Infancy (Birth to Age One)

LEARNING OBJECTIVES
1. Summarize nutritional requirements and dietary recommendations for infants.
2. Describe the physiologic basis for lactation and the specific components of breast milk.
3. Discuss the benefits and barriers related to breastfeeding.
4. Examine feeding problems that parents and caregivers may face with their infants.

Diet and nutrition have a major impact on a child’s development from infancy into the adolescent years. A healthy diet not only affects growth, but also immunity, intellectual capabilities, and emotional well-being. One of the most important jobs of parenting is making sure that children receive an adequate amount of needed nutrients to provide a strong foundation for the rest of their lives.

The term infant is derived from the Latin word infans, which means “unable to speak.” Healthy infants grow steadily, but not always at an even pace. For example, during the first year of life, height increases by 50 percent, while weight triples. Physicians and other health professionals can use growth charts to track a baby’s development process. Because infants cannot stand, length is used instead of height to determine the rate of a child’s growth. Other important developmental measurements include head circumference and weight. All of these must be tracked and compared against standard measurements for an infant’s age. Nationally accepted growth charts are based on data collected by the National Center for Health Statistics. These charts allow for tracking trends over time and comparing with other infants among percentiles within the United States. Growth charts may provide warnings that a child has a medical problem or is malnourished. Insufficient weight or height gain during infancy may indicate a condition known as failure-to-thrive (FTT), which is characterized by poor growth. FTT can happen at any age, but in infancy, it typically occurs after six months. Some causes include poverty, lack of enough food, feeding inappropriate foods, and excessive intake of fruit juice.

Nutritional Requirements

Requirements for macronutrients and micronutrients on a per-kilogram basis are higher during infancy than at any other stage in the human life cycle. These needs are affected by the rapid cell division that occurs during growth, which requires energy and protein, along with the nutrients that are involved in DNA synthesis. During this period, children are entirely dependent on their parents or other caregivers to meet these needs. For almost all infants six months or younger, breast milk is the best source to fulfill nutritional...
requirements. An infant may require feedings eight to twelve times a day or more in the beginning. After six months, infants can gradually begin to consume solid foods to help meet nutrient needs.

**Energy**

Energy needs relative to size are much greater in an infant than an adult. A baby’s resting metabolic rate is two times that of an adult. The RDA to meet energy needs changes as an infant matures and puts on more weight. The IOM uses a set of equations to calculate the total energy expenditure and resulting energy needs. For example, the equation for the first three months of life is \((89 \times \text{weight [kg]} - 100) + 175 \text{ kcal}\).

Based on these equations, the estimated energy requirement for infants from zero to six months of age is 472 to 645 kilocalories per day for boys and 438 to 593 kilocalories per day for girls. For infants ages six to twelve months, the estimated requirement is 645 to 844 kilocalories per day for boys and 593 to 768 kilocalories per day for girls. From the age one to age two, the estimated requirement rises to 844–1,050 kilocalories per day for boys and 768–997 kilocalories per day for girls.

**Macronutrients**

The dietary recommendations for infants are based on the nutritional content of human breast milk. Carbohydrates make up about 45 to 65 percent of the caloric content in breast milk, which amounts to a RDA of about 130 grams. Almost all of the carbohydrate in human milk is lactose, which infants digest and tolerate well. In fact, lactose intolerance is practically nonexistent in infants. Protein makes up about 5 to 20 percent of the caloric content of breast milk, which amounts to 13 grams per day. Infants have a high need for protein to support growth and development, though excess protein (which is only a concern with bottle-feeding) can cause dehydration, diarrhea, fever, and acidosis in premature infants. About 30 to 40 percent of the caloric content of breast milk is made up of fat. A high-fat diet is necessary to encourage the development of neural pathways in the brain and other parts of the body. However, saturated fats and trans fatty acids inhibit this growth. Infants who are over the age of six months, which means they are no longer exclusively breastfed, should not consume foods that are high in these types of fats.

**Micronutrients**

Almost all of the nutrients that infants require can be met if they consume an adequate amount of breast milk. There are a few exceptions, though. Human milk is low in vitamin D, which is needed for calcium absorption and building bone, among other things.
Therefore, breastfed children often need to take a vitamin D supplement in the form of drops. Infants at the highest risk for vitamin D deficiency are those with darker skin and no exposure to sunlight. Breast milk is also low in vitamin K, which is required for blood clotting, and deficits could lead to bleeding or hemorrhagic disease. Babies are born with limited vitamin K, so supplementation may be needed initially and some states require a vitamin K injection after birth. Also, breast milk is not high in iron, but the iron in breast milk is well absorbed by infants. After four to six months, however, an infant needs an additional source of iron other than breast milk.

**Fluids**

Infants have a high need for fluids, 1.5 milliliters per kilocalorie consumed compared to 1.0 milliliters per kilocalorie consumed for adults. This is because children have larger body surface area per unit of body weight and a reduced capacity for perspiration. Therefore, they are at greater risk of dehydration. However, parents or other caregivers can meet an infant’s fluid needs with breast milk or formula. As solids are introduced, parents must make sure that young children continue to drink fluids throughout the day.

**Breastfeeding**

After the birth of the baby, nutritional needs must be met to ensure that an infant not only survives, but thrives from infancy into childhood. Breastfeeding provides the fuel a newborn needs for rapid growth and development. As a result, the WHO recommends that breastfeeding be done exclusively for the first six months of an infant’s life. New mothers must also pay careful consideration to their own nutritional requirements to help their bodies recover in the wake of the pregnancy. This is particularly true for women who breastfeed their babies, which calls for an increased need in certain nutrients.

**Lactation**

Lactation is the process that makes breastfeeding possible, and is the synthesis and secretion of breast milk. Early in a woman’s pregnancy, her mammary glands begin to prepare for milk production. Hormones play a major role in this, particularly during the second and third trimesters. At that point, levels of the hormone prolactin increase to stimulate the growth of the milk duct system, which initiates and maintains milk production. Levels of the hormone oxytocin also rise to promote the release of breast milk when the infant suckles, which is known as the milk ejection reflex. However, levels of the hormone progesterone need to decrease for successful milk production, because progesterone inhibits milk secretion. Shortly after birth, the expulsion of the placenta triggers progesterone levels to fall, which activates lactation. King, J. “Contraception and Lactation: Physiology of Lactation.” Journal of Midwifery and Women’s Health 52, no. 6 (2007): 614–20. © 2007 Elsevier Science, Inc. New mothers need to adjust their caloric and fluid intake to make breastfeeding possible. The RDA is 330 additional calories during the first six months of lactation and 400 additional calories during the second six months of lactation. The energy needed to support breastfeeding comes from both increased intake and from stored fat. For
example, during the first six months after her baby is born, the daily caloric cost for a lactating mother is 500 calories, with 330 calories derived from increased intake and 170 calories derived from maternal fat stores. This helps explain why breastfeeding may promote weight loss in new mothers. Lactating women should also drink 3.1 liters of liquids per day (about 13 cups) to maintain milk production, according to the IOM. As is the case during pregnancy, the RDA of nearly all vitamins and minerals increases for women who are breastfeeding their babies. The following table compares the recommended vitamins and minerals for lactating women to the levels for non-pregnant and pregnant women:

### Recommended Nutrient Intakes during Pregnancy

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Non-pregnant Women</th>
<th>Pregnant Women</th>
<th>Lactating Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (mcg)</td>
<td>700</td>
<td>770</td>
<td>1300</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1.5</td>
<td>1.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Vitamin B12 (mcg)</td>
<td>2.4</td>
<td>2.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>75</td>
<td>85</td>
<td>120</td>
</tr>
<tr>
<td>Vitamin D (mcg)</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>15</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>400</td>
<td>600</td>
<td>500</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>18</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>320</td>
<td>360</td>
<td>310</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>14</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>1.1</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>1.1</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>8</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Institute of Medicine, [http://www.iom.edu](http://www.iom.edu).

Calcium requirements do not change during breastfeeding because of more efficient absorption, which is the case during pregnancy, too. However, the reasons for this differ. During pregnancy, there is enhanced absorption within the gastrointestinal tract. During lactation, there is enhanced retention by the kidneys. The RDA for phosphorus, fluoride, and molybdenum also remains the same.

### Components of Breast Milk

Human breast milk not only provides adequate nutrition for infants, it also helps to protect newborns from disease. In addition, breast milk is rich in cholesterol, which is needed for brain development. It is helpful to know the different types and components of breast milk, along with the nutrients they provide to enable an infant survive and thrive.

**Colostrum**
Colostrum is produced immediately after birth, prior to the start of milk production, and lasts for several days after the arrival of the baby. Colostrum is thicker than breast milk, and is yellowish or creamy in color. This protein-rich liquid fulfills an infant’s nutrient needs during those early days. Although low in volume, colostrum is packed with concentrated nutrition for newborns. This special milk is high in fat-soluble vitamins, minerals, and immunoglobulins (antibodies) that pass from the mother to the baby. Immunoglobulins provide passive immunity for the newborn and protect the baby from bacterial and viral diseases. American Pregnancy Association. “Breastfeeding: Overview.” Last updated January 2012. http://www.americanpregnancy.org/firstyearoflife/breastfeedingoverview.htm

**Transitional Milk**

Two to four days after birth, colostrum is replaced by transitional milk. Transitional milk is a creamy liquid that lasts for approximately two weeks and includes high levels of fat, lactose, and water-soluble vitamins. It also contains more calories than colostrum. After a new mother begins to produce transitional milk, she typically notices a change in the volume and type of liquid secreted and an increase in the weight and size of her breasts. American Pregnancy Association. “Breastfeeding: Overview.” Last updated January 2012. http://www.americanpregnancy.org/firstyearoflife/breastfeedingoverview.htm.

**Mature Milk**

Mature milk is the final fluid that a new mother produces. In most women, it begins to secrete at the end of the second week postchildbirth. There are two types of mature milk that appear during a feeding. Foremilk occurs at the beginning and includes water, vitamins, and protein. Hind-milk occurs after the initial release of milk and contains higher levels of fat, which is necessary for weight gain. Combined, these two types of milk ensure that a baby receives adequate nutrients to grow and develop properly. American Pregnancy Association. “Breastfeeding: Overview.” Last updated January 2012. http://www.americanpregnancy.org/firstyearoflife/breastfeedingoverview.htm.

About 90 percent of mature milk is water, which helps an infant remain hydrated. The other 10 percent contains carbohydrates, proteins, and fats, which support energy and growth. Similar to cow’s milk, the main carbohydrate of mature breast milk is lactose. Breast milk contains vital fatty acids, such as docosahexaenoic acid (DHA) and arachidonic acid (ARA). In terms of protein, breast milk contains more whey than casein (which is the reverse of cow’s milk). Whey is much easier for infants to digest than casein. Complete protein, which means all of the essential amino acids, is also present in breast milk. Complete protein includes lactoferrin, an iron-gathering compound that helps to absorb iron into an infant’s bloodstream.
In addition, breast milk provides adequate vitamins and minerals. Although absolute amounts of some micronutrients are low, they are more efficiently absorbed by infants. Other essential components include digestive enzymes that help a baby digest the breast milk. Human milk also provides the hormones and growth factors that help a newborn to develop.

**Diet and Milk Quality**

A mother’s diet can have a major impact on milk production and quality. As during pregnancy, lactating mothers should avoid illegal substances and cigarettes. Some legal drugs and herbal products can be harmful as well, so it is helpful to discuss them with a health-care provider. Some mothers may need to avoid certain things, such as spicy foods, that can produce gas in sensitive infants. Lactating women can drink alcohol, though they must avoid breastfeeding until the alcohol has completely cleared from their milk. Typically, this takes two to three hours for 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of liquor, depending on a woman’s body weight. Harms, R., MD. “Breast-Feeding and Alcohol: Is It Okay to Drink?” © 1998–2012 Mayo Foundation for Medical Education and Research. Accessed February 21, 2012. http://www.mayoclinic.com/health/breast-feeding-and-alcohol/AN02131. Precautions are necessary because exposure to alcohol can disrupt an infant’s sleep schedule.

**Benefits of Breastfeeding**

Breastfeeding has a number of benefits, both for the mother and for the child. Breast milk contains immunoglobulins, enzymes, immune factors, and white blood cells. As a result, breastfeeding boosts the baby’s immune system and lowers the incidence of diarrhea, along with respiratory diseases, gastrointestinal problems, and ear infections. Breastfed babies also are less likely to develop asthma and allergies, and breastfeeding lowers the risk of sudden infant death syndrome. In addition, human milk encourages the growth of healthy bacteria in an infant’s intestinal tract. All of these benefits remain in place after an infant has been weaned from breast milk. Some studies suggest other possible long-term effects. For example, breast milk may improve an infant’s intelligence and protect against Type 1 diabetes and obesity, although research is ongoing in these areas. Healthy Children.org. “Breastfeeding Benefits Your Baby’s Immune System.” © 2012 American Academy of Pediatrics. Accessed February 21, 2012. http://www.healthychildren.org/English/ages-stages/baby/breastfeeding/pages/Breastfeeding-Benefits-Your-Baby%27s-Immune-System.aspx.

Breastfeeding has a number of other important benefits. It is easier for babies to digest breast milk than bottle formula, which contains proteins made from cow’s milk that require an adjustment period for infant digestive systems. Breastfed infants are sick less often than bottle-fed infants. Breastfeeding is more sustainable and results in less plastic waste and other trash. Breastfeeding can also save families money because it does not incur the same cost as purchasing formula. Other benefits include that breast milk is always ready. It does not have to be mixed, heated, or prepared. Also, breast milk is sterile and is always at the right temperature.
In addition, the skin-to-skin contact of breastfeeding promotes a close bond between mother and baby, which is an important emotional and psychological benefit. The practice also provides health benefits for the mother. Breastfeeding helps a woman’s bones stay strong, which protects against fractures later in life. Studies have also shown that breastfeeding reduces the risk of breast and ovarian cancers. National Cancer Institute. “Reproductive History and Breast Cancer Risk.” Accessed February 6, 2012. http://www.cancer.gov/cancertopics/factsheet/Risk/reproductive-history.

The Baby-Friendly Hospital Initiative In 1991, the WHO and UNICEF launched the Baby-Friendly Hospital Initiative (BFHI), which works to ensure that all maternities, including hospitals and freestanding facilities, become centers of breastfeeding support. A maternity can be denoted as “baby-friendly” when it does not accept substitutes to human breast milk and has implemented ten steps to support breastfeeding. These steps include having a written policy on breastfeeding communicated to health-care staff on a routine basis, informing all new mothers about the benefits and management of breastfeeding, showing new mothers how to breastfeed their infants, and how to maintain lactation, and giving newborns no food or drink other than breast milk, unless medically indicated. Since the BFHI began, more than fifteen thousand facilities in 134 countries, from Benin to Bangladesh, have been deemed “baby friendly.” As a result, more mothers are breastfeeding their newborns and infant health has improved, in both the developed world and in developing nations, United Nations Children’s Fund. “The Baby-Friendly Hospital Initiative.” Accessed June 8, 2012. http://www.unicef.org/programme/breastfeeding/baby.htm.

**Barriers to Breastfeeding**

Although breast milk is ideal for almost all infants, there are some challenges that nursing mothers may face when starting and continuing to breastfeed their infants. These obstacles include painful engorgement or fullness in the breasts, sore and tender nipples, lack of comfort or confidence in public, and lack of accommodation to breastfeed or express milk in the workplace.

One of the first challenges nursing mothers face is learning the correct technique. It may take a little time for a new mother to help her baby properly latch on to her nipples. Improper latching can result in inadequate intake, which could slow growth and development. However, International Board Certified Lactation Consultants (IBCLCs), OB nurses, and registered dietitians are all trained to help new mothers learn the proper technique. Education, the length of maternity leave, and laws to protect public breastfeeding, among other measures, can all help to facilitate breastfeeding for many lactating women and their newborns.

**Contraindications to Breastfeeding**

Although there are numerous benefits to breastfeeding, in some cases there are also risks that must be considered. In the developed world, a new mother with HIV should not
Breastfeeding also is not recommended for women undergoing radiation or chemotherapy treatment for cancer. Additionally, if an infant is diagnosed with galactosemia, meaning an inability to process the simple sugar galactose, the child must be on a galactose-free diet, which excludes breast milk. This genetic disorder is a very rare condition, however, and only affects 1 in thirty- to sixty thousand newborns. Genetics Home Reference, a service of the US National Library of Medicine. “Galactosemia.” July 9, 2012. http://ghr.nlm.nih.gov/condition/galactosemia. When breastfeeding is contraindicated for any reason, feeding a baby formula enables parents and caregivers to meet their newborn’s nutritional needs.

**Bottle-Feeding**

Most women can and should breastfeed when given sufficient education and support. However, as discussed, a small percentage of women are unable to breastfeed their infants, while others choose not to. For parents who choose to bottle-feed, infant formula provides a balance of nutrients. However, not all formulas are the same and there are important considerations that parents and caregivers must weigh. Standard formulas use cow’s milk as a base. They have 20 calories per fluid ounce, similar to breast milk, with vitamins and minerals added. Soy-based formulas are usually given to infants who develop diarrhea, constipation, vomiting, colic, or abdominal pain, or to infants with a cow’s milk protein allergy. Hypoallergenic protein hydrolysate formulas are usually given to infants who are allergic to cow’s milk and soy protein. This type of formula uses hydrolyzed protein, meaning that the protein is broken down into amino acids and small peptides, which makes it easier to digest. Preterm infant formulas are given to low birth weight infants, if breast milk is unavailable. Preterm infant formulas have 24 calories per fluid ounce and are given until the infant reaches a desired weight.

Infant formula comes in three basic types:
1. Powder that requires mixing with water. This is the least expensive type of formula.
2. Concentrates, which are liquids that must be diluted with water. This type is slightly more expensive.
3. Ready-to-use liquids that can be poured directly into bottles. This is the most expensive type of formula.
However, it requires the least amount of preparation. Ready-to-use formulas are also convenient for traveling. Most babies need about 2.5 ounces of formula per pound of body weight each day. Therefore, the average infant should consume about 24 fluid ounces of breast milk or formula per day. When preparing formula, parents and caregivers should carefully follow the safety guidelines, since an infant has an immature immune system. All equipment used in formula preparation should be sterilized. Prepared, unused formula should be refrigerated to prevent bacterial growth. Parents should make sure not to use contaminated water to mix formula in order to prevent foodborne illnesses. Follow the instructions for powdered and concentrated formula carefully—formula that is over-diluted would not provide adequate calories and protein, while over-concentrated formula provides too much protein and too little water which can impair kidney function.

It is important to note again that both the American Academy of Pediatrics and the WHO state that breast milk is far superior to infant formula. This table compares the advantages of giving a child breast milk to the disadvantages of using bottle formula.

<table>
<thead>
<tr>
<th>Breast Milk versus Bottle Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breast Milk</strong></td>
</tr>
<tr>
<td>Antibodies and lactoferrin in breast milk protect infants.</td>
</tr>
<tr>
<td>The iron in breast milk is absorbed more easily.</td>
</tr>
<tr>
<td>The feces that babies produce do not smell because breastfed infants have different bacteria in the gut.</td>
</tr>
<tr>
<td>Breast milk is always available and is always at the correct temperature.</td>
</tr>
<tr>
<td>Breastfed infants are less likely to have constipation.</td>
</tr>
<tr>
<td>Breastfeeding ostensibly is free, though purchasing a pump and bottles to express milk does require some expense.</td>
</tr>
<tr>
<td>Breast milk contains the fatty acids DHA and ARA, which are vital for brain and vision development.</td>
</tr>
</tbody>
</table>


**Introducing Solid Foods**

Infants should be breastfed or bottle-fed exclusively for the first six months of life according to the WHO. (The American Academy of Pediatrics recommends breast milk or bottle formula exclusively for at least the first four months, but ideally for six
Infants should not consume solid foods prior to six months because solids do not contain the right nutrient mix that infants need. Also, eating solids may mean drinking less breast milk or bottle formula. If that occurs, an infant may not consume the right quantities of various nutrients. If parents try to feed an infant who is too young or is not ready, their tongue will push the food out, which is called an extrusion reflex. After six months, the suck-swallow reflexes are not as strong, and infants can hold up their heads and move them around, both of which make eating solid foods more feasible.

Solid baby foods can be bought commercially or prepared from regular food using a food processor, blender, food mill, or grinder at home. Usually, an infant cereal can be offered from a spoon between four to six months. By nine months to a year, infants are able to chew soft foods and can eat solids that are well chopped or mashed. Infants who are fed solid foods too soon are susceptible to developing food allergies. Therefore, as parents and caregivers introduce solids, they should feed their child only one new food at a time (starting with rice cereal, followed by fruits or vegetables), to help identify allergic responses or food intolerances. An iron supplement or iron-fortified cereal is also recommended at this time.

Learning to Self-Feed

With the introduction of solid foods, young children begin to learn how to handle food and how to feed themselves. At six to seven months, infants can use their whole hand to pick up items (this is known as the palmer grasp). They can lift larger items, but picking up smaller pieces of food is difficult. At eight months, a child might be able to use a pincer grasp, which uses fingers to pick up objects. After the age of one, children slowly begin to use utensils to handle their food. Unbreakable dishes and cups are essential, since very young children may play with them or throw them when they become bored with their food.

Feeding Problems during Infancy

Parents and caregivers should be mindful of certain diet-related problems that may arise during infancy. Certain foods are choking hazards, including foods with skins or foods that are very small, such as grapes. Other examples of potential choking hazards include raw carrots and apples, raisins, and hard candy. Parents should also avoid adding salt or seasonings to an infant’s food.

Heating an infant’s food presents a risk of accidental injury or burns, which may occur if the food is heated unevenly or excessively. Keep in mind that an infant cannot communicate that the food is too hot. Also, parents and caregivers should never leave a baby alone at mealtime, because an infant can accidentally choke on pieces of food that are too big or have not been adequately chewed. Raw honey and corn syrup both contain spores of Clostridium botulinum. They produce a poisonous toxin in a baby’s intestines, which can cause the foodborne illness botulism. After the age of one, it is safe to give an
infant honey or corn syrup. However, honey as an ingredient in food, such as in cereal, is safe for all ages because it has been adequately heat-treated.

**Overnutrition**

Overnutrition during infancy is a growing problem. Overfed infants may develop dietary habits and metabolic characteristics that last a lifetime. According to the American Journal of Clinical Nutrition, the consequences of overnutrition and growth acceleration in infancy include long-term obesity, along with Type 2 diabetes and cardiovascular disease later in life. Singhal, A. et al. “Nutrition in Infancy and LongTerm Risk of Obesity: Evidence from Two Randomized Control Trials.” Am J Clin Nutr 92 (2010): 1133–44. Therefore, parents and other caregivers should restrain from overfeeding, and ideally give their infants breast milk to promote health and wellbeing.

**Food Allergies**

Food allergies impact four to six percent of young children in America. Common food allergens that can appear just before or after the first year include peanut butter, egg whites, wheat, cow’s milk, and nuts. For infants, even a small amount of a dangerous food can prove to be life-threatening. If there is a family history of food allergies, it is a good idea to delay giving a child dairy products until one year of age, eggs until two years of age, and shellfish, fish, and nuts until three years of age.

However, lactating women should not make any changes to their diets. Research shows that nursing mothers who attempt to ward off allergies in their infants by eliminating certain foods may do more harm than good. According to the American Academy of Allergy, Asthma, and Immunology, mothers who avoided certain dairy products showed decreased levels in their breast milk of an immunoglobulin specific to cow’s milk. This antibody is thought to protect against the development of allergies in children. Even when an infant is at higher risk for food allergies, there is no evidence that alterations in a mother’s diet make a difference. Gever, J. “Nursing Mom’s Diet No Guard Against Baby Allergies.” Medpage Today. © 2012 Everyday Health, Inc. March 7, 2012. http://www.medpagetoday.com/MeetingCoverage/AAAAIMeeting/31527?utm_content=&utm_medium=email&utm_campaign=DailyHeadlines&utm_source=WC&eun=g330425d0r&userid=330425&email=mzimmerman@cox.netµ_id=.

**Early Childhood Caries**

Primary teeth are at risk for a disorder known as early childhood caries from breast milk, formula, juice, or other drinks fed through a bottle. Liquids can build up in a baby’s mouth, and the natural or added sugars lead to decay. Early childhood caries is caused not only by the kinds of liquids given to an infant, but also by the frequency and length of time that fluids are given. Giving a child a bottle of juice or other sweet liquids several
times each day, or letting a baby suck on a bottle longer than a mealtime, either when awake or asleep, can also cause early childhood caries. In addition, this practice affects the development and position of the teeth and the jaw. The risk of early childhood caries continues into the toddler years as children begin to consume more foods with a high sugar content. Therefore, parents should avoid giving their children sugary snacks and beverages.

**Gastroesophageal Reflux**

Small amounts of spitting up during a feeding is normal. However, there is cause for concern if it is too difficult to feed an infant due to gastroesophageal reflux. This condition occurs when stomach muscles open at the wrong times and allow milk or food to back up into the esophagus. Symptoms of gastroesophageal reflux in infants include severe spitting up, projectile vomiting, arching of the back as though in pain, refusal to eat or pulling away from the breast during feedings, gagging or problems with swallowing, and slow weight gain. For most infants, making adjustments in feeding practices addresses the issue. For example, a parent can feed their baby in an upright position, wait at least an hour after eating for play time, burp more often, or give a child smaller, more frequent feedings.

**Diarrhea and Constipation**

Diarrhea is often caused by a gastrointestinal infection and can dehydrate an infant. It is characterized by stool frequency and consistency that deviates substantially from the norm. If an infant has had several bouts of this condition, they will need to replace lost fluids and electrolytes. A common recommendation is to give a child an oral rehydration solution. Because of the immunoprotective factors in breast milk, breastfed infants are less likely to contract gastrointestinal viral illness and experience diarrhea.

Infant constipation—which is the passage of hard, dry bowel movements, but not necessarily the absence of daily bowel movements—is another common problem. This condition frequently begins when a baby transitions from breast milk to formula or begins eating solid foods. Pediatricians can provide the best guidance for handling the problem. Common recommendations include applying a small amount of water-based lubricant to an infant’s anus to ease the passage of hard stools, and feeding an infant on solid foods pureed pears or prunes, or providing barley cereal in place of rice cereal. Mayo Clinic. “Infant and Toddler Health.” March 16, 2011. © 1998–2012 Mayo Foundation for Medical Education and Research. http://www.mayoclinic.com/health/infant-and-toddler-health/MY00362. Parents can also offer their child a little more water in between feedings to help alleviate the condition.

**Colic**

Colic is a common problem during infancy, characterized by crankiness and crying jags. It is defined as crying that lasts longer than three hours per day for at least three days per week and for at least three weeks (which is commonly known as the “rule of 3’s”), and is
not caused by a medical problem. About one-fifth of all infants develop colic, usually between the second and third weeks. Crying spells can occur around the clock, but often worsen in the early evening. Also, colicky babies may have stomachs that are enlarged or distended with gas.

There is no definitive explanation for colic. Often, colic occurs when a child is unusually sensitive to stimulation. In breastfeeding babies, colic can be a sign of sensitivity to the mother’s diet. Lactating mothers can try to eliminate caffeine, chocolate, and any other potentially irritating foods from their meals. Medline Plus, a service of the US National Library of Medicine. “Colic and Crying.” Last updated August 2, 2011. http://www.nlm.nih.gov/medlineplus/ency/article/000978.htm. However, since colic usually subsides over time, any improvement that occurs with food elimination may coincide with the natural healing process.

Parents and caregivers who are feeding bottle formula to colicky babies should talk with pediatricians about replacing it with a protein hydrolysate formula. American Academy of Pediatrics. “Colic.” HealthyChildren.org. © American Academy of Pediatrics. Last updated May 12, 2011. http://www.healthychildren.org/English/ages-stages/baby/crying-colic/pages/Colic.aspx. Whether breastfeeding or bottlefeeding, it is also important not to overfeed infants, which could make them uncomfortable and more likely to have crying fits. In general, it is best to wait between two and three hours from the start of one feeding to the start of the next. If food sensitivity is the cause, colic should cease within a few days of making changes. Eventually, the problem goes away. Symptoms usually begin to dissipate after six weeks and are gone by twelve weeks. Medline Plus, a service of the US National Library of Medicine. “Colic and Crying.” Last updated August 2, 2011. http://www.nlm.nih.gov/medlineplus/ency/article/000978.htm.

Newborn Jaundice Newborn jaundice is another potential problem during infancy. This condition can occur within a few days of birth and is characterized by yellowed skin or yellowing in the whites of the eyes, which can be harder to detect in dark-skinned babies. Jaundice typically appears on the face first, followed by the chest, abdomen, arms, and legs. This disorder is caused by elevated levels of bilirubin in a baby’s bloodstream. Bilirubin is a substance created by the breakdown of red blood cells and is removed by the liver. Jaundice develops when a newborn’s liver does not efficiently remove bilirubin from the blood. There are several types of jaundice associated with newborns:

- Physiologic jaundice. The most common type of newborn jaundice and can affect up to 60 percent of full-term babies in the first week of life.
- Breast-milk jaundice. The name for a condition that persists after physiologic jaundice subsides in otherwise healthy babies and can last for three to twelve weeks after birth. Breast-milk jaundice tends to be genetic and there is no known cause, although it may be linked to a substance in the breast milk that blocks the breakdown of bilirubin. However, that does not mean breastfeeding should be stopped. As long as bilirubin levels are monitored, the disorder rarely leads to serious complications.
Breastfeeding jaundice. Occurs when an infant does not get enough milk. This may happen because a newborn does not get a good start breastfeeding, does not latch on to the mother’s breast properly, or is given other substances that interfere with breastfeeding (such as juice). Treatment includes increased feedings, with help from a lactation consultant to ensure that the baby takes in adequate amounts.

Newborn jaundice is more common in a breastfed baby and tends to last a bit longer. If jaundice is suspected, a pediatrician will run blood tests to measure the amount of bilirubin in an infant’s blood. Treatment often involves increasing the number of feedings to increase bowel movements, which helps to excrete bilirubin. Within a few weeks, as the baby begins to mature and red blood cell levels diminish, jaundice typically subsides with no lingering effects.American Pregnancy Association. “Breastfeeding and Jaundice.” © 2000–2012 American Pregnancy Association. Accessed February 21, 2012. http://www.americanpregnancy.org/firstyearoflife/breastfeedingandjaundice.htm.

Nutrition in the Toddler Years

LEARNING OBJECTIVES
1. Summarize nutritional requirements and dietary recommendations for toddlers.
2. Explore the introduction of solid foods into a toddler’s diet.
3. Examine feeding problems that parents and caregivers may face with their toddlers.

By the age of two, children have advanced from infancy and are on their way to becoming school-aged children. Their physical growth and motor development slows compared to the progress they made as infants. However, toddlers experience enormous intellectual, emotional, and social changes. Of course, food and nutrition continue to play an important role in a child’s development. During this stage, the diet completely shifts from breastfeeding or bottle-feeding to solid foods along with healthy juices and other liquids. Parents of toddlers also need to be mindful of certain nutrition-related issues that may crop up during this stage of the human life cycle. For example, fluid requirements relative to body size are higher in toddlers than in adults because children are at greater risk of dehydration. Toddlers should drink about 1.3 liters of fluids per day, ideally liquids that are low in sugar.

The Toddler Years (Ages Two to Three)

During this phase of human development, children are mobile and grow more slowly than infants, but are much more active. The toddler years pose interesting challenges for parents or other caregivers, as children learn how to eat on their own and begin to develop personal preferences. However, with the proper diet and guidance, toddlers can continue to grow and develop at a healthy rate.

Nutritional Requirements

MyPlate may be used as a guide for the toddler’s diet (http://www.choosemyplate.gov/preschoolers.html). A toddler’s serving sizes should be
approximately one-quarter that of an adult’s. One way to estimate serving sizes for young children is one tablespoon for each year of life. For example, a two-year-old child would be served 2 tablespoons of fruits or vegetables at a meal, while a four-year-old would be given 4 tablespoons, or a quarter cup. Here is an example of a toddler-sized meal:

- 1 ounce of meat or chicken, or 2 to 3 tablespoons of beans
- One-quarter slice of whole-grain bread
- 1 to 2 tablespoons of cooked vegetable
- 1 to 2 tablespoons of fruit

**Energy**

The energy requirements for ages two to three are about 1,000 to 1,400 calories a day. In general, a toddler needs to consume about 40 calories for every inch of height. For example, a young child who measures 32 inches should take in an average of 1,300 calories a day. However, the recommended caloric intake varies with each child’s level of activity. Toddlers require small, frequent, nutritious snacks and meals to satisfy energy requirements. The amount of food a toddler needs from each food group depends on daily calorie needs. See the following table for some examples:

<table>
<thead>
<tr>
<th><strong>Serving Sizes for Toddlers</strong></th>
<th><strong>Food Group</strong></th>
<th><strong>Daily Serving</strong></th>
<th><strong>Examples</strong></th>
</tr>
</thead>
</table>
| Grains                        |                | About 3 ounces of grains per day, ideally whole grains | • 3 slices of bread  
• 1 slice of bread, plus 1/5 cup of cereal, and 1/4 cup of cooked whole-grain rice or pasta |
| Proteins                      |                | 2 ounces of meat, poultry, fish, eggs, or legumes | • 1 ounce of lean meat or chicken, plus one egg  
• 1 ounce of fish, plus 1/4 cup of cooked beans |
| Fruits                        |                | 1 cup of fresh, frozen, canned, and/or dried fruits, or 100 percent fruit juice | • 1 small apple cut into slices  
• 1 cup of sliced or cubed fruit  
• 1 large banana |
| Vegetables                    |                | 1 cup of raw and/or cooked vegetables | • 1 cup of pureed, mashed, or finely chopped vegetables (such as mashed potatoes, chopped broccoli, or tomato sauce) |
| Dairy Products                |                | 2 cups per day | • 2 cups of fat-free or low-fat milk  
• 1 cup of fat-free or low-fat milk, plus 2 slices of cheese  
• 1 cup of fat-free or low-fat milk, plus 1 cup of yogurt |
Macronutrients

For carbohydrate intake, the Acceptable Macronutrient Distribution Range (AMDR) is 45 to 65 percent of daily calories (113 to 163 grams for 1,000 daily calories). Toddlers’ needs increase to support their body and brain development. Brightly colored unrefined carbohydrates, such as peas, orange slices, tomatoes, and bananas are not only nutrient-dense, they also make a plate look more appetizing and appealing to a young child. The RDA of protein is 5 to 20 percent of daily calories (13 to 50 grams for 1,000 daily calories). The AMDR for fat for toddlers is 30 to 40 percent of daily calories (33 to 44 grams for 1,000 daily calories). Essential fatty acids are vital for the development of the eyes, along with nerve and other types of tissue. However, toddlers should not consume foods with high amounts of trans fats and saturated fats. Instead, young children require the equivalent of 3 teaspoons of healthy oils, such as canola oil, each day.

Micronutrients

As a child grows bigger, the demands for micronutrients increase. These needs for vitamins and minerals can be met with a balanced diet, with a few exceptions. As toddlers mature, they become more comfortable handling dishes and utensils. According to the American Academy of Pediatrics, toddlers and children of all ages need 600 international units of vitamin D per day. Vitamin D-fortified milk and cereals can help to meet this need. However, toddlers who do not get enough of this micronutrient should receive a supplement. Pediatricians may also prescribe a fluoride supplement for toddlers who live in areas with fluoride-poor water. Iron deficiency is also a major concern for children between the ages of two and three. You will learn about iron-deficiency anemia later in this section.

Learning How to Handle Food

As children grow older, they enjoy taking care of themselves, which includes self-feeding. During this phase, it is important to offer children foods that they can handle on their own and that help them avoid choking and other hazards. Examples include fresh fruits that have been sliced into pieces, orange or grapefruit sections, peas or potatoes that have been mashed for safety, a cup of yogurt, and whole-grain bread or bagels cut into pieces. Even with careful preparation and training, the learning process can be messy. As a result, parents and other caregivers can help children learn how to feed themselves by providing the following:

- small utensils that fit a young child’s hand
- small cups that will not tip over easily
- plates with edges to prevent food from falling off
- small servings on a plate
- high chairs, booster seats, or cushions to reach a table
Feeding Problems in the Toddler Years

During the toddler years, parents may face a number of problems related to food and nutrition. Possible obstacles include difficulty helping a young child overcome a fear of new foods, or fights over messy habits at the dinner table. Even in the face of problems and confrontations, parents and other caregivers must make sure their preschooler has nutritious choices at every meal. For example, even if a child stubbornly resists eating vegetables, parents should continue to provide them. Before long, the child may change their mind, and develop a taste for foods once abhorred. It is important to remember this is the time to establish or reinforce healthy habits.

Nutritionist Ellyn Satter states that feeding is a responsibility that is split between parent and child. According to Satter, parents are responsible for what their infants eat, while infants are responsible for how much they eat. In the toddler years and beyond, parents are responsible for what children eat, when they eat, and where they eat, while children are responsible for how much food they eat and whether they eat. Satter states that the role of a parent or a caregiver in feeding includes the following:

- selecting and preparing food
- providing regular meals and snacks
- making mealtimes pleasant
- showing children what they must learn about mealtime behavior
- avoiding letting children eat in between meal- or snack-times


High-Risk Choking

Foods Certain foods are difficult for toddlers to manage and pose a high risk of choking. Big chunks of food should not be given to children under the age of four. Also, globs of peanut butter can stick to a younger child’s palate and choke them. Popcorn and nuts should be avoided as well, because toddlers are not able to grind food and reduce it to a consistency that is safe for swallowing. Certain raw vegetables, such as baby carrots, whole cherry tomatoes, whole green beans, and celery are also serious choking hazards. However, there is no reason that a toddler cannot enjoy well-cooked vegetables cut into bite-size pieces.

Picky Eaters

The parents of toddlers are likely to notice a sharp drop in their child’s appetite. Children at this stage are often picky about what they want to eat. They may turn their heads away after eating just a few bites. Or, they may resist coming to the table at mealtimes. They also can be unpredictable about what they want to consume for specific meals or at particular times of the day. Although it may seem as if toddlers should increase their food intake to match their level of activity, there is a good reason for picky eating. A child’s
growth rate slows after infancy, and toddlers ages two and three do not require as much food.

**Food Jags**

For weeks, toddlers may go on *a food jag* and eat one or two preferred foods—and nothing else. It is important to understand that preferences will be inconsistent as a toddler develops eating habits. This is one way that young children can assert their individuality and independence. However, parents and caregivers should be concerned if the same food jag persists for several months, instead of several weeks. Options for addressing this problem include rotating acceptable foods while continuing to offer diverse foods, remaining low-key to avoid exacerbating the problem, and discussing the issue with a pediatrician. Also, children should not be forced to eat foods that they do not want. It is important to remember that food jags do not have a long-term effect on a toddler’s health, and are usually temporary situations that will resolve themselves.

**Toddler Obesity**


There are a number of reasons for this growing problem. One is a lack of time. Parents and other caregivers who are constantly on the go may find it difficult to fit home-cooked meals into a busy schedule and may turn to fast food and other conveniences that are quick and easy, but not nutritionally sound. Another contributing factor is a lack of access to fresh fruits and vegetables. This is a problem particularly in low-income neighborhoods where local stores and markets may not stock fresh produce or may have limited options. Physical inactivity is also a factor, as toddlers who live a sedentary lifestyle are more likely to be overweight or obese. Another contributor is a lack of breastfeeding support. Children who were breastfed as infants show lower rates of obesity than children who were bottle-fed.

To prevent or address toddler obesity parents and caregivers can do the following:
• Eat at the kitchen table instead of in front of a television to monitor what and how much a child eats.
• Offer a child healthy portions. The size of a toddler’s fist is an appropriate serving size.
• Plan time for physical activity, about sixty minutes or more per day. Toddlers should have no more than sixty minutes of sedentary activity, such as watching television, per day.

Early Childhood Caries

Early childhood caries remains a potential problem during the toddler years. The risk of early childhood caries continues as children begin to consume more foods with a high sugar content. According to the National Health and Nutrition Examination Survey, children between ages of two and five consume about 200 calories of added sugar per day. US Department of Health and Human Services. “Consumption of Added Sugar among US Children and Adolescents.” NCHS Data Brief, No. 87 (March 2012). Therefore, parents with toddlers should avoid processed foods, such as snacks from vending machines, and sugary beverages, such as soda. Parents also need to instruct a child on brushing their teeth at this time to help a toddler develop healthy habits and avoid tooth decay.

Iron-Deficiency Anemia

An infant who switches to solid foods, but does not eat enough iron-rich foods, can develop iron-deficiency anemia. This condition occurs when an iron-deprived body cannot produce enough hemoglobin, a protein in red blood cells that transports oxygen throughout the body. The inadequate supply of hemoglobin for new blood cells results in anemia. Iron-deficiency anemia causes a number of problems including weakness, pale skin, shortness of breath, and irritability. It can also result in intellectual, behavioral, or motor problems. In infants and toddlers, iron-deficiency anemia can occur as young children are weaned from iron-rich foods, such as breast milk and iron-fortified formula. They begin to eat solid foods that may not provide enough of this nutrient. As a result, their iron stores become diminished at a time when this nutrient is critical for brain growth and development.

There are steps that parents and caregivers can take to prevent iron-deficiency anemia, such as adding more iron-rich foods to a child’s diet, including lean meats, fish, poultry, eggs, legumes, and iron-enriched whole-grain breads and cereals. A toddler’s diet should provide 7 to 10 milligrams of iron daily. Although milk is critical for the bone-building calcium that it provides, intake should not exceed the RDA to avoid displacing foods rich with iron. Children may also be given a daily supplement, using infant vitamin drops with iron or ferrous sulfate drops. If iron deficiency anemia does occur, treatment includes a dosage of 3 milligrams per kilogram once daily before breakfast, usually in the form of a ferrous sulfate syrup. Consuming vitamin C, such as orange juice, can also help to improve iron absorption. Kazal Jr., L. A., MD. “Prevention of Iron Deficiency in Infants and Toddlers.” American Academy of Family Physicians 66, no. 7 (October 1, 2002): 1217—25. http://www.aafp.org/afp/2002/1001/p1217.html.
Toddler Diarrhea

As with adults, a variety of conditions or circumstances may give a toddler diarrhea. Possible causes include bacterial or viral infections, food allergies, or lactose intolerance, among other medical conditions. Excessive fruit juice consumption (more than one 6-ounce cup per day) can also lead to diarrhea. American Academy of Pediatrics, Committee on Nutrition 1999–2000. “The Use and Misuse of Fruit Juice in Pediatrics.” Pediatrics 119, no. 2 (February 2007): 405. doi:10.1542/peds.2006-3222. Diarrhea presents a special concern in young children because their small size makes them more vulnerable to dehydration. Parents should contact a pediatrician if a toddler has had diarrhea for more than twenty-four hours, if a child is also vomiting, or if they exhibit signs of dehydration, such as a dry mouth or tongue, or sunken eyes, cheeks, or abdomen. Preventing or treating dehydration in toddlers includes the replacement of lost fluids and electrolytes (sodium and potassium). Oral rehydration therapy, or giving special fluids by mouth, is the most effective measure.

Developing Habits

Eating habits develop early in life. They are typically formed within the first few years and it is believed that they persist for years, if not for life. So it is important for parents and other caregivers to help children establish healthy habits and avoid problematic ones. Children begin expressing their preferences at an early age. Parents must find a balance between providing a child with an opportunity for selfexpression, helping a child develop healthy habits, and making sure that a child meets all of their nutritional needs. Following Ellyn Satter’s division of responsibility in feeding (see above) can help a child eat the right amount of food, learn mealtime behavior, and grow at a healthy and predictable rate. Bad habits and poor nutrition have an accrual effect. The foods you consume in your younger years will impact your health as you age, from childhood into the later stages of life. As a result, good nutrition today means optimal health tomorrow.

Nutrition in Childhood

Learning Objectives
1. Summarize nutritional requirements and dietary recommendations for school-aged children.
2. Discuss the most important nutrition-related concerns during childhood.

Nutritional needs change as children leave the toddler years. From ages four to eight, school-aged children grow consistently, but at a slower rate than infants and toddlers. They also experience the loss of deciduous, or “baby,” teeth and the arrival of permanent teeth, which typically begins at age six or seven. As new teeth come in, many children have some malocclusion, or malposition, of their teeth, which can affect their ability to
chew food. Other changes that affect nutrition include the influence of peers on dietary choices and the kinds of foods offered by schools and afterschool programs, which can make up a sizable part of a child’s diet. Food-related problems for young children can include tooth decay, food sensitivities, and malnourishment. Also, excessive weight gain early in life can lead to obesity into adolescence and adulthood.

**Childhood (Ages Four to Eight):**

At this life stage, a healthy diet facilitates physical and mental development and helps to maintain health and wellness. School-aged children experience steady, consistent growth, with an average growth rate of 2–3 inches (5–7 centimeters) in height and 4.5–6.5 pounds (2–3 kilograms) in weight per year. In addition, the rate of growth for the extremities is faster than for the trunk, which results in more adult-like proportions. Long-bone growth stretches muscles and ligaments, which results in many children experiencing “growing pains,” at nighttime in particular.


**Energy**

Children’s energy needs vary, depending on their growth and level of physical activity. Energy requirements also vary according to gender. Girls ages four to eight require 1,200 to 1,800 calories a day, while boys need 1,200 to 2,000 calories daily, and, depending on their activity level, maybe more. Also, recommended intakes of macronutrients and most micronutrients are higher relative to body size, compared with nutrient needs during adulthood. Therefore, children should be provided nutrient-dense food at meal- and snack-time. However, it is important not to overfeed children, as this can lead to childhood obesity, which is discussed in the next section. Parents and other caregivers can turn to the MyPlate website for guidance: [http://www.choosemyplate.gov/](http://www.choosemyplate.gov/).

**Macronutrients**

For carbohydrates, the Acceptable Macronutrient Distribution Range (AMDR) is 45–65 percent of daily calories (which is a recommended daily allowance of 135–195 grams for 1,200 daily calories). Carbohydrates high in fiber should make up the bulk of intake. The AMDR for protein is 10–30 percent of daily calories (30–90 grams for 1,200 daily calories). Children have a high need for protein to support muscle growth and development. High levels of essential fatty acids are needed to support growth (although not as high as in infancy and the toddler years). As a result, the AMDR for fat is 25–35 percent of daily calories (33–47 grams for 1,200 daily calories). Children should get 17–25 grams of fiber per day.

**Micronutrients**

Micronutrient needs should be met with foods first. Parents and caregivers should select a variety of foods from each food group to ensure that nutritional requirements are met.
Because children grow rapidly, they require foods that are high in iron, such as lean meats, legumes, fish, poultry, and iron-enriched cereals. Adequate fluoride is crucial to support strong teeth. One of the most important micronutrient requirements during childhood is adequate calcium and vitamin D intake. Both are needed to build dense bones and a strong skeleton. Children who do not consume adequate vitamin D should be given a supplement of 10 micrograms (400 international units) per day. The table shows the micronutrient recommendations for school-aged children. (Note that the recommendations are the same for boys and girls. As we progress through the different stages of the human life cycle, there will be some differences between males and females regarding micronutrient needs.)

### Micronutrient Levels during Childhood

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Children, Ages 4–8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (mcg)</td>
<td>400.0</td>
</tr>
<tr>
<td>Vitamin B₆ (mcg)</td>
<td>600.0</td>
</tr>
<tr>
<td>Vitamin B₁₂ (mcg)</td>
<td>1.2</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>25.0</td>
</tr>
<tr>
<td>Vitamin D (mcg)</td>
<td>5.0</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>7.0</td>
</tr>
<tr>
<td>Vitamin K (mcg)</td>
<td>55.0</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>800.0</td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>200.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>10.0</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>130.0</td>
</tr>
<tr>
<td>Niacin (B₃) (mg)</td>
<td>8.0</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>500.0</td>
</tr>
<tr>
<td>Riboflavin (B₂) (mcg)</td>
<td>600.0</td>
</tr>
<tr>
<td>Selenium (mcg)</td>
<td>30.0</td>
</tr>
<tr>
<td>Thiamine (B₁) (mcg)</td>
<td>600.0</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>5.0</td>
</tr>
</tbody>
</table>


### Factors Influencing Intake
A number of factors can influence children’s eating habits and attitudes toward food. Family environment, societal trends, taste preferences, and messages in the media all impact the emotions that children develop in relation to their diet. Television commercials can entice children to consume sugary products, fatty fast-foods, excess calories, refined ingredients, and sodium. Therefore, it is critical that parents and caregivers direct children toward healthy choices.

One way to encourage children to eat healthy foods is to make meal- and snack-time fun and interesting. Parents should include children in food planning and preparation, for example selecting items while grocery shopping or helping to prepare part of a meal, such as making a salad. At this time, parents can also educate children about kitchen safety. It might be helpful to cut sandwiches, meats, or pancakes into small or interesting shapes. In addition, parents should offer nutritious desserts, such as fresh fruits, instead of calorie-laden cookies, cakes, salty snacks, and ice cream. Also, studies show that children who eat family meals on a frequent basis consume more nutritious foods.

Children and Malnutrition

Malnutrition is a problem many children face, in both developing nations and the developed world. Even with the wealth of food in North America, many children grow up malnourished, or even hungry. The US Census Bureau characterizes households into the following groups:

- food secure
- food insecure without hunger
- food insecure with moderate hunger
- food insecure with severe hunger

Hundreds of children grow up in food-insecure households with inadequate diets due to both the amount of available food and the quality of food. In the United States, about 20 percent of households with children are food insecure to some degree. In half of those, only adults experience food insecurity, while in the other half both adults and children are considered to be food insecure, which means that children did not have access to adequate, nutritious meals at times.

Growing up in a food-insecure household can lead to a number of problems. Deficiencies in iron, zinc, protein, and vitamin A can result in stunted growth, illness, and limited development. Federal programs, such as the National School Lunch Program, the School Breakfast Program, and Summer Feeding Programs, work to address the risk of hunger and malnutrition in school-aged children. They help to fill the gaps and provide children living in food-insecure households with greater access to nutritious meals.
The National School Lunch Program

Beginning with preschool, children consume at least one of their meals in a school setting. Many children receive both breakfast and lunch outside of the home. Therefore, it is important for schools to provide meals that are nutritionally sound. In the United States, more than thirty-one million children from low-income families are given meals provided by the National School Lunch Program. This federally-funded program offers low-cost or free lunches to schools, and also snacks to afterschool facilities. School districts that take part receive subsidies from the US Department of Agriculture (USDA) for every meal they serve. School lunches must meet the 2010 Dietary Guidelines for Americans and need to provide one-third of the RDAs for protein, vitamin A, vitamin C, iron, and calcium. However, local authorities make the decisions about what foods to serve and how they are prepared. US Department of Agriculture. “National School Lunch Program Fact Sheet.” 2011. Accessed March 5, 2012. http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf. The Healthy School Lunch Campaign works to improve the food served to children in school and to promote children’s short- and long-term health by educating government officials, school officials, food-service workers, and parents. Sponsored by the Physicians Committee for Responsible Medicine, this organization encourages schools to offer more low-fat, cholesterol-free options in school cafeterias and in vending machines. Physicians Committee for Responsible Medicine. “Healthy School Lunches.” Accessed March 5, 2012. http://healthyschoollunches.org/.

Children and Vegetarianism

Another issue that some parents face with school-aged children is the decision to encourage a child to become a vegetarian or a vegan. Some parents and caregivers decide to raise their children as vegetarians for health, cultural, or other reasons. Preteens and teens may make the choice to pursue vegetarianism on their own, due to concerns about animals or the environment. No matter the reason, parents with vegetarian children must take care to ensure vegetarian children get healthy, nutritious foods that provide all the necessary nutrients.

Types of Vegetarian Diets

There are several types of vegetarians, each with certain restrictions in terms of diet:

- **Ovo-vegetarians.** Ovo-vegetarians eat eggs, but do not eat any other animal products.
- **Lacto-ovo-vegetarians.** Lacto-ovo-vegetarians eat eggs and dairy products, but do not eat any meat.
- **Lacto-vegetarians.** Lacto-vegetarians eat dairy products, but do not eat any other animal products.
- **Vegans.** Vegans eat food only from plant sources, no animal products at all.
Children who consume some animal products, such as eggs, cheese, or other forms of dairy, can meet their nutritional needs. For a child following a strict vegan diet, planning is needed to ensure adequate intake of protein, iron, calcium, vitamin B₁₂, and vitamin D. Legumes and nuts can be eaten in place of meat, soy milk fortified with calcium and vitamins D and B₁₂ can replace cow’s milk.

**Food Allergies and Food Intolerance**

Recent studies show that three million children under age eighteen are allergic to at least one type of food. American Academy of Allergy, Asthma and Immunology. “Allergy Statistics.” Accessed on March 5, 2012. [http://www.aaaai.org/about-the-aaaai/newsroom/allergy-statistics.aspx](http://www.aaaai.org/about-the-aaaai/newsroom/allergy-statistics.aspx). Some of the most common allergenic foods include peanuts, milk, eggs, soy, wheat, and shellfish. An allergy occurs when a protein in food triggers an immune response, which results in the release of antibodies, histamine, and other defenders that attack foreign bodies. Possible symptoms include itchy skin, hives, abdominal pain, vomiting, diarrhea, and nausea. Symptoms usually develop within minutes to hours after consuming a food allergen. Children can outgrow a food allergy, especially allergies to wheat, milk, eggs, or soy.

Anaphylaxis is a life-threatening reaction that results in difficulty breathing, swelling in the mouth and throat, decreased blood pressure, shock, or even death. Milk, eggs, wheat, soybeans, fish, shellfish, peanuts, and tree nuts are the most likely to trigger this type of response. A dose of the drug epinephrine is often administered via a “pen” to treat a person who goes into anaphylactic shock. National Institutes of Health, US Department of Health and Human Services. “Food Allergy Quick Facts.” Accessed March 5, 2012. [http://www.niaid.nih.gov/topics/foodallergy/understanding/pages/quickfacts.aspx](http://www.niaid.nih.gov/topics/foodallergy/understanding/pages/quickfacts.aspx).

Some children experience a food intolerance, which does not involve an immune response. A food intolerance is marked by unpleasant symptoms that occur after consuming certain foods. Lactose intolerance, though rare in very young children, is one example. Children who suffer from this condition experience an adverse reaction to the lactose in milk products. It is a result of the small intestine’s inability to produce enough of the enzyme lactase, which is produced by the small intestine. Symptoms of lactose intolerance usually affect the GI tract and can include bloating, abdominal pain, gas, nausea, and diarrhea. An intolerance is best managed by making dietary changes and avoiding any foods that trigger the reaction. National Digestive Disease Information Clearinghouse, a service of National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. “Lactose Intolerance.” NIH Publication No. 09–2751 (June 2009). Last updated April 23, 2012. [http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/](http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/).

**The Threat of Lead Toxicity**

There is a danger of lead toxicity, or lead poisoning, among school-aged children. Lead is found in plumbing in old homes, in lead-based paint, and occasionally in the soil. Contaminated food and water can increase exposure and result in hazardous lead levels in
Children under age six are especially vulnerable. They may consume items tainted with lead, such as chipped, lead-based paint. Another common exposure is lead dust in carpets, with the dust flaking off of paint on walls. When children play or roll around on carpets coated with lead, they are in jeopardy. Lead is indestructible, and once it has been ingested it is difficult for the human body to alter or remove it. It can quietly build up in the body for months, or even years, before the onset of symptoms. Lead toxicity can damage the brain and central nervous system, resulting in impaired thinking, reasoning, and perception.

Treatment for lead poisoning includes removing the child from the source of contamination and extracting lead from the body. Extraction may involve chelation therapy, which binds with lead so it can be excreted in urine. Another treatment protocol, EDTA therapy, involves administering a drug called ethylenediaminetetraacetic acid to remove lead from the bloodstream of patients with levels greater than 45 mcg/dL. Mayo Foundation for Medical Education and Research. “Lead poisoning.” ©1998–2012 Accessed March 5, 2012. http://www.mayoclinic.com/health/lead-poisoning/FL00068. Fortunately, lead toxicity is highly preventable. It involves identifying potential hazards, such as lead paint and pipes, and removing them before children are exposed to them.

Puberty and Nutrition

LEARNING OBJECTIVES

1. Summarize nutritional requirements and dietary recommendations for preteens.
2. Discuss the most important nutrition-related concerns at the onset of puberty.
3. Discuss the growing rates of childhood obesity and the long-term consequences of it.

Puberty is the beginning of adolescence. The onset of puberty brings a number of changes, including the development of primary and secondary sex characteristics, growth spurts, an increase in body fat, and an increase in bone and muscle development. All of these changes must be supported with adequate intake and healthy food choices.

The Onset of Puberty (Ages Nine to Thirteen)

This period of physical development is divided into two phases. The first phase involves height increases from 20 to 25 percent. Puberty is second to the prenatal period in terms of rapid growth as the long bones stretch to their final, adult size. Girls grow 2–8 inches (5–20 centimeters) taller, while boys grow 4–12 inches (10–30 centimeters) taller. The second phase involves weight gain related to the development of bone, muscle, and fat tissue. Also in the midst of puberty, the sex hormones trigger the development of reproductive organs and secondary sexual characteristics, such as pubic hair. Girls also develop “curves,” while boys become broader and more muscular. Beverly McMillan, Illustrated Atlas of the Human Body (Sydney, Australia: Weldon Owen, 2008), 258.
Energy

The energy requirements for preteens differ according to gender, growth, and activity level. For ages nine to thirteen, girls should consume about 1,400 to 2,200 calories per day and boys should consume 1,600 to 2,600 calories per day. Physically active preteens who regularly participate in sports or exercise need to eat a greater number of calories to account for increased energy expenditures.

Macronutrients

For carbohydrates, the AMDR is 45 to 65 percent of daily calories (which is a recommended daily allowance of 158–228 grams for 1,400–1,600 daily calories). Carbohydrates that are high in fiber should make up the bulk of intake. The AMDR for protein is 10 to 30 percent of daily calories (35–105 grams for 1,400 daily calories for girls and 40–120 grams for 1,600 daily calories for boys). The AMDR for fat is 25 to 35 percent of daily calories (39–54 grams for 1,400 daily calories for girls and 44–62 grams for 1,600 daily calories for boys), depending on caloric intake and activity level.

Micronutrients

Key vitamins needed during puberty include vitamins D, K, and B12. Adequate calcium intake is essential for building bone and preventing osteoporosis later in life. Young females need more iron at the onset of menstruation, while young males need additional iron for the development of lean body mass. Almost all of these needs should be met with dietary choices, not supplements (iron is an exception). The table below shows the micronutrient recommendations for young adolescents.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Preteens, Ages 9–13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (mcg)</td>
<td>600.0</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1.0</td>
</tr>
<tr>
<td>Vitamin B12 (mcg)</td>
<td>1.8</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>45.0</td>
</tr>
<tr>
<td>Vitamin D (mcg)</td>
<td>5.0</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>11.0</td>
</tr>
<tr>
<td>Vitamin K (mcg)</td>
<td>60.0</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1,300.0</td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>300.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>8.0</td>
</tr>
</tbody>
</table>
### Nutrient Requirements for Preteens, Ages 9–13

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium (mg)</td>
<td>240.0</td>
</tr>
<tr>
<td>Niacin (B₃) (mg)</td>
<td>12.0</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>1,250.0</td>
</tr>
<tr>
<td>Riboflavin (B₂) (mcg)</td>
<td>900.0</td>
</tr>
<tr>
<td>Selenium (mcg)</td>
<td>40.0</td>
</tr>
<tr>
<td>Thiamine (B₁) (mcg)</td>
<td>900.0</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>8.0</td>
</tr>
</tbody>
</table>


### Childhood Obesity


There are a number of reasons behind this problem, including:

- larger portion sizes
- limited access to nutrient-rich foods
- increased access to fast foods and vending machines
- lack of breastfeeding support
- declining physical education programs in schools
- insufficient physical activity and a sedentary lifestyle
- media messages encouraging the consumption of unhealthy foods

Children who suffer from obesity are more likely to become overweight or obese adults. Obesity has a profound effect on self-esteem, energy, and activity level. Even more importantly, it is a major risk factor for a number of diseases later in life, including cardiovascular disease, Type 2 diabetes, stroke, hypertension, and certain cancers. World Health Organization. “Obesity and Overweight Fact Sheet.” Last revised March 2011. [http://www.who.int/mediacentre/factsheets/fs311/en/](http://www.who.int/mediacentre/factsheets/fs311/en/).

A percentile for body mass index (BMI) specific to age and sex is used to determine if a child is overweight or obese. This is more appropriate than the BMI categories used for adults because the body composition of children varies as they develop, and differs between boys and girls. If a child gains weight inappropriate to growth, parents and
Caregivers should limit energy-dense, nutrient-poor snack foods. Also, children ages three and older can follow the National Cholesterol Education Program guidelines of no more than 35 percent of calories from fat (10 percent or less from saturated fat), and no more than 300 milligrams of cholesterol per day. In addition, it is extremely beneficial to increase a child’s physical activity and limit sedentary activities, such as watching television, playing video games, or surfing the Internet. Programs to address childhood obesity can include behavior modification, exercise counseling, psychological support or therapy, family counseling, and family meal-planning advice. For most, the goal is not weight loss, but rather allowing height to catch up with weight as the child continues to grow. Rapid weight loss is not recommended for preteens or younger children due to the risk of deficiencies and stunted growth.

**Avoiding Added Sugars**

One major contributing factor to childhood obesity is the consumption of added sugars. Added sugars include not only sugar added to food at the table, but also are ingredients in items such as bread, cookies, cakes, pies, jams, and soft drinks. The added sugar in store-bought items may be listed as white sugar, brown sugar, high-fructose corn syrup, honey, malt syrup, maple syrup, molasses, anhydrous dextrose, crystal dextrose, and concentrated fruit juice. (Not included are sugars that occur naturally in foods, such as the lactose in milk or the fructose in fruits.) In addition, sugars are often “hidden” in items added to foods after they’re prepared, such as ketchup, salad dressing, and other condiments. According to the National Center for Health Statistics, young children and adolescents consume an average of 322 calories per day from added sugars, or about 16 percent of daily calories. National Center for Health Statistics. “Consumption of Added Sugar among US Children and Adolescents, 2005–2008.” *NCHS Data Brief*, no. 87, (March 2012). [http://www.cdc.gov/nchs/data/databriefs/db87.pdf](http://www.cdc.gov/nchs/data/databriefs/db87.pdf). The primary offenders are processed and packaged foods, along with soda and other beverages. These foods are not only high in sugar, they are also light in terms of nutrients and often take the place of healthier options. Intake of added sugar should be limited to 100–150 calories per day to discourage poor eating habits.

**Older Adolescence and Nutrition**

**LEARNING OBJECTIVES**

1. Summarize nutritional requirements and dietary recommendations for teens.
2. Discuss the most important nutrition-related concerns during adolescence.
3. Discuss the effect of eating disorders on health and wellness.

In this section, we will discuss the nutritional requirements for young people ages fourteen to eighteen. One way that teenagers assert their independence is by choosing what to eat. They have their own money to purchase food and tend to eat more meals away from home. Older adolescents also can be curious and open to new ideas, which includes trying new kinds of food and experimenting with their diet. For example, teens will sometimes skip a main meal and snack instead. That is not necessarily problematic. Their choice of food is more important than the time or place.
However, too many poor choices can make young people nutritionally vulnerable. Teens should be discouraged from eating fast food, which has a high fat and sugar content, or frequenting convenience stores and using vending machines, which typically offer poor nutritional selections. Other challenges that teens may face include obesity and eating disorders. At this life stage, young people still need guidance from parents and other caregivers about nutrition-related matters. It can be helpful to explain to young people how healthy eating habits can support activities they enjoy, such as skateboarding or dancing, or connect to their desires or interests, such as a lean figure, athletic performance, or improved cognition.

Adolescence (Ages Fourteen to Eighteen): Transitioning into Adulthood
As during puberty, growth and development during adolescence differs in males than in females. In teenage girls, fat assumes a larger percentage of body weight, while teenage boys experience greater muscle and bone increases. For both, primary and secondary sex characteristics have fully developed and the rate of growth slows with the end of puberty. Also, the motor functions of an older adolescent are comparable to those of an adult. Elaine U. Polan, RNC, MS and Daphne R. Taylor, RN, MS, Journey Across the Life Span: Human Development and Health Promotion (Philadelphia: F. A. Davis Company, 2003), 171–173. Again, adequate nutrition and healthy choices support this stage of growth and development.

Energy
Adolescents have increased appetites due to increased nutritional requirements. Nutrient needs are greater in adolescence than at any other time in the life cycle, except during pregnancy. The energy requirements for ages fourteen to eighteen are 1,800 to 2,400 calories for girls and 2,000 to 3,200 calories for boys, depending on activity level. The extra energy required for physical development during the teenaged years should be obtained from foods that provide nutrients instead of “empty calories.” Also, teens who participate in sports must make sure to meet their increased energy needs.

Macronutrients
Older adolescents are more responsible for their dietary choices than younger children, but parents and caregivers must make sure that teens continue to meet their nutrient needs. For carbohydrates, the AMDR is 45 to 65 percent of daily calories (203–293 grams for 1,800 daily calories). Adolescents require more servings of grain than younger children, and should eat whole grains, such as wheat, oats, barley, and brown rice. The Institute of Medicine recommends higher intakes of protein for growth in the adolescent population. The AMDR for protein is 10 to 30 percent of daily calories (45–135 grams for 1,800 daily calories), and lean proteins, such as meat, poultry, fish, beans, nuts, and seeds are excellent ways to meet those nutritional needs.

The AMDR for fat is 25 to 35 percent of daily calories (50–70 grams for 1,800 daily calories), and the AMDR for fiber is 25–34 grams per day, depending on daily calories.
and activity level. It is essential for young athletes and other physically active teens to intake enough fluids, because they are at a higher risk for becoming dehydrated.

Micronutrients

Micronutrient recommendations for adolescents are mostly the same as for adults, though children this age need more of certain minerals to promote bone growth (e.g., calcium and phosphorus, along with iron and zinc for girls). Again, vitamins and minerals should be obtained from food first, with supplementation for certain micronutrients only (such as iron).

The most important micronutrients for adolescents are calcium, vitamin D, vitamin A, and iron. Adequate calcium and vitamin D are essential for building bone mass. The recommendation for calcium is 1,300 milligrams for both boys and girls. Low-fat milk and cheeses are excellent sources of calcium and help young people avoid saturated fat and cholesterol. It can also be helpful for adolescents to consume products fortified with calcium, such as breakfast cereals and orange juice. Iron supports the growth of muscle and lean body mass. Adolescent girls also need to ensure sufficient iron intake as they start to menstruate. Girls ages twelve to eighteen require 15 milligrams of iron per day. Increased amounts of vitamin C from orange juice and other sources can aid in iron absorption. Also, adequate fruit and vegetable intake allows for meeting vitamin A needs. The table below shows the micronutrient recommendations for older adolescents, which differ slightly for males and females, unlike the recommendations for puberty.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Males, Ages 14–18</th>
<th>Females, Ages 14–18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (mcg)</td>
<td>900.0</td>
<td>700.0</td>
</tr>
<tr>
<td>Vitamin B₆ (mg)</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Vitamin B₁₂ (mcg)</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>75.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Vitamin D (mcg)</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Vitamin K (mcg)</td>
<td>75.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1,300.0</td>
<td>1,300.0</td>
</tr>
<tr>
<td>Folate mcg)</td>
<td>400.0</td>
<td>400.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>11.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>410.0</td>
<td>360.0</td>
</tr>
<tr>
<td>Niacin (B₃) (mg)</td>
<td>16.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>
### Nutrient Requirements

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Males, Ages 14–18</th>
<th>Females, Ages 14–18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus (mg)</td>
<td>1,250.0</td>
<td>1,250.0</td>
</tr>
<tr>
<td>Riboflavin (B₂) (mg)</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Selenium (mcg)</td>
<td>55.0</td>
<td>55.0</td>
</tr>
<tr>
<td>Thiamine (B₁) (mg)</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>11.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>


---

### Eating Disorders

Many teens struggle with an eating disorder, which can have a detrimental effect on diet and health. A study published by North Dakota State University estimates that these conditions impact twenty-four million people in the United States and seventy million worldwide. North Dakota State University. “Eating Disorder Statistics.” Accessed March 5, 2012. [http://www.ndsu.edu/fileadmin/counseling/Eating_Disorder_Statistics.pdf](http://www.ndsu.edu/fileadmin/counseling/Eating_Disorder_Statistics.pdf). These disorders are more prevalent among adolescent girls, but have been increasing among adolescent boys in recent years. Because eating disorders often lead to malnourishment, adolescents with an eating disorder are deprived of the crucial nutrients their still-growing bodies need.

Eating disorders involve extreme behavior related to food and exercise. Sometimes referred to as “starving or stuffing,” they encompass a group of conditions marked by undereating or overeating. Some of these conditions include:

- **Anorexia Nervosa.** Anorexia nervosa is a potentially fatal condition characterized by undereating and excessive weight loss. People with this disorder are preoccupied with dieting, calories, and food intake to an unhealthy degree. Anorexics have a poor body image, which leads to anxiety, avoidance of food, a rigid exercise regimen, fasting, and a denial of hunger. The condition predominantly affects females. Between 0.5 and 1 percent of American women and girls suffer from this eating disorder.

- **Binge-Eating Disorder.** People who suffer from binge-eating disorder experience regular episodes of eating an extremely large amount of food in a short period of time. Binge eating is a compulsive behavior, and people who suffer from it typically feel it is beyond their control. This behavior often causes feelings of shame and embarrassment, and leads to obesity, high blood pressure, high cholesterol levels, Type 2 diabetes, and other health problems. Both males and females suffer from binge-eating disorder. It affects 1 to 5 percent of the population.

- **Bulimia Nervosa.** Bulimia nervosa is characterized by alternating cycles of overeating and undereating. People who suffer from it partake in binge eating, followed by compensatory behavior, such as self-induced vomiting, laxative use, and compulsive exercise. As with anorexia, most people with this condition are

Eating disorders stem from stress, low self-esteem, and other psychological and emotional issues. It is important for parents to watch for signs and symptoms of these disorders, including sudden weight loss, lethargy, vomiting after meals, and the use of appetite suppressants. Eating disorders can lead to serious complications or even be fatal if left untreated. Treatment includes cognitive, behavioral, and nutritional therapy.