

CHAPTER 5: COMPLEMENTARY FOODS

Complementary foods are foods other than breast milk or infant formula (liquids, semisolids, and solids) introduced to an infant to provide nutrients. Recommendations on the introduction of complementary foods provided to caregivers of infants should take into account:

- The infant's developmental stage and nutritional status;
- Coexisting medical conditions;
- Social factors;
- Cultural, ethnic, and religious food preferences of the family;
- Financial considerations; and
- Other pertinent factors discovered through the nutrition assessment process.

This chapter reviews current knowledge regarding the introduction of complementary foods, the appropriate types of complementary foods to feed an infant, home preparation of infant food, using commercially prepared infant food, how to prevent choking, and other practical aspects of feeding complementary foods and beverages. Counseling points that relate to the information presented in this chapter are found in Chapter 8, pages 176 - 188.

Guidelines on Transitioning to Complementary Foods

The ideal time to introduce complementary foods in the diets of infants is difficult to pinpoint. Complementary foods introduced too early are of little benefit to the infant and may even be harmful due to the possibility of choking, developing food allergies, or causing an infant to consume less than the appropriate amount of breast milk or infant formula. Introducing complementary foods too late may cause an infant to develop nutritional deficiencies and/or miss that period of developmental readiness. Consequently, the infant may have difficulties learning to eat complementary foods when they are introduced later. When complementary foods are introduced appropriate to the developmental stage of the infant, nutritional requirements can be met and eating and self-feeding skills can develop properly. Pediatric nutrition authorities agree that complementary foods should not be introduced to infants before they are developmentally ready for them; this readiness occurs in most infants between 4 and 6 months of age.

“There is no evidence for harm when safe nutritious complementary foods are introduced after 4 months when the infant is developmentally ready. Similarly, very few studies show significant benefit for delaying complementary foods until 6 months.”¹ The timing of introduction of complementary foods for an individual infant may differ from this recommendation. There is some disagreement among authorities on the need for additional sources of nutrients besides breast milk in the first 6 months. However, there is agreement that infants need a good dietary source of iron and zinc by about 6 months of age, which cannot be met by breast milk alone.

Developmental Readiness for Complementary Foods

Full-term, healthy infants reach developmental readiness to begin complementary foods between 4 and 6 months old. By this age, infants begin to show their desire for food by drooling, opening their mouths, and leaning forward.² Conversely, they show lack of interest or fullness by leaning back, turning away, pushing the spoon or food away, or closing their mouths.²

*From 4 to 6 months of age, the following developmental changes occur that allow the infant to tolerate complementary foods:*³

- The infant's intestinal tract develops immunologically with defense mechanisms to protect the infant from foreign proteins (thus, the risk of hypersensitive (allergic) reactions to the proteins in complementary foods is reduced).
- The infant's ability to digest and absorb proteins, fats, and carbohydrates, other than those in breast milk and formula, increases rapidly.
- The infant's kidneys develop the ability to excrete the waste products from foods with a high renal solute load, such as meat.
- The infant develops the neuromuscular mechanisms needed for recognizing and accepting a spoon, masticating, swallowing nonliquid foods, and appreciating variation in the taste and color of foods.

*There are milestones an infant reaches when he/she is ready to consume complementary foods, such as being able to:*⁴

- Sit up, alone or with support
- Hold his head steady and straight
- Open his mouth when he sees food coming
- Keep his tongue low and flat to receive the spoon
- Close his lips over a spoon and scrape food off as a spoon is removed from his mouth and
- Keep food in his mouth and swallow it rather than pushing it back out on his chin. By 4 to 6 months of age, the infant's tongue thrust reflex, which causes the tongue to push most solid objects out of the mouth, usually disappears.

These are signs that an infant is mature enough to begin learning to eat from a spoon. Introduction of complementary foods from a spoon is developmentally important for both breastfed and formula-fed infants to learn appropriate feeding skills for childhood. However, an infant's weight or age alone does not determine readiness for complementary foods; each infant develops at his or her own rate. As an infant's oral skills develop, the thickness and lumpiness of foods can gradually be increased. The texture of foods can progress from pureed to ground to fork-mashed and eventually to diced. Commercially prepared infant foods that progress in texture can also be purchased. Infants should only be given foods that are appropriate for their developmental age.

See Figure 1-- Sequence of Infant Development and Feeding Skills in Healthy, Full-Term Infants, page 41, for more information regarding the sequence of infant development and feeding skills.

Figure 7: How the Recommended Sequence of Introducing Complementary Foods Corresponds With Food Textures and Feeding Styles

Age of Infant By Month	Birth	1	2	3	4	5	6	7	8	9	10	11	12
Age Grouping	Birth through 3 months				4 months through 6 months		6 months through 8 months		8 months through 12 months				
Sequence of Introducing Foods	Breast milk or Infant Formula				Complementary Foods**								
Texture of Complementary Foods					Strained/Pureed (thin consistency for cereal)								
									Mashed				
											Ground/Finely Chopped		
													Chopped
Feeding Style	Breastfeeding/Bottle Feeding												
					Spoon Feeding								
					Cup Feeding								
									Self Feeding/Finger Foods				

Special Note:  represents the age range when most infants are developmentally ready to begin consuming complementary foods. The American Academy of Pediatrics Section on Breastfeeding recommends exclusive breastfeeding for the first 6 months of life. The AAP Committee on Nutrition recommends that, in developed countries, complementary foods may be introduced between ages 4 and 6 months. This is a population-based recommendation, and the timing of introduction of complementary foods for an individual infant may differ from this recommendation.

** Complementary foods include infant cereal, vegetables, fruits, meat, and other protein-rich foods modified to a texture appropriate (e.g., strained, pureed, chopped, etc.) for the infant's developmental readiness. See Figure 1 for more guidance on feeding skills and infant development.

Developmental Delays Affect an Infant's Feeding Skills

An infant's development does not always match his or her chronological age. *Infants may be developmentally delayed in their feeding skills due to:*

- Prematurity
- Low-birth weight
- Multiple hospitalizations
- Failure to thrive
- Neuromuscular delay
- Abuse or neglect
- Depression
- Cleft lip or cleft palate
- Inability to feed by mouth (i.e., fed intravenously or via tube) for an extended period or
- A medical condition (e.g., Down's syndrome or cerebral palsy).

Infants with these conditions may not be developmentally ready for complementary foods at similar chronological ages as full-term, healthy infants. A caregiver of a developmentally delayed infant will need instructions on feeding techniques from the infant's health care provider or a trained professional in feeding developmentally disabled children. For more information and resources on feeding infants and children with special health care needs, contact:

- A local pediatrician;
- A registered dietitian or nutritionist specializing in this area (e.g., may be found in the State Health Department, State WIC Program, or in local hospitals);
- A State maternal and child health agency; or
- A registered dietitian or nutritionist at a university-affiliated program for developmental disabilities (contact your local or State health department for information on the nearest program).

Early Introduction of Complementary Foods

In spite of recommendations to delay introduction of complementary foods until 4 to 6 months, studies have demonstrated this practice remains very common. Incidence of early introduction of complementary foods before 4 months has been reported to be from 44 percent⁵ to 93 percent⁶ depending on the group surveyed. The practice is lower among infants who are exclusively breastfed than among those who are fed infant formula or those fed a combination of breast milk and formula.^{5, 6} Racial and ethnic differences appear to play a part;⁷ Hispanic caregivers are least likely to introduce complementary foods before 4 months and African-American caregivers are most likely.^{5, 6} Caregivers tend to introduce complementary foods at an early age because they feel that their infants are not satisfied with breast milk or formula alone or the foods will make their infants sleep through the night. *However, infants who are fed complementary foods before they are developmentally ready for them may:*

- Choke on the food

- Develop food hypersensitivities (allergies) because of an immature digestive tract and/or
- Consume less than the appropriate amount of breast milk or infant formula.

Contrary to popular belief among mothers, feeding complementary foods early will not help infants sleep through the night or eat fewer times in a day; the infant's ability to sleep through the night depends on his developmental maturity and ability to comfort himself when awake and not hungry.² If a caregiver complains that an infant is not satisfied with breastfeeding or the amount of infant formula provided, a nutrition assessment with additional probing questions may ascertain possible problems.

Late Introduction of Complementary Foods

At 6 months old, healthy, full-term infants should be introduced to appropriate complementary foods. By 8 months, they should be developing skills to feed themselves (see Figure 1 for the sequence of infant development and feeding skills on page 41). The jaw and muscle development that occurs when an infant eats complementary foods at the appropriate age contributes to later speech development. Infants who are not introduced to complementary foods when developmentally ready for them may:

- **Reject foods when they are introduced at a later age** - This may occur because infants become comfortable with the easier feeding style necessary to suck from the breast or a bottle. The infant may then have difficulty developing skills to eat independently.
- **Consume an inadequate variety and amount of food to meet their nutritional needs** - Breast milk or infant formulas alone do not provide an adequate concentration or balance of nutrients for the older infant.

Therefore, complementary foods serve an important purpose in the daily diet of infants who are developmentally ready for them.

Importance of Gradually Introducing Each New Food

When introducing infants to complementary foods, caregivers should follow these guidelines:^{1,8}

- Introduce new foods one at a time.
- Introduce “single-ingredient” foods initially to determine the infant's acceptance to each food (e.g., try plain rice cereal before rice cereal mixed with fruit).
- Allow at least 7 days between the introduction of each new “single-ingredient” food.¹ Some research experts acknowledge that complementary foods can be introduced at intervals of 2 to 4 days if the infant is developmentally ready.⁹
- Introduce a small amount (e.g., about 1 to 2 teaspoons) of a new food at first (this allows an infant to adapt to a food's flavor and texture).
- Observe the infant closely for adverse reactions such as rash, wheezing, or diarrhea after feeding a new food.

By following these guidelines, an infant will have time to become acquainted with each new food and the caregiver will be able to easily identify any adverse reactions or difficulties digesting new foods. *Adverse reactions to food include:*¹⁰

- **Food hypersensitivities (allergies):**
 - Occur in approximately 2 percent to 8 percent of infants and children less than 3 years old
 - Involve a reaction of the immune system to a food; a reaction may occur immediately or hours after eating
 - May cause any of the following symptoms:
 - Systemic - anaphylactic shock, failure to thrive
 - Gastrointestinal - diarrhea, vomiting, abdominal pain
 - Respiratory symptoms – coughing, wheezing, ear infections
 - Cutaneous - skin rashes (like eczema)
 - Are associated most with consumption of these foods by infants: cow's milk, whole eggs (or egg white), wheat, peanuts or tree nuts, finfish (e.g., flounder, trout, cod) and shellfish (e.g., shrimp, crab, lobster, scallop, oyster, clam).

Caregivers should not feed any shellfish, peanut butter, whole eggs, or egg whites to their infants before 1 year of age.

- **Food intolerances:**
 - Involve reactions stemming from an enzyme deficiency, a toxin, or a disease (the immune system is not affected); and
 - May cause some of the similar symptoms as food hypersensitivities.

Examples of food intolerances are lactose intolerance (caused by a lack of lactase, the intestinal enzyme that digests the sugar lactose) and celiac disease (in which gluten, a combination of proteins found in wheat, rye, oats, barley, and buckwheat, destroys the lining of the small intestine).

- **Other adverse reactions to food that do not involve the immune system include reactions to the following:** food additives (e.g., artificial food colorings), MSG (monosodium glutamate), natural substances in food such as caffeine, or substances or microorganisms that cause food poisoning. Some infants may develop excessive intestinal gas after consuming certain foods (e.g., certain vegetables, legumes).

If the caregiver observes any of the previously discussed reactions in an infant after a feeding, they should stop feeding the infant that food immediately and consult a health care provider. If an infant appears to be having a severe reaction to a food (e.g., difficulty breathing, shock, etc.), the caregiver should call 911 or take the infant to the nearest hospital emergency room.

Note that it is now well established that antigens can pass into breast milk and some exclusively breastfed infants have been reported to have reactions to foods in their mothers' diets.¹¹ *If an exclusively breastfed infant has symptoms similar to those described above for food hypersensitivities, referral to a qualified health care provider is appropriate.*

Infants at high risk for developing allergy, identified by a strong family history of allergy – infants with at least one first-degree relative (parent or sibling) with allergic disease – should adhere to the following recommendations:¹⁰

- Complementary foods should not be introduced until 6 months of age.
- Dairy products should be delayed until the infant is 1 year old.
- Eggs should be delayed until the infant is 2 years old.
- Peanuts, nuts, and fish should be delayed until 3 years of age.

Establishing Dietary Variety and Food Preferences

Caregivers should show a positive attitude when introducing new foods to their infant. Touching the infant's lips with the spoon containing a new food will provide a taste of the new food before a full spoonful is offered.⁴ New foods that are rejected should not be force-fed to an infant but should be offered again in a week or two. Research has demonstrated that it takes up to 10 to 15 exposures to a new food for an infant to readily accept the food.^{12,13} Infants and children may accept foods previously rejected if time has elapsed since the initial rejection. It may also be helpful if the food is offered to the infant by the caregiver without pressure to accept the food. It may take time to adapt to the flavor and texture of new foods; familiarity plays a significant part in food acceptance.^{14,15} Breastfed infants have been shown to prefer rice infant cereal prepared with their mother's breast milk over infant cereal prepared with water.¹⁶ Similarly, breastfed infants tend to accept the introduction of new foods more readily than formula-fed infants.¹⁷ This affect is most likely a result of the infant's exposure to a variety of flavors in breast milk from the mother's diet.¹⁸ See page 43 for more information regarding the feeding relationship.

Types of Complementary Foods To Introduce

Infants can be fed either home- or commercially prepared infant foods. Research does not support introducing foods in a particular order; however, it is recommended to introduce one "single-ingredient" new food at a time.¹ This section reviews the different types of complementary foods commonly fed to infants. See Figure 7, page 105 and Appendix D, pages 206 - 208, for guidelines on feeding healthy infants.

Iron-Fortified Infant Cereal

Iron-fortified infant cereal is an appropriate first complementary food for infants because it is easy to digest and contributes important nutrients such as iron and zinc to the diet.

Iron and Zinc Needs for Exclusively Breastfed Infants

Iron and zinc are essential nutrients for all healthy, full-term infants, but are special nutrients of concern for exclusively breastfed infants. Research has shown chemical analysis of breast milk at various stages of lactation indicating that at 6 through 11 months postpartum, the zinc and iron content of breast milk alone is not sufficient for older infants.¹⁹ Consequently, the timing of introduction, content, and bioavailability of zinc and iron in complementary foods, such as protein-rich foods and fortified infant cereal, is very important for exclusively breastfed infants. See page 20 for more information regarding the iron requirements of breastfed infants.

Types of Infant Cereal To Feed

A variety of plain iron-fortified infant cereals are available. *Iron-fortified infant rice cereal is a good choice as an infant's first complementary food because it:*

- Digests easily
- Least likely to cause a hypersensitivity (allergic) reaction
- Contains important nutrients and
- Can be altered in texture to meet an infant's developmental needs. The infant's first cereal feeding should be soupy in texture with the texture becoming thicker and lumpier as feeding skills progress.

After introducing rice infant cereal, oat and barley infant cereals can be added at 1-week intervals. Wheat infant cereal should be introduced at 8 months of age. It is most likely to cause a hypersensitivity (allergic) reaction in young infants and this risk decreases by around 8 months. Mixed-grain infant cereals and infant cereal and fruit combinations may be introduced after an infant has been introduced separately to each food in the mixture or combination. Jar infant cereal usually includes multiple ingredients, sugar, and more kilocalories; and is more expensive, ounce for ounce, than reconstituted dry boxed infant cereals. Dry infant cereal can be mixed with breast milk, infant formula, or water to prepare it to the appropriate consistency.

Avoid Adult Cereals

Ready-to-eat iron-fortified cereals designed for adults or older children are not recommended for infants because they:

- Often contain mixed grains
- Tend to contain more sodium and sugar than infant cereals
- Typically contain less iron per infant-sized serving and contain a form of iron that is not as easily absorbed by the infant as the iron in infant cereals and
- Often contain small pieces, such as raisins, dates, or nuts that are hard to chew and could cause choking.

Fruit Juice

In recent years, fruit juice has become a popular beverage to offer infants because it tastes good and infants readily accept it. Although fruit juices contain carbohydrates, may contain vitamin C, and are a source of fluid they have potentially detrimental effects.

Infants who drink excessive amounts of fruit juice from a bottle or cup may:

- Consume an inadequate quantity of breast milk, infant formula, or other nutritious foods;²⁰
- Develop gastrointestinal symptoms, such as diarrhea, abdominal pain, or bloating, from consuming an excessive amount of certain juices, i.e., fruit juices containing a significant amount of sorbitol, a naturally occurring carbohydrate. Juices containing sorbitol include prune, pear, cherry, peach, and apple juice;
- Develop malnutrition and short stature; and²¹
- Develop dental caries.

Definition of Fruit Juice

The Food and Drug Administration (FDA) mandates that a product must contain 100 percent fruit juice in order to be labeled as such. If a beverage contains less than 100 percent fruit juice its label must display a descriptive term, such as “drink,” “beverage,” or “cocktail.”²¹

Consequently, fruit juice should be fed only in moderation. Some fruit juices, such as prune, apple and pear, contain a significant amount of sorbitol, a sugar alcohol, and proportionally more fructose than glucose. Infants can only absorb a portion of the sorbitol (as little as 10 percent) and fructose in these juices.²² The unabsorbed carbohydrate is fermented in the lower intestine, causing diarrhea, abdominal pain, or bloating. These symptoms are commonly reported in infants who drink excessive amounts of juice.

The AAP has concluded that fruit juice offers no nutritional benefit for infants less than 6 months and no benefit over whole fruits for infants older than 6 months. However, 100 percent fruit juice or reconstituted juice can be consumed as part of a well-balanced diet when limited to 4 to 6 ounces daily.²¹

Guidelines on Introducing Fruit Juice

If fruit juices are introduced, caregivers should adhere to the following recommendations:^{1, 21}

- Wait to introduce fruit juices until the infant is 6 months or older.
- Use 100 percent fruit juice.
- Never feed infants unpasteurized juice.
- Introduce new fruit juices one at a time and not sooner than about 7 days apart, and observe the infant for adverse reactions. Introduce mixed fruit juice only after the infant has tried all the juices in the mixture.

- Avoid offering fruit juice in a bottle or spill-proof cup (sippy cup) that can easily be carried around by the infant.
- Avoid offering fruit juice at nap or bedtime.
- Limit juice intake to 4 to 6 ounces a day.

Types of Juices Offered (Infant Juices, Citrus Juices, Canned Juices, and Unpasteurized Juices)

Juices bottled specifically for infants and toddlers do not differ from those bottled for adults and are more expensive; regular juices may be offered to infants following the guidelines outlined above.

Most canned juices manufactured in the United States are packed in cans coated with a lining designed to reduce the rate at which the can corrodes. Once a can is opened, some corrosion still occurs and may affect the juice's flavor. Thus, it is advisable to store juice from a freshly opened can in a clean glass or plastic container. Historically, there has been concern about feeding infants canned food or beverages because of the danger of lead from the can seams leaching into the food. However, the seams of cans manufactured in the United States are no longer made using lead solder. It is possible that canned imported juices, found in ethnic, specialty, and conventional food stores, may have lead seams. As a precaution, advise caregivers to avoid feeding imported canned juices to their infants. Also, fruit juices should not be stored in lead crystal containers or pottery containers, which may leach lead into the juice. See page 127 for more information regarding potential lead exposure from food.

Unpasteurized juices should never be given to infants because there is a risk of the infant being exposed to *Escherichia coli* O157:H7 (see page 36 for information on *Escherichia coli* O157:H7).²³ Unpasteurized juices may be found in the refrigerated sections of grocery or health food stores, cider mills, or farm markets. Labels on unpasteurized juices must contain the following: "WARNING: This product has not been pasteurized and therefore may contain harmful bacteria that can cause serious illness in children, the elderly, and persons with weakened immune systems."²⁴

Importance of Feeding Juice From a Cup Instead of a Bottle

Whether regular "adult" juices or infant juices are used, infants should be fed juice from a cup without a lid. Cups with lids designed to prevent spilling are not recommended, because they allow the infant or toddler to carry the cup around with them. This practice can lead to the infant consuming excessive amounts of liquid, since they have constant access to it. Unfortunately, many commercial infant juices are available in 4- and 8-ounce bottles designed so that a rubber nipple can easily be attached. Advise caregivers to pour fruit juice into a cup without a lid and never feed it from a bottle.

Vegetables and Fruits

Vegetables and fruits provide infants with carbohydrates, including fiber; vitamins A and C; and minerals. A recent comprehensive analysis of the available literature indicates that the order of introduction, fruits first or vegetables first, is not important.⁹

Introducing Home- and Commercially Prepared Vegetables and Fruits

Home- or commercially prepared vegetables and fruits can be fed to infants. A wide variety of vegetables and fruits should be introduced over time. However, the recommendations to introduce one single-ingredient new food at a time, wait 7 days between each new food, and watch the infant closely for adverse reactions, still apply.¹

Use of Commercially Prepared Vegetable or Fruit Infant Foods

If commercially prepared vegetable or fruit infant foods are used, plain varieties are generally preferred instead of fruit desserts or infant food mixtures with added ingredients such as sugar, nonfat dry milk, or corn syrup. Plain vegetables and fruits generally offer more nutrient value for the cost of the food compared to fruit desserts and infant food mixtures. Commercially prepared fruit and vegetable infant foods that progress in texture can be used as the infant's developmental abilities advance. See pages 128 - 129 for more information regarding the safe use of commercially prepared infant foods.

A Caution About Vegetables High in Nitrates or Nitrites

The AAP recommends that spinach, beets, turnips, carrots, or collard greens prepared at home should not be fed to infants less than 6 months old because they may contain sufficient nitrate to cause methemoglobinemia.²⁵ Methemoglobinemia, also termed blue baby syndrome, is characterized by blue skin and difficulty in breathing and could lead to death. The nitrate in these vegetables is converted to nitrite before ingestion or in the infant's stomach. The nitrite binds to iron in the blood and hinders the blood's ability to carry oxygen. The potential risk of developing methemoglobinemia is only present with home-prepared high-nitrate vegetables; commercially prepared infant and junior spinach, carrots, and beets contain only traces of nitrate and are not considered a risk to the infant.²⁶ Manufacturers of infant foods select produce grown in areas of the country that do not have high nitrate levels in the soil and monitor the amount of nitrate in the final product. Thus, advise caregivers not to feed infants less than 6 months old those home-prepared vegetables potentially high in nitrates noted above. See pages 35 - 36 regarding the risk to infants consuming water contaminated with nitrate.

Vegetables and Fruits That May Cause Choking

Due to the risk of choking, it is best to avoid feeding infants these vegetables and fruits:

- Raw vegetables (including green peas, string beans, celery, carrot, etc.);
- Cooked or raw whole corn kernels;
- Whole, uncut cherry or grape tomatoes;
- Hard pieces of raw fruit;
- Whole pieces of canned fruit;

- Whole, uncut grapes, berries, cherries, or melon balls (these fruits should be cut into quarters, with pits removed, before feeding); and
- Uncooked dried fruit (including raisins).

Protein-Rich foods

Protein-rich foods are generally introduced to infants between 6 and 8 months of age. If an additional source of iron or zinc is needed and the infant is developmentally ready, protein-rich foods may be introduced between 4 and 6 months. Iron and zinc are nutrients of concern for exclusively breastfed infants and should be considered when caregivers determine a time to introduce protein-rich foods. See page 109 for more information regarding iron and zinc needs of breastfed infants. Protein-rich foods include meat, poultry, fish, egg yolks, cheese, yogurt, and legumes. See page 146 regarding protein in vegetarian diets. Home- or commercially prepared meats are a good source of iron and zinc, in addition to iron-fortified infant cereal. Introduction of protein rich foods earlier than 6 months may cause hypersensitivity (allergic) reactions. For the infant over 6 months, as with all new foods, protein-rich foods should be introduced one at a time, waiting 7 days between exposing each new food, while observing the infant closely for reactions to the foods.¹

Home-Prepared Meats, Poultry, and Fish

Infants can be offered well-cooked strained or pureed lean beef, pork, lamb, veal, chicken, turkey, liver, boneless finfish (fish other than shellfish), egg yolk, legumes, tofu, sliced or grated mild cheese, yogurt, or cottage cheese.

Concerns About Fish

Infants should be observed closely if fish is introduced because fish can cause hypersensitivity (allergic) reactions in some infants (shellfish is not recommended for infants less than 1 year old). See pages 107 - 109 for more information regarding food hypersensitivities. Certain fish have been found to have high levels of mercury that may harm an infant's developing nervous system.²⁷ The Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) advise pregnant and breastfeeding women, infants, and young children to avoid some types of fish and eat those that are lower in mercury.²⁸ See Figure 8, page 116, for more information regarding mercury in fish and shellfish. (Additional resource: What You Need to Know about Mercury in Fish and Shellfish at <http://www.epa.gov/waterscience/fish/files/MethylmercuryBrochure.pdf>)

Information about fish caught locally can generally be found in the State fishing regulations booklet, the local health department, or on the EPA's Fish Advisory Web site, <http://www.epa.gov/waterscience/fish/>. Information about mercury levels in specific fish can be found at the FDA food safety Web site, <http://www.cfsan.fda.gov/~frf/sea-mehg.html>.

Commercially Prepared Infant Food Meats versus Mixed Dinners

Plain commercially prepared infant food meats offer more nutrient value, ounce for ounce,

compared to commercially prepared infant food mixed dinners (the mixed dinners do not contain as much protein and iron as the plain meats). Instead of using mixed dinners, the desired amounts of plain meats and plain vegetables could be mixed together. Some infants will accept meat better when it is mixed in this manner. See pages 128 - 129 on the safe use of commercially prepared infant foods.

Eggs

Egg yolk can be introduced to infants, but egg whites and whole egg (because it has egg white) are not recommended until 1 year of age, because they contain proteins that may cause hypersensitivity (allergic) reactions in infants. See pages 107 - 109 for more information regarding food hypersensitivities. All eggs and egg-rich foods must be carefully handled and properly prepared to reduce the possibility of contamination with *Salmonella enteritidis* and other bacteria. Raw eggs should never be fed to infants (or anyone else) because they may contain bacteria that can cause illness if the egg is eaten uncooked or undercooked. Recommended guidelines for selection, preparation, and storage of eggs and egg-rich foods can be found on page 125.

Cheese and Yogurt

Cottage cheese, hard cheeses, and yogurt can be gradually introduced as occasional protein foods. Since these foods contain similar proteins to cow's milk, infants should be observed closely for reactions after eating these foods. See page 107 - 109 for more information regarding food hypersensitivities. Cheese can be eaten cooked in foods or in the sliced form. Small slices or strips of cheese are easier and safer to eat than a chunk of cheese, which could cause choking.

Legumes (Dry Beans or Peas) and Tofu

Cooked legumes (dry beans and peas) or tofu (bean curd made from soybeans) can be introduced into an infant's diet as a protein food. Any dry beans or peas can be cooked and modified to a consistency easily eaten by an infant. It is best to introduce small quantities (1 to 2 teaspoons) of mashed or pureed and strained legumes initially (whole beans or peas could cause choking). As with any food, a caregiver should observe to see if the infant does not like them, has a reaction to the food, or appears to have difficulty digesting them. If so, they can be introduced again at a later time. Guidelines for selection, preparation, and storage of legumes and tofu can be found on pages 125 - 126.

Nuts

Although nuts are a good source of protein, they are not appropriate for infants.⁸ Nut butters and foods containing nut butters should be avoided in infancy. Whole or chopped nuts and peanut or other nut butters, which can form a gob, present a choking hazard and increase the risk of food hypersensitivity (allergic) reactions. Consequently, they should never be given to infants. See pages 107 - 109 for more information regarding food hypersensitivities.

Figure 8

What You Need To Know About Mercury in Fish and Shellfish

The Facts

Fish and Shellfish are an important part of a healthy diet. Fish and shellfish contain high-quality protein and other essential nutrients, are low in saturated fat, and contain omega-3 fatty acids. A well-balanced diet that includes a variety of fish and shellfish can contribute to heart health and children's proper growth and development. So, women and young children in particular should include fish or shellfish in their diets due to the many nutritional benefits.

However, nearly all fish and shellfish contain traces of mercury. For most people, the risk from mercury by eating fish and shellfish is not a health concern. Yet, some fish and shellfish contain higher levels of mercury that may harm an unborn baby or young child's developing nervous system. The risks from mercury in fish and shellfish depend on the amount of fish and shellfish eaten and the levels of mercury in the fish and shellfish. Therefore, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) are advising women who may become pregnant, pregnant women, breastfeeding mothers, and young children to avoid some types of fish and eat fish and shellfish that are lower in mercury.



3 Safety Tips:

1. Do not eat:

Shark
Swordfish
King Mackerel
Tilefish

Why?

They contain high levels of mercury.

2. Eat a variety of fish that are lower in mercury.

Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, Pollock and catfish.

Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna

3. Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas

Things to remember for your infant:

Do not feed any shellfish before 1 year.

Infants at high risk for developing allergy, identified by a strong family history of allergy should not be introduced to fish until 3 years of age.

Visit the Food and Drug Administration's Food Safety Web site, <http://www.cfsan.fda.gov/> or the Environmental Protection Agency's Fish Advisory Web site, <http://www.epa.gov/waterscience/fish/> for a listing of mercury levels in fish.

Feeding Water Once Protein-rich Foods Are Introduced

Protein-rich foods (e.g., home-prepared meats, commercially prepared plain meats and mixed dinners, egg yolks, cheese) have a higher renal solute load than some other foods. An infant's health care provider may recommend feeding a small amount of sterile water (~ 4 to 8 ounces per day) in a cup when complementary foods rich in protein are introduced. *Instruct caregiver to consult their health care provider concerning their infant's water needs.*

Protein-Rich Foods That May Cause Choking

Due to the risk of choking, it is best to avoid feeding infants these protein-rich foods:

- Tough or large chunks of meat;
- Hot dogs, meat sticks, or sausages;
- Fish with bones;
- Large chunks of cheese, especially string cheese;
- Peanuts or other nuts and seeds;
- Peanut and other nut/seed butters; and
- Whole beans.

Grain Products

Between 6 and 8 months old, many infants are ready to try crackers, bread, noodles, macaroni, and other grain products. By this stage in their development, infants can practice picking up these foods with their fingers. Grain products provide carbohydrates, thiamin, niacin, riboflavin, iron, other minerals, and, in the case of whole-grain products, fiber to the diet.

Examples of grain products that are appropriate for infants include: plain ground or mashed rice or barley; noodles; plain enriched or whole grain crackers, preferably low in salt; small pieces of toast or crust of bread; and zwieback, teething biscuits, or graham crackers (without honey).

Since infants may choke on cooked grain kernels (e.g., cooked rice, barley, or other grain kernels), these foods should be cooked until very soft and then pureed or finely mashed or put through a sieve before serving. It is best to mash or finely chop (1/2-inch pieces or smaller) cooked noodles, spaghetti, and macaroni until the infant is 8 to 10 months or older. Older infants can be fed plain crackers, teething biscuits, corn grits, soft tortilla pieces, zwieback, and small pieces of bread as well.

Grain Products That May Cause Choking

Due to the risk of choking, it is best to avoid feeding infants these grain products:

- Cookies or granola bars;
- Potato/corn chips, pretzels, and similar snack foods;
- Crackers or breads with seeds, nut pieces, or whole grain kernels such as wheat berries; and
- Whole kernels of cooked rice, barley, wheat, or other grains.

Finger Foods

At about 6 months, infants develop what is known as a palmer grasp - the ability to push something into his palm using his fingers. Between 6 and 8 months, they develop the ability to hold something between their thumb and forefinger - this is called a pincer grasp. By this time, infants can begin to feed themselves with their hands and try some finger foods. *These foods should be:*

- Small enough for them to pick up and
- Soft enough for them to chew on.

Appropriate finger foods include: cooked macaroni or noodles, small pieces of bread, small pieces of soft, ripe peeled fruit or soft cooked vegetables, small slices of mild cheese, crackers, or teething biscuits. This is a messy stage, but allowing infants to feed themselves is very important to their development of feeding skills. Using a highchair or booster seat with a removable tray that can be washed easily or covering the area under the infant's seat with newspaper or a plastic mat will help manage the mess.

Caregivers should be alerted to the risk of infants choking and instructed to closely supervise infants while eating. See pages 132 – 134 regarding choking prevention. By about 10 to 12 months, most healthy, full-term infants are able to feed themselves chopped foods from the table with their fingers unassisted.

Sweetened Foods and Sweeteners

Sweeteners (e.g., sugar, syrups) eaten alone or added to foods provide additional kilocalories to the diet and, as fermentable carbohydrates, promote the development of tooth decay. Sweetened foods may be higher in sugar and fat and lower in key nutrients than other more nutritious foods, such as plain fruit. Plain fruit is a good choice as a dessert for an infant. *Advise caregivers to avoid feeding infants:*

- Commercially prepared infant food desserts, commercial cakes, cookies, candies, and sweet pastries;
- Chocolate -- some infants have hypersensitivity (allergic) reactions to this food; and
- Added sugar, glucose, molasses, maple syrup, and corn syrup or other syrups in their food, beverages, or water.

Honey

Honey, including that used in cooking or baking or as found in processed foods (e.g., yogurt with honey, honey graham crackers), should not be fed to infants under 12 months of age.² Honey is sometimes contaminated with *Clostridium botulinum* spores. Foods made with honey that in the preparation process are not heated to a certain temperature, may still contain viable spores. When consumed by an infant, these spores can produce a toxin that may cause infant botulism, a foodborne illness that can result in death. The gastrointestinal tract of infants cannot destroy these spores (older children and adults can destroy the small amount of spores in honey). Corn

syrup and other syrups currently on the market are not sources of *Clostridium botulinum* spores and are not associated with infant botulism; however, they are not appropriate for infant consumption.

Sweetened Foods That May Cause Choking

Due to the risk of choking, it is best to avoid feeding infants these sweetened foods:

- Hard candy, jelly beans, caramels, or gum drops/gummy candies;
- Chewing gum; and
- Marshmallows.

Beverages

Breast milk and/or infant formula are the only beverages that should be offered to infants less than 6 months of age. Water may be added in limited amounts once protein-rich foods are introduced (see below for more information). Similarly, juice may be added in limited amounts at the appropriate time. See pages 111 - 112 for guidelines on introducing juice. Other beverages do not have a place in the diets of infants. They do not provide nutrients necessary for infants and may take the place of more nutritious foods or beverages in the diet.

Water

Healthy infants fed adequate amounts of breast milk or infant formula in the first 6 months of life generally do not require additional plain water added to their diet. An infant's health care provider may recommend feeding a small amount of sterile water (~ 4 to 8 ounces per day) in a cup when complementary foods are introduced. See pages 25 - 28 for additional information regarding water, excessive water in the diet, and water safety issues.

Caffeine-Containing Beverages

Beverages containing caffeine and theobromine, a caffeine-related substance, are not recommended for infants. Caffeine and theobromine act as stimulant drugs in the body. Coffee, tea, some carbonated beverages such as colas, and hot chocolate contain these substances. In some cultures, infants are commonly fed coffee or tea as a beverage. This practice should be discouraged.

Herbal Teas

Complementary and alternative medicine is increasing in popularity, especially the use of herbal therapies. As many as 45 percent of caregivers have reported giving herbal therapies to their children; 80 percent were given on the advice of friends or relatives.²⁹ However there are few controlled trials evaluating the safety of the use of herbs in infants.³⁰ In some cultures, herbal teas have been given to infants with symptoms of colic, but certain herbal teas contain powerful substances similar to drugs and are not appropriate for infant consumption. See page 149 for

more information regarding treatment for colic. Seizures, jitteriness, hyperexcitability, vomiting, and muscle twitching have been reported in infants given star anise tea, which is widely used among Latinos.³¹ Liver and neurological injury has been reported in infants fed mint tea containing pennyroyal oil.³² Because of these adverse side-effects and the lack of research data, herbal teas are inappropriate for infant consumption.

Sweetened Beverages

Sodas, fruit drinks, punches and aides, sweetened gelatin water, sweetened iced tea, and similar drinks are not recommended for infants because of their high sugar content. The sugars in these beverages are fermentable carbohydrates and thus can promote tooth decay.³³ See page 139 for more information regarding tooth decay. Some caregivers may feed sweetened beverages to their infants when ill. This practice could be dangerous if the infant has symptoms that could lead to dehydration (e.g., diarrhea or vomiting). *Infants with symptoms such as diarrhea, vomiting, or signs of dehydration (shown on page 27), should be referred to a health care provider.* Caregivers should only use an appropriate oral electrolyte solution to treat vomiting or diarrhea when prescribed by their infant's health care provider.

Artificially Sweetened "Low Calorie" Beverages (or Foods)

Since infants are growing rapidly and require energy for growth, there is no need for "low calorie" beverages in their diets. Further, artificial sweeteners have not been proved safe specifically for consumption by infants. Therefore, beverages such as sodas, iced tea, and fruit punch mixes that contain artificial sweeteners, such as saccharin, aspartame, or Splenda are not recommended for infants or young children.⁸ Similarly, it is also not recommended to feed infants artificially sweetened foods or add artificial sweetener to their foods or beverages.⁸

Food Selection, Preparation, and Storage

Infants are more susceptible to harmful effects from contaminated food than older children or adults. General cleanliness, proper food selection, and sanitary food preparation and storage are important to preventing foodborne illnesses in infants. The following sections provide general information on selection, cleanliness, equipment to use, preparation, safety, and storage of foods, both home-prepared and commercially manufactured for infant consumption.

Home-Prepared Infant Food

Foods prepared for an infant at home can be equally nutritious and more economical than commercially prepared infant food. The caregiver using home-prepared infant foods has more control over the variety and texture of food than with commercially prepared infant foods. However, home-prepared infant foods must be appropriately modified for infants to safely consume. As an infant's feeding skills progress, the thickness and lumpiness can gradually be increased. Food texture can progress from pureed to ground, fork mashed, and eventually diced. *Care must be taken in preparing an infant's food at home to ensure that the food is:*

- Prepared and stored safely
- Appropriate in texture
- Cooked using methods that conserve nutrients and
- Prepared without adding unnecessary ingredients, such as sugar and salt.

General Guidelines To Follow When Preparing Infant Foods at Home

Cleanliness. Because infants have immature immune systems, they are particularly sensitive to disease-producing micro-organisms and toxins that may contaminate food. Therefore, it is important to clean anything (e.g. hands, surfaces, utensils, equipment) that might come in contact with food before starting preparation.

Key concepts to convey to caregivers on general cleanliness and reducing contamination of food include the following:

- Wash hands with soap and hot water and rinse thoroughly:
 - Before breastfeeding, formula feeding, or preparing any food or bottles;
 - Before handling any food or food utensils;
 - After handling raw meat, poultry, or fish;
 - After changing an infant's diaper and clothing;
 - After using the bathroom or assisting a child in the bathroom;
 - After sneezing or coughing into tissues or hands or wiping noses, mouths, bottoms, sores, or cuts; and
 - After handling pets or other animals or garbage.
- Before preparing food, wash all working surfaces used to prepare food such as counter tops or tables with soap and hot water, and then rinse thoroughly with hot water.
- Before preparing food, wash all equipment, such as a blender, food mill, food processor, infant food grinder, utensils, pots, pans, and cutting boards carefully with soap and hot water. Rinse thoroughly with hot water and allow to air dry. Separate cutting boards should be used for animal foods (i.e., meat, poultry, fish) and non-animal foods (i.e., vegetables, fruits, breads).

Preparation. Common kitchen equipment is all that is necessary to make infant foods at home. A simple metal steamer, available in most supermarkets, can be used to cook fruits and vegetables and will reduce the loss of vitamins in cooking.

These types of equipment can be used to process food into an appropriate texture:

- **Blender or food processor** - purees foods, including meats, vegetables, and fruit, to a very smooth consistency, if desired;
- **Fine mesh strainer** - purees very soft cooked vegetables and ripe or cooked fruits -- the food would be pushed through the strainer with the back of a spoon;

- **Infant food grinder or food mill** - purees most foods to a smooth consistency and purees meats to a coarser consistency; and
- **A kitchen fork and/or knife** - foods can be mashed with a fork or chopped finely with a knife, for older infants.

After pureeing food, liquid (cooking liquid, plain water, breast milk, infant formula, or fruit juice) can be added for a thinner consistency. As an infant gets older and progresses in the development of feeding skills, the consistency and texture of foods can be altered accordingly. Avoid adding sugar or salt to an infant's food. When cooking foods for the family, the infant's portion can be separated out before adding those ingredients.

Strongly discourage caregivers from chewing table foods in their mouths and then feeding the food to their infants. Saliva from the caregiver's mouth contaminates the food with bacteria and dilutes its nutrient content.

Serving and Storage. Home-prepared infant foods should be used immediately and quickly stored in a properly functioning refrigerator or frozen for longer storage.

Vegetables and Fruits

Recommended guidelines for the preparation of vegetables and fruits include the following:

- Select high-quality fresh vegetables and fruits or plain frozen vegetables and fruits (e.g., without added salt or sauces). Fresh or frozen vegetables or fruits are preferable over canned vegetables or fruits, which may contain added salt or sugar.
- If canned products are used due to their lower cost, those without salt or syrup or packed in their own juice are preferable.
- Wash fresh vegetables and fruits with clean water to remove dirt. Remove pits, seeds, and inedible peels and other parts. Edible skins and peels can be removed either before or after cooking.
- When cooking is needed, cook the vegetables or fruit in a covered saucepan on a stove; either boil with a small amount of water or steam until just tender enough to be pureed or mashed. A microwave oven can also be used to initially cook these foods. Avoid excessive cooking of vegetables and fruits in order to limit destruction of vitamins. After cooking is finished, the food should be allowed to cool slightly (10 to 15 minutes). Then it can be pureed or mashed with liquid until it reaches the desired smoothness. Vegetables puree easier in large quantities in a blender or food processor. Previously prepared vegetables or fruits can be reheated before serving on the stove or in a microwave oven. If a microwave oven is used, the food should be allowed to sit for a few minutes, stirred thoroughly, and tested for temperature before serving.
- Examples of vegetables that can be used to make infant foods include: asparagus, broccoli, brussel sprouts, cabbage, carrots, cauliflower, collard greens, green beans, green peas, green peppers, kohlrabi, kale, plantain, potatoes, spinach, summer or winter squash, and sweet potatoes. However, watch the infant for reactions after feeding any of these as new foods. Do not feed home-prepared spinach, beets, turnips, carrots, or collard greens, which are high

in nitrates, to infants **under 6 months old**. See page 113 for more information concerning nitrate-containing vegetables.

- These fresh fruits can be mashed (after peeling) without cooking if ripe and soft: apricots, avocado, bananas, cantaloupe, mango, melon, nectarines, papaya, peaches, pears, and plums. Stewed pitted dried fruits can be pureed or mashed. Apples, pears, and dried fruits usually need to be cooked in order to puree or mash them easily. Watch the infant for reactions after feeding any of these fruits as new foods.
- It is not necessary to add salt, sugar, syrups, oil, butter, margarine, lard, or cream to vegetables and fruits prepared for an infant. Honey should never be added to an infant's foods because of the risk of infant botulism. See page 118 for more information concerning honey.

Meats, Poultry, and Fish

Recommended guidelines for the preparation, use, and storage of meats, poultry, and fish for infant food include the following:^{34, 35, 36, 37}

- **Food storage** - Meats, poultry, and fish should either be stored in a refrigerator or cooked as soon as possible after purchase. These foods should not be allowed to sit out at room temperature. Store these uncooked foods in the coldest part of the refrigerator and prepare them quickly. Cook or freeze fresh poultry, fish, ground meats, and variety meats (like tongue or other organs) within 2 days; other beef, veal, lamb, or pork should be cooked or frozen within 3 to 5 days.
- **Thawing foods** - If bought frozen, thaw meat, poultry, and fish in a refrigerator, submerged in a leak-proof bag in cold water which is changed every 30 minutes, or in a microwave oven. If thawed in a microwave oven, cook immediately. Do not thaw these foods on a kitchen counter or in standing room temperature or hot water; bacteria grow rapidly as food thaws at room temperature.
- **Reduce the risk of contamination of other foods** - To avoid bacterial contamination of other foods, do not allow raw or partially cooked meat, poultry, fish, or their juices, to come in contact with other foods or the surfaces, serving plates, or utensils used to serve or prepare other foods. For example, do not use a fork to test a piece of meat, poultry, or fish while cooking and then use the fork to mix a cold vegetable dish. Wash hands well with soap and hot water after touching raw or partially cooked meat, poultry, or fish to avoid contaminating other foods and cooking surfaces. Separate cutting boards should be used for animal foods (i.e., meat, poultry, fish) and non-animal foods (e.g., vegetables, fruits, breads). Regardless of the type of board used, make sure it is thoroughly cleaned with soap and hot water and well rinsed or sanitized with a solution of 1 teaspoon chlorine bleach in 1 quart of water prior to use.
- **Preparation before cooking** - Always wash hands thoroughly before preparing these foods. Remove the fat, skin, and bones from meat, poultry, and fish before cooking. Take particular care in removing all the bones, including small ones, from fish. It is more difficult to find all the bones after cooking; and bacteria from your hands are destroyed by heat if bones are removed before cooking. After cooking, additional tough inedible parts and remaining visible fat can be removed.

- **Cooking guidelines** - Cook meat, poultry, and fish properly and thoroughly to kill any bacteria that might be present in the food and to improve the digestibility of the protein. Examples of meats that are undercooked and potentially unsafe are: hamburger that is red in the middle, pork that is pink in the middle, and rare and medium-rare steak and roast beef. Cook fish thoroughly until the flesh is opaque and it flakes easily with a fork. Color is not a reliable indicator of the safety or doneness of meat, poultry, or fish. *A food thermometer should be used to cook food to the following temperatures:*³⁸
 - Ground meats - 160 degrees Fahrenheit;
 - Ground poultry - 165 degrees Fahrenheit;
 - Beef, veal, and lamb steaks, roasts, and chops - 145 degrees Fahrenheit;
 - All cuts of fresh pork - 160 degrees Fahrenheit;
 - Whole poultry - 180 degrees Fahrenheit in the thigh; 170 degrees Fahrenheit in the breast; and
 - Fish - 145 degrees Fahrenheit.
- **The best cooking methods include: broiling, baking or roasting, pan broiling, braising, pot roasting, stewing, or poaching (for fish).** Oven cooking at temperatures below 325 degrees Fahrenheit is not recommended because temperatures below that level may not heat internal parts of the food sufficiently to kill bacteria.
- **Never feed partially cooked or raw animal foods.** Never feed infants partially cooked or raw meat, poultry, or fish because these foods may contain harmful micro-organisms that could cause serious food poisoning. Ground beef may contain the potential serious bacteria *Escherichia coli* O157:H7.²³ While most types of E. coli are harmless, this strain produces a toxin that can cause severe bloody diarrhea and abdominal cramps. In infants and children under 5, a serious illness called hemolytic uremic syndrome (HUS) may result, leading to kidney failure. Cook pork and lamb until well done to destroy parasites (*Trichinella spiralis* and *Toxoplasmosa gondii*) that may also be present in these meats. Raw fish may harbor parasites and/or high levels of bacteria.
- **Preparation after cooking** - After cooking, cut the deboned meat, poultry, or fish into small pieces and puree to the desired consistency. Warm meat is easier to blend than cold meat; chicken, turkey, lamb, and fish are the easiest to puree. Also, meats are easier to puree in a blender or food processor in small quantities. Make sure to clean the blender or food processor thoroughly before using it to make infant food. As an infant's feeding skills mature, meats, poultry, fish, and legumes can be served ground or finely chopped instead of pureed. Caregivers should not add gravy or sauces to the infant's food or masticate (chew) meats before feeding them to the infant (saliva from the caregiver's mouth will contaminate the food with bacteria and dilute its nutrient content).
- **Meats to avoid feeding infants** - Due to their high salt and/or fat content, hot dogs, sausage, bacon, bologna, salami, luncheon meats, other cured meats, fried animal foods, and the fat and skin trimmed from meats are not generally recommended for infants. Hot dogs, bologna, and luncheon meats are also not recommended as they may contain harmful bacteria unless they are heated thoroughly until steaming hot. Lean meat, poultry, and fish are preferable.
- **Storage after cooking** - After cooking, it is very important to either use animal foods immediately or store them in a properly functioning refrigerator (for no longer than 24 hours) or freezer (for no longer than 1 month). Cooked meats held at room temperature provide the

perfect medium for bacterial growth. Discard any meat, poultry, or fish that has been left unrefrigerated for more than 2 hours (1 hour if the temperature is above 90 degrees Fahrenheit), including serving time.

Eggs and Egg-Rich Foods³⁹

- Buy grade AA or A eggs with clean, uncracked shells. Do not buy unrefrigerated eggs.
- Refrigerate eggs in the original carton, preferably in the main section of the refrigerator, which is colder than refrigerator door sections.
- Use eggs within 3 to 5 weeks. Hard-cooked eggs may be eaten for up to 1 week if they have been properly refrigerated.
- Cook eggs thoroughly to kill possible bacteria. Boil eggs until the yolk is firm and not runny, and then separate the yolk from the white. Feed infants only the yolk part. The hard egg yolk can be mashed with some liquid, such as water or infant formula, to the desired consistency. Casseroles and dishes containing eggs should be cooked to a temperature of 160 degrees Fahrenheit but are inappropriate for infants if prepared with whole eggs because of the risk of the infant having an allergic reaction. See page 107 - 109 for more information regarding food hypersensitivities (allergies) or intolerances.
- Refrigerate eggs or egg-rich foods immediately after cooking or keep them hot. Discard eggs or egg-rich foods if kept out of the refrigerator for more than 2 hours, including serving time.
- Do not feed infants raw or partially cooked eggs or foods that contain them, such as homemade ice cream, mayonnaise, or eggnog. Although most commercial ice cream, mayonnaise, and eggnog are usually made with pasteurized eggs, these products are inappropriate for infants if made with whole eggs because of the risk of the infant having an allergic reaction. See page 107 - 109 for more information regarding food hypersensitivities (allergies) or intolerances.

Legumes (Dry Beans or Peas) and Tofu

Home-prepared dry beans or peas are more economical and lower in sodium than canned beans. However, if canned beans are used, drain the salty water and rinse the beans with clean water before using. Instructions for cooking dry beans and peas can be found on the package label and in many basic cookbooks.

Tofu (bean curd) can also be mashed and fed to infants. Caregivers should select fresh tofu; i.e., tofu prepared daily if made fresh, or aseptically packaged, water-packed tofu that has not exceeded the expiration date. Aseptically packaged tofu may be shelf stable for up to 9 months. *Fresh or aseptically-packaged tofu that has been opened should be:*⁴⁰

- Stored in the refrigerator immersed in fresh cold clean water - the water should be changed at least every other day;
- Used within 5 to 7 days;
- Discarded if the expiration date has passed;
- Frozen for future use if not consumed within 7 days - to freeze tofu, drain all water, wrap it in plastic, foil, or freezer wrap and store in the freezer for up to 5 months; and

- Cooked for a short time (e.g., boil in clean water for about 5 minutes), then allow to cool before feeding to an infant.

Recommended guidelines for serving and storage of home-prepared infant foods after cooking and pureeing include:

- If planning to use immediately, serve freshly cooked food to an infant shortly after preparation is completed. Allow the food to cool for a short period (10 to 15 minutes) to avoid burning the infant's mouth. Test the temperature of the food before feeding it to the infant.
- Do not allow freshly cooked foods to stand at room temperature or between 40 degrees and 140 degrees Fahrenheit - the temperature zone most of the bacteria causing foodborne illnesses thrive in. The temperature in a properly functioning refrigerator should be 40 degrees Fahrenheit or below and can be verified with a refrigerator thermometer.
- Refrigerate or freeze home-prepared foods that will not be eaten immediately after cooking. Discard the foods if left unrefrigerated for 2 hours, including serving time. Remember the concept "If in doubt, throw it out." That is, if there is any possibility that a perishable food was left unrefrigerated for over 2 hours, discard it. It is not wise to taste the food to see if it is safe because a food can contain disease-producing micro-organisms yet taste normal.
- Use freshly prepared refrigerated food within 48 hours (except meats and egg yolks, which should be used within 24 hours).
- Two easy methods of storing infant food (after it has cooled) in serving-size quantities in the freezer include:
 - **Ice cube tray method** - Pour cooked pureed food into sections of a clean ice cube tray; cover with plastic wrap, a lid, or aluminum foil; and place into the freezer. When frozen solid, the cubes can be stored in a freezer container or plastic freezer bags in the freezer.
 - **Cookie sheet method** - Place 1 to 2 tablespoons of cooked pureed food in separate spots on a clean cookie sheet, cover with plastic wrap or aluminum foil, and place into the freezer. When frozen solid, the frozen food pieces can be stored in a freezer container or plastic freezer bags in the freezer.
- Label and date the bags or containers of frozen food and use them within 1 month. The temperature in a properly functioning freezer should be 0 degrees Fahrenheit or below. Since freezers may be opened regularly, the temperature may not always be 0 degrees Fahrenheit. Freezer temperature can be checked with a special thermometer. If frozen foods start melting or getting soft, this is an indication to have the freezer checked.
- When ready to use the frozen infant food, thaw the desired amount of food in refrigerator or under cold running water. Do not thaw frozen infant food at room temperature. Thoroughly reheat refrigerated or frozen home-prepared infant foods before feeding them to an infant. Reheating is important to kill bacteria, which can grow slowly while a food is in the refrigerator or freezer or during thawing. Test the temperature of the food before feeding it. Discard any uneaten leftover food.
- Do not refreeze infant food. Store thawed food in the refrigerator and use it within 48 hours (24 hours for meats, poultry, or fish) or discard it.

Caregivers should give explicit instructions for warming, feeding, and handling bottles and food before leaving an infant in the care of a babysitter or family member.

Food Preparation Techniques To Lower Choking Risk

You can lower an infant's risk of choking on food by taking the proper precautions. When preparing food for infants, make sure it is in a form that does not require much chewing. *The following preventive preparation techniques are recommended:*

- Cook food until soft enough to easily pierce with a fork.
- Cut soft foods into small pieces (cubes of food not larger than ¼ inch) or thin slices that can easily be chewed.
- Cut soft round foods, such as soft cooked carrots, into short strips rather than round pieces.
- Substitute foods that may cause choking with a safe substitute, such as thinly sliced meat or hamburger instead of hot dogs.
- Remove all bones from poultry and meat and especially from fish.
- Cut small round foods (e.g. grapes, cherry tomatoes, grape tomatoes) in quarters.
- Remove pits and seeds from very ripe fruit and cut the fruit into small pieces.
- Grind or mash and moisten food for young infants.
- Cook and finely grind or mash whole grain kernels of wheat, barley, rice, etc., before feeding to an infant. Do not feed infants raw or cooked whole grain kernels (i.e., grains in the whole form).

Reducing Lead Exposure from Food

To reduce an infant's possible exposure to lead from foods, these guidelines are recommended:⁴¹

- Do not feed the infant any canned imported foods or beverages -- these cans may have lead seams (lead in seams can enter the food).
- In preparing, cooking, storing, or serving foods for an infant:
 - Avoid using ceramic ware or pottery, especially if imported from another country, for cooking or storing food or beverages;
 - Do not use leaded crystal bowls, pitchers, or other containers to store foods or beverages;
 - Never cook or store foods in antique or decorative ceramic or pewter vessels or dishes;
 - Do not use antique utensils for preparing or serving foods; and
 - Store foods or beverages in plastic or regular glass containers.

Commercially Prepared Infant Food

Commercially prepared infant foods are safe, sanitary, and nutritious alternatives for a caregiver to use when not preparing an infant's foods at home. Infant food is available in jars or plastic tubs of varying sizes. If refrigeration is not available to a caregiver, the smallest size infant food containers should be selected and any leftover food should be discarded.

In general, single-ingredient foods are preferred over combination foods or dinners. When introducing infants to complementary foods, caregivers should introduce single-ingredient foods initially to determine the infant's acceptance to each food before combining different ingredients. Combination foods or dinners are more expensive ounce for ounce and usually have less nutritional value by weight than single-ingredient foods. Older infants who are ready for foods with a chunkier texture can be shifted to mashed or finely chopped home-prepared foods instead of infant food combination dinners. It is not necessary to feed infant food desserts such as puddings, custards, and cobblers, which contain added sugar. Infants can be fed more nutritious and naturally sweet foods such as plain fruit as a dessert.

Encourage caregivers to read the ingredient list on the food label of infant foods. Ingredients are listed on the label in order of those present in the largest amount to the smallest amount. The label can help the caregiver determine important information such as, which infant foods have more food and less water than others or which contain no added sugar and salt.

Selection, Serving, and Storage of Commercially Prepared Infant Foods

Advise caregivers to use these safety guidelines when selecting commercially prepared infant foods:

- **Avoid sticky or stained jars/containers.** Sticky or stained jars/containers of infant food may be cracked, exposing the food to bacteria, or have glass particles on them from being packed with other cracked jars.
- **Observe "use-by" dates for purchase and pantry storage of unopened infant food.** If the date has passed, do not use the food.
- **Discard jars with chipped glass or rusty lids.**
- **Wash or wipe off the jar or container of infant food before opening.**
- **Check the container's vacuum seal.** Infant food jars have a button or depressed area in the center of the lid, which is an indicator of whether the vacuum seal has been broken. Do not select or use any jar of infant food with the vacuum seal already broken (the button popped out). A popping or "whoosh" noise should be heard when the vacuum seal is broken. To facilitate opening the jar, run it under warm water for a few minutes. Do not tap the jar lid with a utensil or bang it against a hard surface; this could break glass chips into the food. If a grating sound is heard when opening the jar lid, check if there are any glass particles under the lid. Also, always examine the food for any abnormal particles (glass, etc.).

These safety guidelines are important to remember when serving and storing commercially prepared infant foods:

- **Serve food from a bowl.** Do not feed infant food directly from jars or containers. Infants usually do not finish a container of infant food in one feeding. If a spoon used for feeding is put back into the container, the infant's saliva could cause subsequent contamination and spoil the remainder of the food. It is preferable to remove the desired amount of food from the container using a clean spoon and put it into a bowl for serving.
- **Discard leftover food.** Always discard any leftover food in a bowl and do not put it back into the container.
- **Immediately store an opened jar of unused food and use it quickly.** After a container of infant food is opened, immediately store it in a refrigerator and use the food within 48 hours, except for infant food meats and egg yolks, which should be used within 24 hours. If not used within these time periods, discard the food.
- **Do not microwave containers of infant food.** Even though the label on some infant food containers indicates that they can be heated in a microwave, this is not recommended because the food may be heated unevenly and some parts of the food may burn the infant's mouth. Instead, remove food from the container; heat it until it is warm on a stove, in a food warmer, or in a microwave oven. Then stir it and test its temperature before feeding. If a microwave oven is used to heat food removed from a container, let the food sit for a few minutes, stir thoroughly, and test its temperature.

Food Safety Resources

The U.S. Department of Agriculture (USDA) operates a toll-free Meat and Poultry Hotline to address specific food safety concerns. The Hotline is staffed by both English-speaking and Spanish-speaking food safety specialists who can address questions on topics such as proper food handling, how to tell if a particular food is safe to eat, and how to better understand food labels. The nationwide toll-free number is 1-888 MPHOTLINE (1-888-674-6854) or for the hearing impaired (TTY) 1-800-256-7072; to talk with a food safety specialist directly, call between 10 a.m. and 4 p.m. Eastern Standard Time (EST), Monday through Friday. At other times, callers have access to an extensive selection of prerecorded messages on food safety. Information can also be accessed on the U.S. Department of Agriculture's Food Safety and Inspection Service Web site at <http://www.fsis.usda.gov/> hundreds of publications for consumers are available on the Web site. Consumers can also email questions to mpholine.fsis@usda.gov. The local Cooperative Extension Service office, listed in the phone book under county government, is also an excellent source of food safety information as are State environmental health agencies or programs.

Practical Aspects of Feeding Complementary Foods

This section reviews appropriate methods to use when feeding complementary foods to an infant, approximate amounts of the different foods to feed, how and when to feed using a cup, appropriate positioning of an infant, equipment to use in feeding complementary foods, and information on choking prevention. The information in this section is designed for the healthy full-term infant. *Developmentally delayed infants may require special seating, feeding utensils, bowls, and feeding methods. These infants should be referred to a health care provider.*

General Guidelines for Feeding Complementary Foods

Wash an infant's hands before eating. Caregivers should wash an infant's hands and face frequently and especially before he or she eats. An infant's hands can pick up harmful microorganisms, lead paint dust, etc., which may be consumed during eating if not washed away.

Position the infant appropriately. To feed an older infant safely, the infant should be sitting straight up in a comfortable high-chair (or similar chair) and be secured in the chair. This practice reduces the risk that the infant will choke on the food or fall out of the chair. An infant who is lying down with food or eating while playing, walking, or crawling can easily choke. The caregiver should sit directly in front of the infant while feeding him or her.

Feed the infant using a spoon. The most appropriate method of feeding pureed or mashed foods to infants is using a spoon. Some caregivers may add cereal or other foods to the bottle. *However, the practice of feeding complementary foods using a bottle is inappropriate for these reasons:*

- **It replaces breast milk or infant formula in the infant's diet with food that may not be needed to meet nutritional requirements.**
- **The infant is taught to eat complementary foods incorrectly.** Often the bottle is used to start an infant on complementary foods before he or she is developmentally ready to eat those foods from a spoon. Infants benefit developmentally from the experience of eating from a spoon. Different tongue and lip motions are involved in sucking from a nipple than for eating from a spoon.
- **An infant may choke more easily.** Often, when cereal is fed in a bottle, the nipple hole will be cut larger. A wider nipple allows the liquid and cereal or other food to flow through faster, which promotes choking.

For similar reasons, "infant feeders" are not recommended for feeding infants. An infant feeder is a hard plastic receptacle with a spout at one end and a plunger at the other end. It allows a caregiver to push a slurry of liquid mixed with food into an infant's mouth.

Note: A health care provider may recommend the addition of infant cereal to a bottle for infants or children with certain types of medical conditions (such as gastroesophageal reflux).²⁶ This practice should not be followed unless specifically recommended by the infant's health care provider.

Using a spoon, bowl, and fingers for eating. Feed a young infant with a small spoon that easily fits into his mouth, and place the food in a small plastic unbreakable bowl or dish with edges that are not sharp. Spoons should be made of unbreakable material that will not splinter if the infant bites them. However, infants should be permitted to "explore" their food with their hands as they get older; by doing so they will have an easier time learning to feed themselves. Although a spoon and bowl may be used for the older infant, it is appropriate to allow these infants to pick up food and eat it with their fingers. Encourage caregivers to be patient and accept that their infants will make a mess when eating; this is a natural part of learning for an infant. See page

105, Figure 7: How Recommended Sequence of Introducing Foods Corresponds With Food Textures and Feeding Styles.

Recommended Amounts of Complementary Foods

When an infant is ready to begin complementary foods, the caregiver can start with small servings of 1 to 2 teaspoons of individual foods once a day and gradually increase the serving size to 2 to 4 tablespoons or more per feeding. A 4- to 6-month-old infant may start out with one meal per day including complementary foods, and then gradually work up to about three meals and two to three snacks per day.

Since an infant's appetite influences the amount of food eaten on a particular day, there is day-to-day variation in the quantity of food consumed. If fed commercially prepared infant foods, most infants will not be able to finish an entire container of food in one meal. It is not appropriate to encourage or force infants to finish what is in their bowl or to eat a whole container of infant food if they indicate that they are full. Encourage caregivers to let their infants determine how much they eat. Infants indicate that they are interested in consuming additional complementary foods by opening their mouths and leaning forward. *They indicate that they are full and satisfied by:*

- Pulling away from the spoon
- Turning their heads away
- Playing with the food
- Sealing their lips
- Pushing the food out of their mouths and/or
- Throwing the food on the floor.

The quantity of food an infant takes varies between infants and from meal to meal or day to day for an individual infant. Infants may want to eat less food when teething or not feeling well and more food on days when they have a very good appetite. The best guide for how much to feed an infant is following his indications of hunger and fullness. See Appendix D for Guidelines to Feeding a Healthy Infant, pages 206 - 208.

Weaning From a Bottle

Weaning an infant from a bottle to a cup is a gradual process requiring the infant to learn new skills. Some infants learn to drink from a cup more easily than others. To make weaning easier, a cup can be introduced in place of a bottle at the feeding of least interest or at mealtimes when other family members are drinking from cups. Generally, the infant will not consume the same quantity of fluid from a cup as from a bottle at one sitting. Caregivers should try to totally wean their infants off bottles and onto a cup by about 12 to 14 months old.⁴² Those who are still feeding from a bottle after this age may be at risk for early childhood caries (formerly called nursing bottle caries).⁴² See pages 139 - 141 for more information regarding early childhood caries.

Drinking From a Cup

Some infants, 4 to 5 months of age, may be able to drink or suck small amounts of liquid from a cup when held by another person. At about 6 months, most infants develop the ability to, with assistance, drink from a cup with some liquid escaping from their mouths. After 8 months old, when infants begin to curve their lips around the rim of a cup, they are able to drink from a cup with less spilling. Reassure caregivers that spills and some mess normally occur as an infant learns to use a cup, and that maintaining patience during this time is important.

Caregivers can help their infants learn how to drink from a cup by:

- Introducing small amounts (1 to 2 ounces) of infant formula, breast milk, pasteurized 100 percent juice, or water in a "baby-sized" regular plastic cup. Cups with spill-proof lids (sippy cups) are not recommended since they may encourage the infant to carry the cup and drink more often. Frequent sips of infant formula or juice put children at higher risk for developing early childhood caries. The American Academy of Pediatric Dentistry recommends avoiding frequent, repetitive consumption of any liquid containing fermentable carbohydrates (such as infant formula, milk, juice, or sweetened beverages) from a bottle or no-spill training cup.⁴² See pages 138 - 142 for more information regarding oral health and early childhood caries.
- Holding the cup for the young infant; and
- Feeding very slowly; i.e., tilting the cup so that a very small amount of liquid (one mouthful) leaves the cup; then, the infant can swallow without hurry.

Choking Prevention

Choking is a major cause of fatal injury in infants and young children. Food items are associated with approximately 40 percent of fatal choking incidents and approximately 60 percent of nonfatal choking episodes in children.⁴³ Candy and chewing gum are the foods most often implicated. Normally when eating, the airway to the lungs is blocked off as food passes to the esophagus on its way to the stomach. This prevents food from passing into the airway. However, in infants or young children, choking can occur more easily because the airway is not always blocked off properly when swallowing, allowing food to enter the airway and prevent breathing. Choking may also occur when food is inhaled directly into the airway. To avoid the risk of an infant choking, only foods that can be easily dissolved with saliva and do not require chewing should be fed to infants.

Since choking can occur anywhere and anytime an infant is eating, strongly encourage caregivers to do the following:

- Use correct feeding (see page 130) and food preparation techniques (see pages 120 – 127).
- Feed small portions and encourage infants to eat slowly.
- Avoid teething pain medicine before meals since this may anesthetize the mouth.

- Maintain a calm atmosphere during eating time (i.e., avoid too much excitement or disruption during eating).
- Avoid eating in the car since the driver cannot assist a choking infant and may be the only adult in the car.
- Closely supervise mealtimes.

Certain eating behaviors increase an infant's risk of choking on food and should be avoided. These include:

- Propping a bottle in an infant's mouth;
- Feeding using a bottle with a nipple with a large hole;
- Feeding complementary foods to an infant who is not developmentally ready for them;
- Feeding an infant too quickly;
- Feeding an infant while he is lying down, walking, talking, crying, laughing, or playing;
- Feeding difficult-to-chew foods to infants with poor chewing and swallowing abilities;
- Feeding complementary food to an older infant without close supervision; and
- Feeding foods that may cause choking.

A food's potential to cause choking is usually related to one or more of the following characteristics:

- **Size** - Both small and large pieces of food may cause choking. Small hard pieces of food (such as nuts and seeds, small pieces of raw hard vegetables) may get into the airway if they are swallowed before being chewed properly. Larger pieces may be more difficult to chew and are more likely to completely block the airway if inhaled.
- **Shape** - Food items shaped like a sphere or cylinder may cause choking because they are likely to block the airway more completely than other shapes. Some examples are whole grapes, hot dog-shaped products (including meat sticks and string cheese), and round candies.
- **Consistency** - Foods that are firm, smooth, or slick may slip down the throat. Some examples are whole grapes, nuts, hard candy, hot dog-like products, string cheese, large pieces of fruit with skin, whole pieces of canned fruit, and raw peas. Dry or hard foods may be difficult to chew and easy to swallow whole. Some examples are popcorn, nuts and seeds, small hard pieces of raw vegetable, cookies, pretzels, and potato chips. Sticky or tough foods (e.g., peanut butter, dried fruit, tough meat, sticky candy) may not break apart easily and may be hard to remove from the airway.

In summary, the following foods are not recommended for infants because they are associated with choking:

- Tough or large chunks of meat;
- Hot dogs, meat sticks or sausages;
- Fish with bones;
- Large chunks of cheese, especially string cheese;
- Peanuts or other nuts and seeds;

- Peanut and other nut/seed butters;
- Whole beans;
- Cooked or raw whole-kernel corn;
- Whole uncut cherry or grape tomatoes;
- Raw vegetable pieces (e.g., carrots, green peas, string beans, celery, etc.) or hard pieces of partially cooked vegetables;
- Whole uncut grapes, berries, cherries or melon balls, or hard pieces of raw fruit;
- Whole pieces of canned fruit (cut them up instead);
- Fruit pieces with pits or seeds;
- Uncooked raisins and other dried fruit;
- Plain wheat germ;
- Whole grain kernels;
- Popcorn;
- Potato/corn chips and similar snack foods;
- Pretzels;
- Hard candy, jelly beans, caramels, or gum drops/gummy candies;
- Chewing gum; and
- Marshmallows.

The American Heart Association (<http://www.americanheart.org/>) American Lung Association (<http://www.lungusa.org>), and the American Red Cross (<http://www.redcross.org>) all conduct classes and provide training and educational materials on first aid, choking prevention and emergency treatment and cardiopulmonary resuscitation (CPR). Information on classes held locally can be found on their websites. The American Heart Association has a wall poster entitled “Heartsaver First Aid for the Choking Infant” (#70-2283) appropriate for posting in offices or waiting rooms, with description and illustration of emergency treatment. It is available for purchase by phone 1-800-611-6083 or through their Web site at <http://www.americanheart.org/presenter.jhtml?identifier=3026000>. The AAP also has a pamphlet on first aid, choking, and CPR which can be ordered on their Web site (<http://www.aap.org>) or may be available from a local pediatrician.

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