to sit with support, becoming unsatisfied after a formula or breast milk feeding, shortened intervals between feedings, opening the mouth when presented with food, diminished extrusion reflex (where the tongue raises and pushes against any object that is placed between the lips, resulting in food being pushed out), showing interest in what a caregiver is eating, and demonstrating cues that they are finished feeding, such as turning the head away from the breast or bottle when they are done. (25)

WHAT FOODS TO INTRODUCE FIRST

Pediatricians have traditionally advised starting with iron-fortified cereal or vegetables prior to the introduction of fruits to avoid an infant being exposed to sweeter flavors; however, there is insufficient evidence to support any specific order of infant complementary food introduction. It is more important to first offer a variety of single-ingredient fruits, vegetables, grains, and meats, in any order, to allow for a baby to become accustomed to diverse flavors. Some foods have a tendency to constipate babies (examples include bananas and rice cereal), while others have a relative laxative effect ("*p*" foods, such as prunes, pears, peaches, and apricots), so it is recommended that parents feed their infants a balance of these foods and adjust them to their baby's bowel habits. Introduction of the more highly allergenic foods will be discussed herein. In addition, liquid whole milk and honey (or products that contain honey, such as honey-sweetened cereal) should not be given before 1 year of age, and unpasteurized dairy and undercooked foods (such as meat, fish, or eggs) should not be introduced to infants or young children. The AAP also recommends that homemade purees of vegetables that are higher in nitrates (spinach, beets, squash, carrots) not be given earlier than 3 months of age, since these vegetables can potentially cause methemoglobinemia. Since complementary foods should not be introduced prior to 4 months, however, this should be of little concern. (25)

Importance of Zinc- and Iron-Fortified Foods

Full-term neonates are born with adequate iron stores, which become depleted by around 4 to 6 months of age. Since breast milk is lower in iron, iron-fortified infant cereals or pureed meats are important first foods for breastfed infants. In addition, foods rich in vitamin C, such as cantaloupe, mango, strawberries, and broccoli, should be included in the diet, along with nonheme iron-rich foods (for example, prunes, lentils, and kidney or white beans) to improve iron absorption. Likewise, breast milk provides an adequate amount of zinc until 6 months of age, after which babies should be provided with additional zinc through complementary foods, such as meat and fortified infant cereal. (21)

Rice and Arsenic

In 2013, the FDA released information concerning high levels of arsenic that may be found in rice products. Arsenic is a natural component of water, air, food, and soil, as well as a result of contamination from human actions, including mining and arsenic-containing pesticides. Arsenic is found in 2 forms: inorganic and organic. While organic arsenic is harmless, inorganic arsenic may be associated with negative health effects, such as poorer performance in developmental tests to measure learning and also a higher risk for bladder and lung cancer. (26)

Infants in the United States typically consume large amounts of rice, since rice is often the first grain given, as well as the first food introduced when solids are started at 4 to 6 months of age. On the basis of national data, 8-month-old infants consume the most rice relative to their body weight. Rice intake for infants, the source of which is mostly rice cereal, is nearly 3 times greater than that of adults.

In 2016, the FDA set new limits on inorganic arsenic in rice cereal to <100 parts per billion. On the basis of the FDA analysis, slightly less than half of rice cereal currently on the market already meets these proposed guidelines, with most containing levels that are close to the proposed levels. The FDA also tested other foods commonly eaten by infants and toddlers, including juices, puffs, and nonrice cereals, and found that all of these nonrice foods contained low levels of

arsenic that were well below the established limit. The FDA recommends that iron-fortified cereal, such as rice cereal, be given to provide important nutrients for infants; however, iron-fortified infant rice cereal does not have to be the first food introduced, and other cereals (oat, barley, and multigrain) should also be offered to a baby as part of a varied diet. (27)

Introduction of Wheat

With the increased awareness of celiac disease, there have been numerous studies of whether infant nutrition plays a role in the onset of celiac disease. Research has focused on timing of introduction, amount of introduction, and whether ingesting small amounts of gluten while breastfeeding would be helpful in preventing celiac disease. Current data do not show that any of these infant feeding practices, or breastfeeding, prevent celiac disease. (28) It is currently recommended that children be introduced to wheat around 6 months of age or after a few first foods have been introduced.

Introduction of Highly Allergenic Foods into the Infant's Diet

One of the major shifts in recommendations for infant feeding has been the timing of the introduction of highly allergenic foods (milk, egg, soy, wheat, peanuts, tree nuts, fish, and shellfish). In 2000, the AAP recommended delaying introduction of highly allergenic foods for high-risk children (infants or toddlers with a history of atopy). Specifically, it was suggested that parents start giving toddlers cow milk at 1 year of age, egg at 2 years of age, and peanuts, tree nuts, and seafood at 3 years of age. (29) At the time, it was thought that delaying introduction would possibly prevent the development of other allergic conditions, especially eczema. (30) However, during the time when these recommendations were adopted, a marked increase was observed in the incidence of childhood food allergies. (31) As a result, in 2008, these recommendations were withdrawn by the AAP and major allergy and immunology societies, as there was insufficient and inconclusive evidence to suggest that a benefit was derived from delaying the introduction of allergenic foods.

Increasing evidence now suggests that delaying allergenic food introduction may increase the risk of food allergy and that early introduction (between 4 and 6 months of age) may actually decrease the risk of food allergy. (32) While we have revised guidelines specifically for the introduction of peanuts to infants, formal guidelines for the introduction of other allergenic foods have not been published or are still being developed.

Peanuts

In 2015, a landmark clinical trial (the Learning Early About Peanut, or "LEAP," study) demonstrated that the early introduction of peanuts was preventative for infants at "high risk for peanut allergy." (33) In this study, high-risk infants were defined as those with severe eczema and/or egg allergy and a 4-mm percutaneous skin test response to peanut extract. From this group, infants who were introduced to peanuts between 4 and 11 months of age and maintained it regularly in their diet had a 24.7% lower risk of having of peanut allergy by the age of 3 years, when compared to similar at-risk infants who were instructed to avoid peanut. Thus, incorporating peanuts into the diet early in these "high-risk" infants was protective against the development of peanut allergy.

As a result of findings from the LEAP trial and other studies, in 2016, the AAP and major US and European allergy and immunology societies published preliminary guidelines specifically for the introduction of peanuts to infants. (34) In 2017, recommendations for the introduction of peanuts to infants were formalized, and the National Institute of Allergy and Infectious Diseases published an addendum to the Guidelines for the Diagnosis and Management of Food Allergy. (35) The instructions for the introduction of peanuts to infants depend on their identified level of risk for development of peanut allergy: (1) For infants who have severe eczema and/or egg allergy, serum peanut-specific immunoglobulin E (IgE) measurement or peanut skin-prick testing should be considered, and on the basis of these results, if favorable, foods that contain peanuts should be introduced between 4 and 6 months of age. For these infants, a physician-supervised oral food challenge to peanuts in an age-appropriate form may be indicated for the first exposure to peanuts. Peanuts should not be introduced to infants for whom testing suggests there is an allergy to peanuts. (2) For infants who have mild to moderate eczema, age-appropriate foods that contain peanuts can be introduced around 6 months of age. These infants do not necessarily require an evaluation prior to being introduced to peanuts. (3) For infants who have no eczema or other food allergy, peanuts may be freely introduced in age-appropriate forms and timed in accordance with the family's preference or cultural norms.

For all of these scenarios, other solid foods should be fed to the infant prior to introducing foods that contain peanuts to show that the infant is developmentally ready to begin complementary feeding. Furthermore, age-appropriate forms of foods that contain peanuts should be chosen. For instance, whole nuts and peanut butter given directly from a spoon or in lumps are choking hazards for infants. Peanut butter thinned and mixed into oatmeal or pureed fruit or peanut puffs dissolved in breast milk or formula are appropriate for young infants.

Other Allergenic Foods

In the interim, for infants who are not at high risk for food allergies, we recommend the introduction of other typically

allergenic foods (milk, egg, soy, wheat, fish, shellfish, tree nuts, sesame) in age-appropriate forms and consistencies, along with other complementary foods at any time after 4 to 6 months of age. For infants who are at higher risk for food allergies, including children who have mild eczema or a strong family history of atopy but who have not themselves shown any symptoms of food allergy, allergenic foods should be introduced early, starting between 4 and 6 months of age, after a few typical early infant foods (such as grains, meat, fruits, or vegetables) have already been tried and tolerated. For these infants, it is suggested that allergenic foods first be tried in small amounts at home and that the serving size be gradually increased if there is no sign of allergic reaction. (36)

Special consideration should be given for any infant who has had moderate to severe persistent eczema during infancy, an acute allergic reaction after breastfeeding, or an immediate allergic reaction to any complementary food, especially if it is a highly allergenic food. These infants are considered to be at "high risk" and may require an allergy evaluation or allergy testing prior to starting highly allergenic foods.

MEDICAL CONDITIONS OF INFANCY

Gastroesophageal Reflux

GER in infants is common and normal, and in most cases, it is not considered a disease. It typically begins around 2 to 3 weeks after birth and peaks between 4 and 5 months of age. Most infants with GER will completely improve by the time they are 9 to 12 months of age. The cause of GER is a variety of physiological factors, including transient relaxations of the lower esophageal sphincter. In addition, the lower esophageal sphincter muscle is also shorter and does not grow to its full size until 2 years of age. The diaphragm in infants is anatomically lower in the thorax than it is in adults, making the antireflux barrier less effective.

Children with GER are often known as "happy spitters." Happy spitters are not uncomfortable when they spit up or eat; they usually eat well and have normal weight gain for their age. The diagnosis of GERD is assigned when there are complications of GER, such as feeding problems, poor weight gain or weight loss, and pain from esophagitis or aspiration. Signs of feeding problems in children with GERD include feeding refusal, crying with feeding, arching of the back, frequent regurgitation, and vomiting.

Treatment options for GER in infancy include frequent burping and holding the infant upright for up to 30 minutes after feeding, which are collectively known as *reflux precautions*. Some infants may also benefit from thickening formula or expressed breast milk by adding infant cereal to the bottle. Thickened formula or expressed breast milk may decrease spit-up symptoms. Use of medications, including antacids, histamine-2 receptor antagonists, and proton pump inhibitors, is indicated in children with GERD who demonstrate weight loss, feeding problems (such as feeding refusal, crying, or arching of the back with feedings), and esophagitis. (4) Proton pump inhibitors should be used with discretion in children with GERD, since long-term use has been associated with potential side effects, including decreased calcium and magnesium absorption, problems with bone metabolism, increased risk of gastrointestinal infections, and acute interstitial nephritis. (37)(38)

Milk Protein Allergy

"Milk protein allergy" is a fairly prevalent cause of rectal bleeding in infancy and is more accurately termed "food protein–induced proctocolitis." (39) This condition has commonly been called "allergic colitis" or "milk soy protein intolerance." Milk is the most common trigger for this condition; however, soy, egg, corn, and other foods have been implicated in some cases. (40) This form of proctocolitis is not well understood, but it is recognized that foods cause an inflammatory response in the distal colon. Food protein–induced proctocolitis is not mediated by IgE; thus, this condition is not associated with acute hypersensitivity reactions.

Food protein–induced proctocolitis is most often diagnosed clinically. This form of food intolerance manifests as rectal bleeding, with onset between 2 and 8 weeks of age in breastfed or formula-fed infants who are otherwise healthy. (41) Parents will note stools with flecks or streaks of blood distributed within the stool, possibly associated with mucus, and may report some fussiness or more frequent bowel movements. (42) This condition is not associated with clinically significant diarrhea, vomiting, feeding difficulty, or growth issues.

Rectal fissures should always be ruled out, since this is the most common cause of blood in the stool at this age. Stool studies and other testing, including flexible sigmoidoscopy or colonoscopy, are generally not required to establish the diagnosis of food protein–induced proctocolitis. Standard allergy testing (IgE measurement or skin prick testing), which is used for assessing IgE-mediated food allergy, is also not helpful.

Treatment generally involves eliminating the infant's exposure to the culprit food. For a breastfeeding infant, this means removing milk and soy (or other potentially triggering foods) from the mother's diet. For a formula-fed infant, transitioning from a milk- or soy-based formula to an extensively hydrolyzed infant formula should result in resolution of proctocolitis. In some cases, an amino acid–based formula will be needed, or multiple food allergens may need to be eliminated. In general, with complete avoidance, the infant's symptoms will improve

within a few days to 2 weeks, and resolution with milk and soy elimination is generally diagnostic. Testing the stool for occult blood is generally not necessary. (43)

If proctocolitis persists despite making these dietary modifications, we would recommend careful review of the maternal diet (to ensure absolute avoidance of a suspected food trigger) or a pediatric gastroenterology evaluation to rule out other potential causes of rectal bleeding in an infant.

Milk (or other food protein)–induced proctocolitis generally resolves before 12 months of age, at which time most infants will tolerate gradual reintroduction of the avoided food.

Food Protein–Induced Enterocolitis Syndrome

Acute food protein–induced enterocolitis syndrome (FPIES) is a non–IgE-mediated response to food that manifests in young infants as episodes of repetitive and severe vomiting, often followed by diarrhea, starting several hours after a baby ingests a causative food. Vomiting may be protracted (lasting for several hours) and can be severe enough to lead to dehydration or shock. Diarrhea may be watery or bloody and may also persist for several hours or more after vomiting ceases. An infant having an FPIES reaction may also appear lethargic and pale but will not have cutaneous skin findings (ie, hives, rash, itching) or respiratory symptoms characteristic of an IgE-mediated food allergy. (44)

FPIES most often manifests between 2 and 7 months of age, coinciding with the timing of formula and solid food introduction for infants. (45)(46)(47) The most common triggers for FPIES in the United States are cow milk and soy. (48) Among solid foods, the most common FPIES triggers are rice, oat, other grains, egg, vegetables, poultry, and fish, although FPIES reactions have been observed with many other foods. (49) Furthermore, infants may have FPIES with single or multiple foods. The diagnosis of FPIES and the identification of causal foods is established clinically on the basis of a history of characteristic symptoms. There are no laboratory or other diagnostic tests that confirm the diagnosis of FPIES, and the pathophysiology of FPIES is still poorly understood.

Treatment of an acute FPIES reaction may be a medical emergency and requires fluid resuscitation (either orally or intravenously). Vomiting due to acute FPIES may also abate with the administration of the antiemetic ondansetron. (50) Management of FPIES in the long term requires elimination and continued avoidance of the causative food. After several months to years, children often outgrow their FPIES to a causative food; however, to determine tolerance, the food should ideally be reintroduced under physician supervision during a formal, supervised feeding. (51)

Lactose Intolerance

Unlike proctocolitis, which is a reaction to cow milk protein, lactose intolerance is due to an intolerance to the milk sugar lactose. Full-term neonates are born with sufficient amounts of lactase, the enzyme needed to break down lactose into glucose and galactose so that it can be absorbed in the intestines. Even though lactase levels may be decreased in premature newborns, most will be able to tolerate a formula containing lactose. Primary lactose intolerance is rare during infancy and early toddlerhood. It may be seen transiently in children after gastroenteritis or in children who have celiac disease due to villous atrophy that leads to decreased lactase levels on the brush border of the small bowel. There is no underlying intestinal inflammation in primary lactose intolerance; however, children may have increased intestinal gas, abdominal distention, and watery diarrhea due to the presence of lactose (an osmotic load) in the colon, which leads to increased water secretion. On the other hand, infants with proctocolitis will have colonic inflammation that can lead to bloody and mucous stools.

Constipation

Constipation is defined as a change in normal bowel movements, including a decrease in the frequency, an increased consistency of stools, and the passage of painful and/or larger stools. In addition, in some children, it may be associated with streaks of blood on the outside of the stool and an altered appetite.

Normal Stool Production Patterns. At birth, and usually within the first 48 hours after birth, neonates will pass meconium. Stools may be a yellow, light brown, or greenish color and will become less sticky once the meconium has passed. More liquid stools, the consistency of peanut butter with seeds, are more normal in breastfed infants, while stools will be similar in color, though more firm, in formula-fed infants. Infants usually pass a stool after every feeding because of the quick movement of food through the colon and a strong gastrocolic reflux.

Stool production is involuntary in infancy, as babies do not have control of the external anal sphincter. In response to the presence of stool, the colon stretches, which signals the internal anal sphincter to open. When infants push to pass a stool while lying down, the anorectal canal does not straighten, and the pelvic floor muscles, particularly the puborectalis muscle, do not relax, making stools more difficult to pass. Infants may appear uncomfortable, strain, or turn red in the face, but they will usually pass a soft stool. This normal process is known as *rectal confusion*, and it usually resolves by 4 months of age. Some babies may go 1 week without a bowel movement. This frequency is normal, as long as the stool is soft, the baby is passing gas and eating well without vomiting, and

the belly is soft and not distended. (37) Abdominal massage or "bicycle" leg exercises may be helpful in these infants. Rectal stimulation or use of rectal suppositories is not routinely recommended.

Treatment of Constipation. In the case of hard stools, or if there are streaks of blood in the stool and/or rectal fissures noted at examination, nutritional therapies, such as small amounts of prune juice or "*p*" fruits (prunes, pears, papayas, apricots, peaches, and plums) if the infant is already eating solids, may be introduced into the diet. Beginning at 6 months of age, a few ounces of water may be given in a sippy cup during meals and snack times. Sometimes medications, including lactulose or polyethylene glycol 3350, may also be needed. Although current data show that the use of polyethylene glycol 3350 is safe in children when used for up to several weeks to months, with side effects that include diarrhea, gas, cramping, and abdominal bloating, ongoing pediatric studies are underway to evaluate the long-term safety of this medication in children. (52) If there is no response to medications, or in the setting of delayed passage of meconium, testing may be considered to evaluate the infant for less common causes of constipation, such as cystic fibrosis, Hirschsprung disease, hypothyroidism, and celiac disease, if the infant is already consuming foods that contain gluten.

CONCLUSIONS

New research that has emerged in the past few years has allowed pediatricians to better educate parents on the introduction of complementary foods and common conditions that may arise during infancy. Through better education, we can help improve the traditional way of feeding our children to reach optimal infant and toddler nutrition.

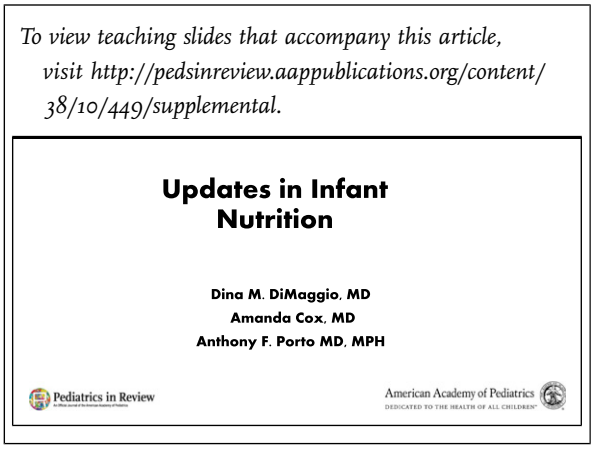
ACKNOWLEDGMENT

A special thanks to Nicole Hermosilla, RD, CNSC, for her time and for sharing her neonatal intensive care unit nutritional expertise with us.

Summary

1. On the basis of some research evidence, as well as consensus, the World Health Organization growth charts should be used to track a child's growth from 0 to 24 months; the Centers for Disease Control and Prevention growth charts should still be used for children 2 years of age and older. (1)
2. On the basis of strong research evidence, exclusively breastfed and partially breastfed babies should be supplemented with 400 IU of vitamin D per day, starting a few days after birth. Babies should continue taking vitamin D unless weaned to 32 oz of vitamin D–fortified formula (approximately 1 L) or vitamin D–fortified whole milk, if over 1 year of age. (7)
3. On the basis of strong research evidence, infants should be breastfed for approximately 6 months, after which complementary foods are introduced as breastfeeding is continued, followed by continued breastfeeding until 1 year of age or as long as mother and baby desire. (5)
4. On the basis of strong research evidence, fluoride toothpaste should be used with the first tooth eruption. (20)
5. On the basis of some research evidence, as well as consensus, in 2013, the Food and Drug Administration (FDA) released information about high levels of arsenic that may be found in rice products. In 2016, the FDA set new limits on inorganic arsenic in rice cereal to <100 parts per billion. The FDA recommends that iron-fortified cereal, such as rice cereal, be given to infants to provide important nutrients; however, iron-fortified infant rice cereal does not have to be the first food introduced, and other cereals (oat, barley, and multigrain) should also be offered to a baby as part of a varied diet. (27)(28)
6. On the basis of some research evidence, as well as consensus, delaying the introduction of gluten does not prevent celiac disease. (29)
7. On the basis of strong evidence that early introduction of peanuts prevents peanut allergy in infants who are at high risk, new guidelines for introducing peanuts to infants have been published. Delaying the introduction of allergenic foods in general is no longer recommended. (33)(34)(35)(36)

To view teaching slides that accompany this article, visit http://pedsinreview.aappublications.org/content/38/10/449/supplemental.



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1. You are performing a physical examination for a well-child check on a 6-month-old male infant who was born at 38 weeks' gestation to a 23-year-old gravida 1 para 0 mom. Mom is wondering if the baby's growth and development are appropriate for his age, as she noticed that his growth slowed down in the past 2 to 3 months. You review the growth parameters obtained at today's visit. Which of the following findings is most consistent with normal growth and development in the first 6 months of this baby's life?
   A. Doubling of the birth weight.
   B. Increased head circumference by 5 inches since birth.
   C. Increased height by 10 to 12 cm.
   D. Slow weight gain in the first 3 months after birth, followed by a growth spurt in the next 3 months.
   E. Weight gain of 10 g per day.
2. A male neonate born at 36 5/7 weeks' gestation is admitted to the neonatal intensive care unit (NICU) at 36 hours of age for symptoms consistent with neonatal abstinence syndrome. On examination, he is jittery and irritable. His vital signs are stable, aside from mild tachypnea with a respiratory rate of 70 breaths/min. The mother is a homeless gravida 3 para 3 18-year-old who did not receive prenatal care and had a febrile illness at delivery that was consistent with a viral upper respiratory tract infection. Her urine drug screen result was positive for methamphetamine on admission. Test results for HIV, hepatitis B, rubella, and tuberculosis are pending. The mother expressed her desire to exclusively breastfeed her newborn by either feeding him expressed breast milk or putting him on the breast. Maternal infection with which of the following agents constitutes a contraindication to breastfeeding (both placing the neonate on the breast or offering expressed breast milk) in the immediate postpartum period?
   A. Active tuberculosis prior to initiating therapy.
   B. H1N1 influenza virus.
   C. Hepatitis B.
   D. Human T-cell lymphotropic virus type I or II.
   E. Varicella virus, onset 4 days prior to delivery.
3. You are getting ready to discharge a well newborn from the nursery. You stop by to talk to the infant's first-time mother, provide her with the discharge instructions, and answer any questions she might have. Mom is currently breastfeeding but prefers to manually express breast milk and then provide the breast milk to her newborn via the bottle. She asks about the safest way to store expressed breast milk. Which of the following is the most acceptable storage practice for expressed breast milk?
   A. Breast milk can be left at room temperature for a maximum of 12 hours.
   B. If refrigerated, it should be placed as far away from the refrigerator door opening as possible.
   C. If stored in a refrigerator, it should be consumed within 2 weeks.
   D. If thawed, it should be consumed within 72 hours.
   E. It may be stored in a deep freezer for up to 24 months.
4. A 6-month-old female infant born prematurely at 24 weeks' gestation is seen in the clinic for follow-up. Her past medical history is significant for extreme prematurity, resulting in a 4½-month stay in the NICU. She developed surgical necrotizing enterocolitis at 1 month of age and required resection of 80% of the small intestine (jejunum and ileum). She currently receives 50% of her calories enterally and 50% via parental nutrition, administered via a central line. Her direct bilirubin level today is stable at 3.0 mg/dL (51.3 μmol/L). When deciding which formula would be indicated to establish adequate growth, which of the following compositions of formula is the most appropriate to use in this patient with short bowel syndrome?

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A. Amino acid–based formulas, which contain proteins that have been reduced to amino acids but are not lactose free.
B. Formulas with added prebiotics, such as gluco- and fructo-oligosaccharides, as well as probiotics.
C. Formulas with a high percentage of medium-chain triglycerides that are absorbed readily with bile salts.
D. Formulas high in calories, since adequate caloric content is the most important factor, not the components in the formula.
E. Partially hydrolyzed protein formulas with a casein-to-whey ratio of 80:20.

5. A distraught father brings his 2-month-old infant to the acute care clinic for evaluation. He states that the infant began having multiple episodes of emesis in the previous 48 hours. He asserts that the emesis is sometimes associated with liquid stools. Per the report, the episodes do not necessarily occur with feedings. He states that the infant is fed 20-cal/oz cow milk infant formula. Recently, the parents have begun thickening the formula at night with rice cereal to help the baby sleep for longer periods of time in between feedings. Physical examination findings are significant for a sleepy but arousable infant with clinical evidence of dehydration. You suspect food protein–induced enterocolitis syndrome (FPIES). Which of the following is the most appropriate next step in the management of this patient?

A. Immediate intravenous fluid resuscitation.
B. Increased rice cereal in the formula to provide more bulk to the stools.
C. Small frequent feedings of the same feeding regimen.
D. Starting metoclopramide to decrease transit time.
E. Switching the patient to a soy-based formula.

Additional Resources for Pediatricians

AAP Textbook of Pediatric Care, 2nd Edition

- Chapter 36: Healthy Nutrition: Infants - https://pediatriccare.solutions.aap.org/chapter.aspx?sectionid=139999011&bookid=1626

Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents

- Promoting Healthy Nutrition - https://pediatriccare.solutions.aap.org/chapter.aspx?sectionid=154098060&bookid=2041

Parent Resources from the AAP at HealthyChlidren.org

- Starting Solid Foods: https://www.healthychildren.org/English/ages-stages/baby/feeding-nutrition/Pages/Switching-To-Solid-Foods.aspx
- How Often and How Much Should Your Baby Eat?: https://www.healthychildren.org/English/ages-stages/baby/feeding-nutrition/Pages/How-Often-and-How-Much-Should-Your-Baby-Eat.aspx

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Updates in Infant Nutrition

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Pediatrics in Review 2017;38;449
DOI: 10.1542/pir.2016-0239

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