

CHAPTER 6: SPECIAL CONCERNS IN INFANT FEEDING

This chapter will discuss special concerns in feeding infants, including oral health, vegetarian diets, common gastrointestinal problems, and prevention of overweight and obesity. Counseling points related to the information presented in this chapter are found in Chapter 8, pages 188 - 190.

Oral Health

Tooth decay is the most common chronic childhood disease. It is the most common chronic infectious disease that does not respond to antibiotics and does not heal itself. Good nutrition, use of proper feeding techniques, and careful attention to keeping the mouth and teeth clean are all important for assuring that an infant develops and maintains healthy, strong teeth. Infants from low-income families whose mothers have low educational levels and who eat sugar-containing foods have been shown to be 32 times more likely to have dental caries at age 3.¹ Similarly, statistics from the United States Government Accountability Office indicate that children from low-income families are 5 times more likely to have untreated tooth decay and experience 12 times more activity restricted days due to dental problems than children from higher-income families. This section reviews tooth development, dental caries, early childhood caries, dental care for infants, and teething. Refer to pages 23 - 24 for information regarding fluoride supplementation for infants, as related to preventive dental care.

Tooth Development

The primary teeth and many permanent teeth begin forming inside the jawbones before birth. The primary teeth, which erupt over the first 2 ½ years of the infant's life, are important as are the permanent teeth that follow. The primary teeth are critical for chewing and eating food, normal development of the jaw bones and muscles, proper placement of the permanent teeth, the appearance of the face, and proper speech development. The first primary teeth to erupt are the central and lateral incisors (the front four teeth on the lower and upper sections of the mouth). The first teeth may erupt at about 6 months old or later. Since the primary teeth are not fully replaced by permanent teeth until a child is 12 to 14 years old, keeping them healthy and intact during this period is of particular importance.

The nutrients necessary for proper tooth development include protein and the minerals calcium, phosphorus, and fluoride. Protein provides the foundation for the teeth and the minerals are deposited in this foundation to form a hard tooth structure. Fluoride, when incorporated during tooth development and after the teeth erupt, makes tooth enamel significantly more resistant to the acid attack that produces dental caries. Thus, a nutritionally adequate diet, along with adequate fluoride, is important for both the development and maintenance of healthy, strong teeth. Yet, even if a nutritious diet is consumed, as soon as any of the primary teeth begin to appear, they can decay under certain conditions.

Dental Caries (Tooth Decay)

Three variables contribute to the development of dental caries -- susceptible teeth, specific bacteria in the mouth, and fermentable carbohydrates (sugars and starches). Tooth decay begins when fermentable carbohydrates from food or beverages are metabolized to organic acids by bacteria, primarily *Streptococcus mutans* (*S. mutans*), in the mouth. The *S. mutans* bacteria that normally live in the mouth adhere to the tooth surfaces and form dental plaque, the sticky, colorless material that accumulates around and between the teeth and gums and in the pits and grooves of the chewing surfaces of the teeth. The sticky plaque enables the bacteria and the acids they produce to remain on the tooth surface instead of being washed away by saliva. The longer plaque is allowed to stay undisturbed on the tooth surfaces, the greater is the likelihood that the bacteria will produce acids from carbohydrates. The acids demineralize or destroy the enamel on teeth and create dental caries.

If any of the primary teeth are lost prematurely to decay, surrounding teeth can move into the empty space. Then, permanent teeth may erupt not having sufficient room to be placed properly. They will then come in crooked, making them more difficult to clean and thus more susceptible to decay. Proper feeding practices, appropriate fluoride intake, and regular care of an infant's teeth help to prevent dental caries from occurring.

Evidence indicates that the primary source of *S. mutans* in the mouth of infants is their mother's saliva.² *S. mutans* is transferred from mother to infant or child (through shared eating utensils or toothbrushes) and increases the risk of the child developing dental caries, especially if a mother has untreated dental caries.² *For this reason, it is advisable for mothers or other intimate caregivers to do the following:*²

- Avoid exposing their infant or child to their saliva by sharing eating utensils or toothbrushes, cleaning a dropped spoon or pacifier with their saliva, or chewing food themselves and then feeding it to their infants.
- Take care of their mouths with regular tooth-brushing, flossing, and dental care.
- Use fluoridated toothpaste and rinse daily with a fluoridated mouth rinse.
- Avoid or limit foods that promote development of dental caries. The American Academy of Pediatrics (AAP) recommends that if infants must consume fruit juice parents offer pasteurized 100 percent fruit juice to their infants only at meals and avoid offering all carbonated beverages until the infant is 30 months old.³
- Use of xylitol-containing chewing gum by mothers has been associated with a decrease in the development of caries in their child by reducing the mother-child transmission of *S. mutans*.⁴
- Obtain treatment for any existing dental caries.

Early Childhood Caries (Nursing Bottle Caries or Baby Bottle Tooth Decay)

Early childhood caries (formerly called nursing bottle caries or baby bottle tooth decay) is a specific form of severe tooth decay of an infant's primary teeth.

*Severe dental caries of this type are characterized by these distinguishing features:*²

- Begin soon after tooth eruption
- Progress rapidly
- Decay occurs on smooth surfaces, generally considered to be at low risk of decay. In the case of early childhood caries, the decay is usually seen on the four maxillary incisors (the upper four front teeth) - these teeth are among the first to erupt and are bathed in liquids first while the lower teeth are protected in part by the infant's tongue. As the decay progresses, these teeth become brown or black and may be completely destroyed. If inappropriate practices continue, the other teeth may also undergo similar decay and
- Have a lasting harmful affect on dentition throughout childhood.⁵ The impact of early childhood caries is seen in increased hospitalizations and emergency room visits, increased treatment time and costs, poor growth, increased school absence or activity restriction, and poor learning ability.

Early childhood caries develop when bacteria is present and an infant's teeth are bathed in liquids containing fermentable carbohydrates (such as infant formula, other milks, fruit juice, sweetened water, or other sweetened beverages) for prolonged periods of time during the day or night.² Taking a bottle of these liquids to bed should be discouraged. Decreased cleaning movements of the tongue and lower production of saliva (resulting in reduced cleansing of the teeth) during sleep contribute to the development of caries, as does extended and repetitive use of a no-spill “tippy” training cup. Breastfed infants may also be vulnerable to early childhood caries. Breastfeeding mothers should be alerted to the need for oral hygiene after feedings, especially when the infant’s first teeth have begun to emerge. See Figure 9, page 142, which illustrates healthy teeth and cases of early childhood caries.

Prevention of Early Childhood Caries

To prevent early childhood caries and caries development in general, these steps are recommended:

- Use bottles for feeding iron-fortified infant formula or expressed breast milk. Do not feed juice or sweetened beverages in a bottle.
- Feed pasteurized 100 percent fruit juice only in a cup. Drinking from a cup will be messy at first. Be patient and allow the infant to learn this skill.
- Feed bottles of infant formula or breast milk to the infant only at feeding time; do not allow an infant to suck on a bottle while sleeping (i.e., bedtime or naptime). If an infant should fall asleep during a feeding, move the infant around slightly to stimulate swallowing before putting him or her down to sleep.
- Do not feed sweetened beverages to infants in either a bottle or a cup. These beverages include: water sweetened with sugar or honey (honey should never be fed to infants because of the risk of contamination with *Clostridium botulinum* spores – See page 118 - 119); soda; sweetened iced tea; fruit drinks, punches, or ades; sweetened gelatin or other sweetened drinks. Infants should be fed nutritious beverages that will help them grow, such as breast milk or infant formula (pasteurized 100 percent fruit juice can be fed but in small amounts).

If your infant is having diarrhea, contact your health care provider for advice on what to feed him to eat and drink.

- Do not allow the infant to walk around or sit alone (e.g., playpen) with a bottle or spill-proof cup for extended periods.
- Avoid adding sweeteners to the infant's food or feeding the infant concentrated sweet foods such as lollipops, sweet candies, candy bars, sweet cookies or cakes, or sweetened cereals.
- Never give the infant a pacifier dipped in honey (honey should never be fed to infants because of the risk of contamination with *Clostridium botulinum* spores – See pages 118 - 119), syrup, sugar, or other sweetened substance.
- Gradually begin shifting bottle feedings to cup feedings anytime between 6 and 12 months old. As an infant advances from a bottle to a cup, the infant's chances of developing early childhood caries are reduced. Strongly encourage caregivers of healthy, full-term infants to wean their infants from a bottle to a cup by about 1 year of age.
- Follow the advice of your medical or dental health care provider regarding the infant's fluoride needs.
- Clean the infant's teeth regularly (See page 141 - 142 for recommended steps to follow to keep an infant's teeth clean).

The best approach to help a caregiver improve or correct improper bottle feeding practices is to offer practical alternatives. *For example, if an infant has become accustomed to a bottle in bed or a sweetened pacifier, suggest that the caregiver try the following alternatives:*

- Demonstrate love for her child, not with the bedtime bottle or sweetened pacifier, but rather by using a security blanket or teddy bear, singing or playing music, holding or rocking her child, or reading a story to her child.⁶
- Shift a bedtime bottle feeding to 1 hour before the bedtime or naptime.
- Give a plain pacifier only.

Caring for an Infant's Mouth and Teeth

Because the primary teeth are susceptible to decay as soon as they erupt, it is essential that care of the teeth and gums begin in early infancy.

The following steps are recommended to keep the teeth clean and prevent dental caries.^{3, 2}

- Before teeth appear, clean your infant's mouth beginning from the first day of life. Wipe out the mouth gently and massage the gums with a clean damp gauze pad or washcloth after feedings or at least twice a day, including before bedtime. More frequent cleaning may be recommended by a health care provider.
- Begin cleaning the infant's teeth as soon as they appear through the gums. Teeth should be brushed or wiped with a soft, clean washcloth twice a day (morning and evening). A very small, child-size toothbrush with soft, rounded-end bristles may be used with extreme care. Use water only, not toothpaste since an infant will swallow it. Continue using a clean gauze pad or washcloth to clean those areas in the mouth without teeth. More frequent cleaning

Figure 9

Examples of Healthy Teeth and Early Childhood Caries

Photograph of healthy teeth



Photographs below show teeth with mild to severe cases of early childhood caries



Photographs courtesy of: Dr. Norman Tinanoff, DDS, MS, Professor, University of Connecticut Health Center, School of Dental Medicine, Department of Pediatric Dentistry, Farmington, Connecticut

may be recommended by a health care provider, especially if there are beginning signs of tooth decay.

- After teeth erupt, 100 percent, pasteurized fruit juice should be given during meals only (limited to 4 to 6 ounces daily). Carbonated beverages should be excluded. Frequent or excessive consumption of liquid should be discouraged. After a meal, the infant's mouth should be wiped with a damp cloth.
- Infants and children should have exposure to optimal levels of fluoride through the water supply or appropriate supplements. See Chapter 1, pages 23 - 24 for guidelines regarding fluoridation.

Dental Care

To assure that any dental problems are discovered and treated before becoming serious problems, the American Academy of Pediatric Dentistry (AAPD) and AAP recommend that infants receive an oral health risk assessment by a qualified pediatric health care professional by 6 months of age.³ Those infants at significant risk of developing dental caries should be evaluated by a dentist between 6 and 12 months. Infants should be taken for their first dental visit by 12 months of age.⁷

*During early dental checks, a dentist or health care provider can:*⁸

- Examine the teeth for decay, demineralization, plaque, or gingivitis;
- Evaluate environmental factors that contribute to the development of caries including fluoride exposure, consumption of simple sugars or foods strongly associated with caries, socioeconomic status of the caregiver, and regular use of dental care; and
- Evaluate general health conditions, including those of children with special health care needs.

Other health care providers can provide appropriate anticipatory guidance to establish good oral health.⁹ Infant dental checks should be seen as the beginning of a life of regular dental care that prevents a child from experiencing the negative effects of dental disease. If an infant or child seems to have dental problems or decay at any time, refer him or her to a medical or dental health care provider as soon as possible. If left untreated, dental caries can become very serious, possibly requiring the extraction of teeth at a very early age.

Teething

Teething occurs when the erupting primary teeth make an infant's gums sore or tender. Caregivers may notice that, during teething, the infant's gums are red and puffy and may see or feel the emerging tooth.

Some methods of alleviating an infant's discomfort when teething include:

- Chilling a clean favorite rattle, teething ring, pacifier, or a spoon in the refrigerator and offering it to the infant to chew on; and
- Cleaning the infant's mouth 2 to 3 times per day with a damp clean gauze pad or washcloth.

It is not recommended to give an infant hard, raw vegetables like carrots or ice chips to chew on (they can choke on these) or to rub brandy or other alcoholic beverages on the teeth. Even small amounts of an alcoholic beverage can have adverse effects on infants. It is not advisable to give infants teething pain relief medicine before mealtime because it may interfere with chewing.

Resource materials on oral health for infants and young children include:

- National Maternal and Child Oral Health Resource Center <http://www.mchoralhealth.org/>
- WIC Works Resource System http://www.nal.usda.gov/wicworks/Topics/Oral_health.html

Vegetarian Diets

Families or individuals choose vegetarian diets for religious, philosophical, economic, ecological, health, or personal reasons. A vegetarian diet is generally defined as a diet that includes primarily or only plant foods (i.e., fruits, vegetables, legumes, nuts and seeds, and grains) and excludes certain or all animal foods (e.g., meats, poultry, fish, eggs, and dairy products).

Classifications of Vegetarian Diets

Vegetarian diets have been classified into the following subdivisions, based on the types of animal foods included in the diet. Within each classification, there may be variations of the food eaten. *The various classifications of vegetarian diets are listed as follows:*

- **Lacto-vegetarian diet** – plant foods and dairy products;
- **Lacto-ovo-vegetarian diet** – plant foods, dairy products, and eggs;
- **Semi-vegetarian diet** – plant foods and may include dairy products, eggs, fish, and/or poultry;
- **Vegan diet** – plant foods only and no foods from animal sources at all. This diet can place an infant's health and nutritional status at risk if not carefully planned;
- **Macrobiotic diet** – unpolished rice and other whole grains, legumes, seaweed, fermented foods, nuts and seeds, vegetable oils, fruits and vegetables, fish, and occasionally red meat if caught in the wild; this diet includes various stages of increasingly severe dietary restriction that excludes some of these foods. Generally, dairy products, red meat, and poultry are excluded from this diet. This diet can be dangerous to the health of infants and children; and
- **Fruitarian** – fruits, nuts and seeds, fermented cereals, olive oil, and honey. This diet can be very dangerous to the health of infants and children.

Adequacy of Vegetarian Diets

Most infants are on a lacto-vegetarian diet (milk/cereal/vegetables/fruit) during the first 4 to 6 months of life, with no risk to their health. For an infant whose caregiver desires a vegetarian diet, breast milk or soy-based infant formula alone provides adequate nutrition for approximately the first 6 months. Growth of infants fed soy-based infant formula is comparable to growth of infants fed breast milk or cow's milk-based infant formula. The AAP has indicated soy-based infant formula is appropriate for infants whose caregivers are seeking a vegetarian diet.¹⁰ Little data is available on the growth of older infants maintained on a vegetarian diet; there is some indication that growth rates may be slower early in childhood, but catch up in later childhood.^{11,12} Both the AAP and the American Dietetic Association (ADA) have stated that vegan diets can meet the needs of older infants if attention is paid to specific nutrients.^{13, 14}

Risks of Some Vegetarian Diets

As vegetarian diets become more restrictive, the nutritional and health risks of vegetarian diets for infants increase. Infants of any age on a restrictive vegetarian diet, such as macrobiotic or fruitarian, are placed at significant risk for growth abnormalities, serious nutritional deficiencies, and health problems. Inadequate vegetarian diets may lead to failure to thrive, iron deficiency anemia, megaloblastic anemia due to lack of vitamin B₁₂, (which is often masked by high folic acid levels, which may lead to eventual neurologic problems), and vitamin D deficiency rickets. *In working with caregivers of infants on restrictive vegetarian diets, it is appropriate to:*

- Inform the caregivers about the limits and potential detriments of restrictive diets;
- Discourage use of very restrictive vegetarian diets;
- Refer the infant to a health care provider for a medical evaluation and advice on supplementation if the caregiver decides to keep the infant on a restrictive diet; and
- Provide nutrition assessment and initial and follow-up nutrition counseling (if a caregiver decides to keep his or her infant on a vegan diet).

Guidelines for Nutrition Counseling

In providing nutrition counseling to caregivers of infants on vegetarian diets, these guidelines are recommended:

1. Assess the diet for adequacy, including nutritional deficiencies and/or excesses, and determine if the diet is appropriate for the infant's developmental level.
2. Discuss with the caregiver the appropriate amounts and types of foods needed to supply adequate energy, protein, vitamins, and minerals. Be mindful that the dietary preferences of vegetarian clients may be based on deeply held beliefs and cultural food habits. Work with the caregiver at initial and follow-up nutrition counseling sessions to assure that the diet is nutritionally adequate. *Adequacy of these nutrients should be closely evaluated:*
 - **Energy content** - Since many vegetable- and cereal-based foods have a low-energy and high-fiber content, an infant's foods need to be chosen wisely to assure that sufficient kilocalories and nutrients can be consumed daily. Although a small amount of fiber in an

infant's diet should not be harmful, a high-fiber diet tends to fill an infant's stomach and limit the amount of foods the infant can physically consume during meals. Vegan infants are most vulnerable to inadequate energy intake during the weaning period; providing some refined grain products, peeled fruits and vegetables, and fruit juice can help provide adequate calories without adding significant fiber.¹² A high-fiber diet can also reduce the availability of the minerals, iron, calcium, and zinc from foods in the diet. Thus, encourage caregivers to select a variety of foods, including those with a moderate- or low-fiber content (e.g., cheese, yogurt, and tofu).

- **Protein** - The protein needs of a lacto- or lacto-ovo-vegetarian infant are easily met if the diet includes sufficient quantities of high-quality protein foods (e.g., yogurt, cheese, egg yolks). A vegan diet must be planned carefully to ensure that a sufficient quality and quantity of protein is provided. *Advise caregivers who decide to keep their infants on a vegan diet to:*
 - Breastfeed or use soy-based infant formula.¹⁵ Soy-based infant formulas are nutritionally balanced. Soy beverages (sometimes described as soy drinks or soy milks) or rice beverages (rice milk), sold in grocery and specialty food stores, are grossly lacking in key nutrients needed by infants (calcium, niacin, vitamins D, E, and C) and should not be fed as substitutes for infant formula. Full-fat soymilk may be offered to vegan infants starting at 12 months.¹⁵
 - Feed combinations of plant foods (e.g., beans and rice) to infants consuming complementary foods during the course of each day.

Combinations of plant foods to feed during the day that meet the protein needs of the older vegetarian or vegan infant include:

- Cooked, mashed tofu and ground or mashed rice;
 - Iron-fortified infant cereal and soy-based infant formula;
 - Cooked pureed kidney beans with ground or mashed rice, mashed noodles, or a piece of whole-wheat bread; and
 - Other combinations of different legumes and cereal grains (e.g., rice, wheat, barley) prepared with the appropriate texture.
- **Vitamin B₁₂** - Since vitamin B₁₂ is only found in animal foods and some obscure food sources (e.g., nutritional yeast), infants who do not consume animal foods or vitamin B₁₂-fortified foods can develop a deficiency in this vitamin. Thus, assess the diet of any vegetarian infant to determine whether sources of vitamin B₁₂ are included, either from infant formula or indirectly in the diet of the infant's lactating mother. Caregivers who choose a vegan diet for their infants should be advised to breastfeed or use commercial soy-based infant formula. Since the vitamin B₁₂ content of breast milk is influenced by the breastfeeding mother's diet, a B₁₂ deficiency can develop in an exclusively breastfed infant whose mother is on a vegan diet. Breastfed infants of vegan mothers should receive supplemental vitamin B₁₂ in the amount of 0.4 µg per day up to 6 months of age and 0.5 µg per day beginning at 6 months of age.¹⁶ Alternatively, vegan breastfeeding mothers can consume vitamin B₁₂ - fortified foods or take a supplement containing vitamin B₁₂ to ensure that their breast milk has adequate vitamin B₁₂ stores. If a mother

provides breast milk deficient in this vitamin to an exclusively breastfed infant for a period of time, the infant can develop neurological damage. *Refer the infant and/or mother to a health care provider for assessment of vitamin B₁₂ status.*

- **Vitamin D** - Vitamin D needs of vegetarian infants do not differ from those of infants fed foods of animal origin. See pages 11 - 12 for information regarding the vitamin D needs of breastfed infants and recommended levels of supplementation. Vegetarian infants who are not breastfed should be fed soy-based infant formula. Soy-based infant formulas provide adequate vitamin D in the first 4 to 6 months and as the vegetarian infant's milk beverage in the second 6 months of life.
- **Calcium** - Calcium needs are easily met if an infant is consuming adequate quantities of breast milk or infant formula, both rich sources of calcium. Calcium, in smaller amounts and a less available form, is also in soybeans and other legumes, grain products, and dark green leafy vegetables (including chard, kale, collard greens, and spinach). However, do not feed home-prepared spinach or collard greens, which are high in nitrate, to infants under 6 months old. See page 113 for more information regarding nitrate-containing vegetables.
- **Iron** - Most healthy, full-term infants are born with iron stores that are not depleted until about 4 to 6 months old. A vegetarian infant who consumes an appropriate amount of iron-fortified infant formula daily and iron-fortified cereal starting between 4 and 6 months should receive an adequate amount of iron in the first year of life. Alternate sources of iron need to be provided to infants age 6 months or older who are exclusively breastfed. See pages 19 - 21 for more information regarding iron sources for breastfed and formula-fed infants. Iron sources, besides meat, poultry, and fish, include iron-fortified infant cereal and other enriched and whole-grain products, cooked dried beans and peas, and cooked dried fruits. Since these plant foods contain poorly absorbed nonheme iron, it is recommended to feed vitamin C-rich foods at the same meal with those foods to increase iron absorption. See page 14 and Appendix C, pages 199 - 205 for examples of vitamin C-rich foods. *Refer infants who may be iron-deficient, based on dietary intake or hematological tests, to a health care provider for assessment, monitoring, and advice on supplementation.*
- **Zinc** - Breast milk or infant formulas consumed in appropriate amounts provide sufficient zinc for young infants. After 6 months of age, food sources of zinc should be added to the diet. Zinc sources, besides meat, poultry, fish, and egg yolks, include whole-grain cereals, breads, and other fortified or enriched grain products; cheese; yogurt; and legumes. Zinc bioavailability may be improved by using yeast-leavened whole-grain breads and fermented soy products.¹⁷ Although some experts recommend zinc supplementation for vegan infants during the weaning period,^{18, 19} the AAP does not because clinical signs of zinc deficiency are rarely seen in vegetarians.¹³
- **Riboflavin (vitamin B₂)** - Dairy products are one of the major sources of riboflavin in an infant's diet. Infants who are not fed breast milk, milk-based infant formula, or other dairy products can obtain riboflavin from soy-based infant formula; enriched, fortified,

and whole-grain breads or cereals; dark green leafy vegetables; legumes; broccoli; and avocado.

3. Emphasize the importance of following general guidelines on introducing new foods and watching for hypersensitivity (allergic) or other reactions that an infant may have to new foods. Honey should never be fed to infants because of the risk of contamination with *Clostridium botulinum* spores.
4. Discuss with the caregiver the importance of modifying the texture of foods to meet the infant's needs. Some foods commonly included in vegetarian diets may be coarse and hard to digest and/or may require teeth for chewing. *Guidelines to ensure certain foods are suitable for infants to consume include the following:*
 - Puree or mash cooked whole dried beans and peas. Legumes should be pressed through a sieve to remove skins.
 - Grind up or finely mash cooked whole grain kernels, such as rice, wheat berries, barley, etc. Avoid these grain products that require chewing and can cause choking: granola-type cereals, cooked whole grain kernels, and plain, dry wheat germ.
 - Do not feed whole or chopped nuts and seeds to infants. Discourage the use of nut/seed butters because they can stick to the roof of the mouth possibly causing choking and may cause hypersensitivity (allergic) reactions. In families with a strong family history of allergy, peanuts and other nuts should not be introduced until 3 years of age.²⁰ See pages 107 - 109 for more information regarding hypersensitivity reactions.
 - Follow standard recommendations regarding home preparation of fruits, vegetables, and grains for infants. See pages 120 - 127 for more information regarding home preparation of infant foods.

If the above concerns are appropriately addressed when feeding a vegetarian infant, it should be possible for the infant to receive an adequate balance of nutrients and, thus, achieve optimum growth and development. See Appendix D, pages 206 – 208 for general guidelines on feeding healthy infants.

Common Gastrointestinal Problems

Spitting Up and Vomiting

It is normal for young infants to spit up a small amount of breast milk or infant formula after feedings. The muscle located between the stomach and the esophagus may not be sufficiently developed to keep all the food in an infant's stomach after eating. Usually about a teaspoon or less of breast milk or infant formula will come out of an infant's mouth after feeding when the infant is burped or allowed to lie flat down on his or her side or back. Although some caregivers may want to lay their infant on his or her stomach to prevent spitting up, infants should only be put to sleep lying on their back, without any pillows, blankets, or toys to prop the infant. Following these guidelines will help prevent Sudden Infant Death Syndrome (SIDS).⁶

A more severe form of spitting up is called gastroesophageal reflux (GER). Reflux is defined as the spontaneous, effortless regurgitation of material from the stomach into the esophagus. GER may be caused by the immature gastrointestinal tract and seems to be related to a delay in stomach emptying; up to half of the cases may be related to cow's milk protein allergy.²¹ Although thickening breast milk or infant formula has been prescribed as a treatment for GER, the effectiveness of this therapy is controversial.²² **The addition of infant cereal to breast milk or infant formula or the use of infant formula with added rice cereal should only be done if prescribed by the infant's health care provider.**

Infants with GER who have wheezing, recurrent pneumonia or upper respiratory infections, symptoms of esophagitis (an irritation of the esophagus), irritability during feeding, or failure to thrive are at particular risk and should be referred to a health care provider immediately.

Methods to reduce excessive spitting up include the following:

- Burp the infant several times during a feeding. Burping is generally done during normal breaks in a feeding; it slows a feeding and can lessen the amount of air swallowed.
- Hold the infant in an upright position after a feeding for about 15 to 30 minutes.
- Avoid excessive movement or play right after eating.
- Avoid forcing the infant to eat or drink when full and satisfied.

Vomiting refers to the forceful discharge of food through the esophagus and involves a more complete emptying of the stomach's contents. It can occur as a symptom of a reaction to food eaten, a minor or major medical condition, or use of certain medications. Vomiting can also result from stimulation to the inner ear from being in a moving vehicle or even from excitement or nervousness. Vomiting can place an infant at risk of dehydration. See page 27 for signs of dehydration.

Refer an infant to a health care provider for medical evaluation if the caregiver notes that the infant is vomiting or that his or her spitting up is unusual in terms of volume, contents, or accompanying symptoms.

Colic

Up to one fifth of all infants experience colic in the first few months of life. Colic is described as prolonged, inconsolable crying that appears to be related to stomach pain and discomfort (infants may pull their legs up in pain) often in the late afternoon or early evening.⁶ It usually develops between 2 to 6 weeks of age and may continue until the infant is 3 to 4 months old. Formula-fed infants seem to experience colic more often than breastfed infants; the cause of colic is unknown. A systematic review of a variety of therapies used to manage colic indicates no clearly effective treatments.²³ Some evidence indicates that breastfed infants may benefit from breastfeeding mothers eliminating milk products or other allergenic foods from their diet; similarly some benefit has been shown with the use of hypoallergenic infant formula.²³ Colic has also been associated with infants fed sorbitol-containing fruit juices, such as apple, white grape, and pear juice.²⁴

Diarrhea

Diarrhea is defined as the frequent passage of loose, watery stools. Diarrhea should not be confused with the normal stools of breastfed infants. Diarrhea in infants can be caused by a reaction to a food, excessive juice consumption, use of certain medications, medical conditions or infections, malabsorption of food, or consuming contaminated food or water. Proper infant formula preparation and storage techniques are very important in assuring that infant formula is not contaminated and a potential cause of diarrhea.

If untreated, diarrhea in an infant can rapidly lead to dehydration, which can be life-threatening; diarrhea is the most common cause of hospitalizations in otherwise healthy infants. Chronic diarrhea may lead to nutrient deficiencies because food passes through the gastrointestinal tract too quickly to be digested and nutrients cannot be absorbed. *Thus, refer an infant to a health care provider for medical evaluation if the caregiver notes that the infant is having diarrhea.*

Use of ordinary beverages to treat diarrhea may actually worsen the condition and lead to further dehydration.²⁵ In most cases of acute diarrhea, and clearly when dehydration is not present, continued feeding of the infant's usual diet is the most appropriate treatment.²⁵ This is true whether the infant's usual intake is breast milk, milk-based infant formula, soy-based infant formula, or any of these milks along with complementary foods. ***Caregivers should consult with the infant's health care provider about the treatment of diarrhea and not self-treat diarrhea by feeding ordinary beverages such as carbonated beverages, sport drinks, fruit juice, tea, or chicken broth.***

The Centers for Disease Control and Prevention (CDC) and the AAP recommend the following during diarrhea.^{26 27}

- Breast-fed infants should continue to breastfeed on demand.
- Formula-fed infants should continue to be fed usual amounts of infant formula immediately following rehydration (if indicated).
- Low lactose or lactose-free infant formula is usually not necessary.
- Infant formula should not be diluted during diarrhea.
- The use of soy-based formulas is not necessary.
- Infants eating complementary foods should continue to receive their usual diet during diarrhea.
- Simple sugars (as found in soft drinks, juice, and gelatin) should be avoided; solid food intake should emphasize complex carbohydrates.
- Withholding food for > 24 hours or feeding highly specific diets (for example the BRAT diet [bananas, rice, applesauce, tea]) is inappropriate.

Depending on an infant's condition, a health care provider may prescribe an appropriate oral rehydration solution to prevent and treat dehydration resulting from diarrhea. **Oral rehydration solutions should be used only under the supervision of physicians or other trained health personnel.**

Constipation

Constipation is generally defined as the condition when bowel movements are hard, dry, and difficult to pass. Although some believe that constipation is related to the frequency or the passage of stools, this may not be as important as the consistency of the stools. Part of the difficulty in determining whether an infant is constipated is that each caregiver may have a different perception of how often an infant should have a bowel movement and whether an infant's stool is "too hard." True constipation is not very common among breastfed infants who receive adequate amounts of breast milk or formula-fed infants who consume adequate diets. Some caregivers believe iron causes their infant to be constipated, but studies have demonstrated no relationship between iron-fortified infant formula and gastrointestinal distress, including constipation.²⁸ Formula-fed infants tend to have firmer stools, but this does not indicate constipation.

Constipation can be caused by a variety of factors or conditions, including:

- Dietary influences, such as:
 - inadequate breast milk, infant formula, complementary foods, or fluid intake;
 - improper dilution of infant formula;
 - early introduction of complementary foods; or,
 - excessive cow's milk in older infants.
- Abnormal anatomy or neurologic functioning of the digestive tract;
- Use of certain medications;
- A variety of medical conditions and hormonal abnormalities;
- Stool withholding due to rectal irritation from thermometers, vigorous wiping, etc.;
- Excessive fluid losses due to vomiting or fever;
- Lack of movement or activity; or
- Abnormal muscle tone.

If a caregiver complains that an infant is constipated, refer the infant to a health care provider for medical evaluation. If the health care provider determines that the infant's diet is inappropriate and a factor influencing the constipation, it is appropriate to assess the infant's diet, with particular focus on:

- The adequacy of intake of breast milk or infant formula
- Proper infant formula preparation and dilution if formula-fed
- Whether appropriate types and amounts of complementary foods are consumed (see Appendix D, pages 206 - 208 for guidelines on feeding healthy infants) and
- Premature introduction of complementary foods if the infant is less than 4 months old.

Overweight and Obesity Prevention

Overweight has been defined on the basis of population norms as body mass index (BMI) at or above the 95th percentile for age on the appropriate gender-specific CDC growth chart.²⁹ BMI

between the 85th and 95th percentiles has been defined as at risk for overweight. Body mass index is calculated as weight in kilograms divided by the square of height in meters. BMI-for-age growth charts are not available for infants and children under 2 years. For infants and children less than 2 years old, overweight has been defined as weight-for-length at or above the 95th percentile on gender-specific NCHS growth charts.³⁰

The prevalence of overweight among American children has been rising rapidly. Data from the National Health and Nutrition Examination Surveys (NHANES) II and III show an increase in overweight 6- to 23-month-olds from 7.2 percent in 1976-1980 to 11.6 percent in 1999-2000.³² Similarly, an increase in overweight 2- to 5-year-olds occurred, from 5.0 percent in 1976-1980 to 10.4 percent in 1999-2000.³¹ In 1998, 13.2 percent of children participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) were overweight.³² Within this population, the rates of prevalence varied by ethnic group; Hispanic children 16.4 percent, Native American children 18.6 percent, Asian 12.5 percent, black 12.2 percent, and white 11.1 percent. The incidence of Type 2 diabetes in children is increasing at the same time.³³

The following factors related to infant feeding may play a part in the development of childhood obesity:

- **Breastfeeding** - Multiple studies indicate a protective effect of breastfeeding on the later development of obesity;^{34 35 36} however, research is still ongoing. Longer duration of breastfeeding has been associated with a reduced risk of becoming overweight.³⁶
- **Weaning from the bottle later than 18 months of age** - Each additional month of bottle use corresponds to a 3-percent increase in the likelihood of being in a higher BMI category (85th to 95th percentile or > 95th percentile).³⁷
- **Rapid weight gain in infancy** - Rapid weight gain in the first 4 to 6 months is associated with a higher incidence of overweight and obesity in later childhood and adolescence.^{38,39, 40, 41}
- **Maternal control** - There is conflicting evidence about whether controlling or restricting a child's intake affects the development of obesity. Breastfeeding through the first year has been associated with lower levels of maternal control over the child's intake.^{42,43} The child's ability to respond to internal cues of hunger and satiety, rather than respond to parental pressure or restriction, may be less likely to lead to obesity.^{44,45} Some reports indicate that maternal control is not associated with a higher BMI in children;^{46,47} others indicate the relationship is complex and may be influenced by the child's predisposition to obesity⁴⁷ or the parent's hunger, history of eating disorders, or place of birth outside the United States.⁴⁸
- **Dietary choices** - Some clinicians and researchers believe that emphasizing lower dietary fat intake may lead to excess carbohydrate intake, resulting in excessive weight gain.⁴⁹ A more reasonable approach may be a moderate fat intake for children, emphasizing dietary variety.⁵⁰

The AAP states that early recognition of excessive weight gain in relation to linear growth is important for initiating early intervention. They advocate a dietary approach that encourages moderate consumption of healthful food choices, rather than over consumption or restriction. The AAP's recommendations for health supervision of infants to prevent overweight and obesity include the following:⁵¹

- Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
- Encourage, support, and protect breastfeeding.
- Encourage parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains; encouraging children's autonomy in self-regulation of food intake and setting appropriate limits on choices; and modeling healthy food choices.
- Routinely promote physical activity, including unstructured play at home, in school, in child care settings, and throughout the community.

Discourage television viewing for children younger than 2 years, and encourage more interactive activities that will promote proper brain development, such as talking, playing, signing, and reading together.

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