



# **Nutrition Issues and Concerns**

# BREASTFEEDING

In the United States, 60 percent of mothers breastfeed their infants for a brief period, with fewer than 25 percent of infants receiving any breastmilk by 6 months of age. The *Healthy People 2010* objectives for breastfeeding are to achieve, among women in the United States, levels of 75 percent who initiate breastfeeding and of 50 percent who maintain breastfeeding for at least 6 months.<sup>1</sup> To achieve these objectives, it is essential that health professionals and parents recognize the enormous benefits of breastfeeding and breastmilk and understand how to effectively manage lactation.

Most infants born in the United States in the 20th century have not been breastfed. Cow's milk

preparations and other infant formulas were usually adopted as the major source of nutrition during the first year of life. However, research during the past 20 years has repeatedly demonstrated the importance of breastmilk for infants. This recognition of the health, nutritional, immunological, psychological, and societal advantages of breastmilk over all substitutes has led to a gradual increase in breastfeeding, especially during the first 2 to 4 months of life. Recently, additional health benefits from breastfeeding—as well as economic and environmental advantages—for mothers have been defined.<sup>2,3</sup>

## Breastfeeding Benefits

Breastfeeding provides infants with significant protection against a variety of infectious diseases, particularly in areas of the world with poor sanitation and contaminated water and food supplies. Epidemiological studies in the United States and other developed countries have shown that, compared with formula-fed infants, breastfed infants have fewer and less severe bacterial and viral diseases, including meningitis, gastroenteritis, otitis media, pneumonia, botulism, urinary tract infections, and necrotizing enterocolitis.<sup>2,3</sup>

There are a number of studies demonstrating that breastfeeding also helps prevent some chronic diseases, including type 1 diabetes mellitus, Crohn's disease, ulcerative colitis, lymphoma, and asthma and other allergic diseases.<sup>2,3</sup> Some of the preventive effects of breastfeeding (including those preventing otitis media and asthma) continue well beyond the period of breastfeeding, suggesting that



breastfeeding enhances long-term immunological response.<sup>4</sup> Moreover, growth patterns observed in the first year of life suggest that breastfeeding may help prevent obesity. Multiple studies have demonstrated an association between breastfeeding and improved cognitive behavior, including higher IQs and improved school performance through adolescence.

In the days after delivery, the mother's lactation reduces postpartum bleeding and the size of the uterus (an effect of oxytocin). The absence of menstruation during lactation reduces iron loss and delays the resumption of ovulation. Consequently, the time between pregnancies is increased, the risk of prematurity in later pregnancies is reduced, and adverse outcomes for the pregnancy or the infant are reduced. In proportion to the total duration of lactation, women who breastfeed have lower rates of ovarian cancer, premenopausal breast cancer, hip fractures, and osteoporosis.<sup>2,3</sup>

In the United States, hospitalizations, medical office visits, and pharmaceutical use are significantly reduced for breastfed infants, cutting health care costs by an average of \$200 per breastfed infant compared with formula-fed infants.<sup>5</sup> Improved infant health reduces the loss of income due to parents' absence from work to care for the infant. Breastfeeding also eliminates or reduces the cost of purchasing infant formula, which has been estimated to range from \$750 to \$1,500 for the first year of life. Breast-pump rental and lactation consultation services may reduce some of these savings, but the net economic benefit is significant.

## Breastmilk Composition

Human milk is radically different from cow's milk and even from prepared infant formula, despite attempts to modify formulas to make them similar to breastmilk. Breastmilk is extremely low in protein (about 0.9 g/100 mL) compared with raw cow's milk, which has nearly four times the concentration of protein.<sup>6</sup> Infant formulas are diluted to provide a low protein concentration that is comparable to human milk, but the protein structure (which is more difficult for the young infant to absorb) remains the same as that of cow's milk. In some formulas, the ratio of whey to casein is altered to make it comparable to breastmilk, in which whey is dominant. Because breastmilk's concentration of protein is very low, infants need to breastfeed frequently. Human milk proteins contain antibodies (known as secretory IgA) that are structured specifically to resist digestion.

The fats in breastmilk are very different from those in infant formulas and are absorbed better than those from animal or vegetable sources. Breastmilk also contains hundreds of micronutrients, including free amino acids, essential fatty acids, minerals, growth factors, cytokines, and other chemical agents that contribute to virtually every aspect of infant growth and development. Many of these components serve as both nutrients and bioactive agents to enhance the infant's development.

Breastmilk's composition varies during the course of breastfeeding. Colostrum, the initial milk, is higher in protein and lower in fat and lactose concentrations than mature milk.<sup>6</sup> Throughout the course of lactation, secretory IgA concentration gradually declines, allowing the infant's own immune system to develop and lose its dependency

on the mother's sources. Because the mother and infant share the same environment, the mother develops and secretes specific antibodies to the viruses and bacteria to which the infant is exposed. This response is rapid, requiring only a few days. These dynamic changes in the composition of breastmilk show how well it adapts to meet the needs of the infant. Furthermore, breastmilk contains everything that the healthy, full-term infant requires for about the first 6 months of life, including water and most vitamins and minerals. (Some infants may require vitamin D or iron supplements.<sup>2</sup>)

## Initiating Breastfeeding

Breastfeeding is established most successfully when it is begun during the first hour after birth. The infant and mother should remain together throughout the recovery and postpartum period, with no interruptions in the "rooming-in." The mother should be encouraged to put her infant to the breast at the earliest signs of hunger (e.g., mouthing motions, hand-to-mouth movements, wide-eyed eagerness, cooing).<sup>2</sup> Crying is a late sign of hunger that often interferes with good breastfeeding; the crying infant usually requires calming before breastfeeding can begin. Positioning and latching-on require some initial experimentation. A good "let-down" sensation (tingling in the breast) accompanied by brief cramping pain in the uterus (from the release of oxytocin by the pituitary gland) are signs of a good latch-on. Counseling by a lactation expert can often identify problems in positioning and latching-on that can be easily corrected before unnecessary pain and nipple injury occur.

Mothers should breastfeed at least 10 to 12 times every 24 hours during the early weeks of lac-

tation, and the infant should be allowed to feed at both breasts for as long as desired during each feeding session. Frequent breastfeeding and complete emptying of both breasts will help prevent engorgement. The hind milk—the portion that comes out toward the end of emptying a breast—contains much more fat, which provides essential calories and signals the infant to end feeding on that breast.<sup>4</sup> Water and formula supplementation are not needed and should be discouraged, because they will interfere with the development of good breastfeeding patterns. Water supplementation also increases the likelihood that the infant will not consume as many calories and subsequently develop jaundice and severe hyperbilirubinemia. The use of pacifiers should also be discouraged during the early weeks of life, when they may complicate breastfeeding initiation and cause premature weaning.<sup>2</sup>

The adequacy of the infant's milk intake can be evaluated by the mother and health professionals by observing whether the infant has five or more wet diapers and three or four stools per day by 5 to 7 days of age. A trained observer should evaluate the breastfeeding position, latch-on, and sucking and swallowing during the first few days. Within 2 to 3 days after discharge from the hospital, the mother and infant should be seen by a physician or other health professional trained in lactation management to evaluate the breastfeeding.<sup>2</sup> At this time, infants should be weighed; if they have lost more than 7 percent of their birthweight, the mother's breastfeeding practices should be evaluated and corrected if necessary to increase milk production and feeding. Nipple pain and cracking, breast engorgement, and all other problems should also be addressed to ensure that breastfeeding is successful. If problems are not evaluated and corrected at

this point, breastfeeding may be stopped too early.

Mothers should be able to obtain counseling from a lactation expert by phone and in person when needed. Home visits by lactation consultants, nurses, nutritionists, and/or physicians trained in breastfeeding can be very helpful in evaluating and correcting breastfeeding problems. Peer support groups (e.g., La Leche League) are also helpful throughout infancy, especially when the mother is initiating breastfeeding and adapting to her new infant.

## The Mother's Diet

During the early weeks of breastfeeding, the mother does not need to eat more food than she would have eaten before pregnancy. Fat stores provide adequate energy sources for milk production. Encourage the mother to drink extra fluids (especially milk, juice, and water) to keep from getting thirsty. Breastfeeding accelerates the mother's return to her prepregnancy weight and shape. However, after about 6 weeks, lactating mothers need to eat more to satisfy their hunger. An increase of about 600 to 800 calories and about a quart of water per day is usually sufficient. A well-balanced diet is adequate, and no special foods or nutrient groups are required.

While most foods (including spicy and exotic ones) eaten by the mother are well tolerated by breastfeeding infants, occasionally the infant may have symptoms that suggest allergy or intolerance. For example, cow's milk protein enters the breastmilk and has been shown to result in sensitization and allergic symptoms in about 8 percent of breastfed infants. In these cases, the mother may need to eliminate known or suspected allergenic foods from her diet. The mother's caffeine intake should be



eliminated or reduced, because it may lead to prolonged waking periods or agitation in the infant. Alcohol intake during lactation should also be eliminated or at least restricted to only an occasional single drink, because alcohol is readily transferred into breastmilk and can intoxicate the infant.

## Continuing Breastfeeding

Breastmilk provides sufficient nutrition for about the first 6 months of life and should be encouraged. Iron-fortified infant cereal, which provides additional energy and iron, is a good choice for the first supplemental food given to infants. Healthy infants usually require little or no supplemental water (except in hot weather). Water is not needed during the first 6 months and should be offered thereafter only when conditions are extremely warm or when the infant has lost an excessive amount of water. Breastfeeding should be continued for at least the first year of life and into the second year and beyond for as long as both the mother and infant or child desire it. The benefits of

breastfeeding for both mother and infant or child continue for as long as breastfeeding is practiced. However, after 6 months of age, infants living in areas where the water supply is severely deficient in fluoride (less than 0.3 ppm) should receive oral fluoride supplements.<sup>2</sup>

Some mothers may wish to breastfeed and formula-feed their infants, perhaps because they have returned to work or school outside of the home. Mixed feeding should be discouraged during the early weeks of breastfeeding because it often interferes with the establishment of a good breast-milk supply and may lead to premature weaning from the breast.<sup>7</sup> To maintain her milk supply and avoid engorgement, the mother needs to breastfeed or pump her breasts frequently and regularly every day. Some mothers may be able to adapt their breastfeeding schedule after a few months so that they can go 6 to 8 hours during the day without pumping and then breastfeed the infant frequently in the evening and at night.

For mothers returning to work or school, breastfeeding can be effectively maintained by pumping about every 4 hours and storing the expressed breastmilk in a cooled container (e.g., an insulated bag with ice packs, a prefrozen insulated vacuum bottle). This milk can then be stored in the refrigerator for up to 48 hours, for feeding to the infant the following day by bottle or cup, or it can be frozen for 3 to 6 months if stored at 0°F in the back of the freezer. Breastmilk should never be stored in the door of a freezer or refrigerator. Sterile or well-cleaned hard plastic or glass containers are suitable for storing breastmilk. Frozen breastmilk should be thawed slowly either at room temperature, in the refrigerator, or in a warm-water bath. Breastmilk should never be warmed in a microwave

oven since it can easily overheat, burning the infant and destroying the beneficial qualities of the milk.

Mothers who plan to go back to work or school should talk with their employer or school about the need for a private place and time to pump. Some employers purchase high-grade electric breast pumps for employees' use and allow sufficient time to use them. These arrangements benefit an organization financially because employees' absences to care for their infants or children, as well as health insurance costs, may be reduced, and employee satisfaction and retention will improve.

Weaning should occur naturally and gradually when the mother and infant are ready, although preferably not before the infant's first birthday.<sup>2,7</sup> Breastfeeding can continue for 12 months or as long as the mother and infant wish to continue.<sup>2</sup> The most comfortable way to wean is for mothers to gradually reduce the frequency of breastfeeding and replace breastmilk with other foods and milks over a period of several weeks. For infants, only iron-fortified infant formula is appropriate as a substitute for breastmilk.<sup>2</sup>

## Contraindications to Breastfeeding

While breastmilk is the best food for almost every infant, breastfeeding and breastmilk in some cases may be contraindicated, either temporarily or permanently.<sup>2,3</sup>

The strongest contraindication is when the infant has an inherited metabolic disorder such as galactosemia, in which the infant is unable to metabolize the galactose portion of the milk sugar called lactose. Lactose elimination must then be instituted for the infant, and the infant should not

be breastfed. Infants with phenylketonuria may continue to receive breastmilk (because of its low protein concentration) if they are monitored carefully for blood phenylalanine levels. There are other inherited disorders that contraindicate breastfeeding, but they are rare.

Although HIV infection and untreated active pulmonary tuberculosis are contraindications to breastfeeding in the United States and other developed countries, most maternal infections do not contraindicate breastfeeding.<sup>2,3</sup> Maternal hepatitis A, B, and C are not transmitted through breastfeeding. Cytomegalovirus through breastfeeding may be a risk to premature infants, but it is not a risk to full-term infants. A mother who develops a fever or other signs of infection while breastfeeding (whether from a viral or bacterial infection) has already exposed her infant to the infection and should be encouraged to continue breastfeeding the infant or to express breastmilk; the breastmilk will provide specific antibodies and other nonspecific anti-infectious agents to protect the infant. In fact, discontinuing breastfeeding may increase the infant's risk of developing the infection. Mastitis does not harm the infant, and the continuation of breastfeeding is essential to hasten the mother's recovery. Breastfeeding may even be continued with breast abscesses, as long as the incision and surgical drainage tube are far enough away from the areola that they are not involved in feeding.

Breastfeeding mothers can take most drugs, whether prescription or over-the-counter. Radioactive isotopes, certain antimetabolites, and a few antibiotics and antipsychosis drugs are contraindicated during breastfeeding. Every effort should be made to substitute safe drugs and/or maintain lactation by pumping while the drugs are being administered. Excellent references are available to identify

which drugs are safe and which are not.<sup>8,9</sup> Oral contraceptives of low-dose progesterone are safe and compatible with breastfeeding, but estrogen-containing agents should be avoided because they may inhibit milk production.

## Summary

Breastmilk is a valuable, readily available resource with extensive short- and long-term benefits for both mother and infant. It is essential that health professionals understand the benefits and management of breastfeeding and that this topic be included in their education and training.<sup>10</sup> Health professionals can thus help ensure the improved health and development of almost all infants, children, and adolescents.

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## Suggested Reading

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## Supporting an Adolescent Mother's Decision to Breastfeed

Denise Booker, a 17-year-old high-school junior who is single and pregnant, can't decide how to feed her baby. She is enrolled in WIC (Special Supplemental Nutrition Program for Women, Infants and Children) and has attended prenatal classes. All of the health professionals have emphasized the benefits of breastfeeding, pointing out the complete nutrient content of breastmilk, the lower risk of infection for babies, and the convenience of not having to sterilize bottles and prepare infant formula. Denise has also learned that she could complete her senior year at a high school that provides child care and would allow her to breastfeed her baby during school hours. She has become convinced that breastfeeding offers many advantages to her and her baby.

Denise's mother and the baby's father are trying to discourage Denise from breastfeeding. Both believe that breastfeeding will "tie her down" to the baby and will interfere with their ability to care for the baby. Denise's mother bottlefed all of her children and she thinks it is

*Denise has also learned that she could complete her senior year at a high school that provides child care and would allow her to breastfeed her baby during school hours.*

unnecessary to have to pump breastmilk when infant formula is widely available. She has also expressed uneasiness about handling expressed breastmilk when she is caring for her grandchild.

Denise discusses her dilemma with the WIC nutritionist, Mariana Rivera. They set up a meeting at which Denise, her mother, and her boyfriend talk openly about the issue of breastfeeding vs. bottlefeeding. The nutritionist plays a videotape that demonstrates the techniques for breastfeeding

and for feeding expressed breastmilk. After a thorough discussion, they all agree to support Denise's desire to breastfeed her baby.

After the baby is born, a lactation consultant visits Denise in the hospital. She helps Denise position the baby for breastfeeding and explains the baby's natural reflex to search for the nipple and begin suckling. The consultant shows Denise how to tell if the baby is properly latched on to the breast and swallowing milk. Before Denise and her baby leave the hospital, the lactation consultant gives Denise some pamphlets and other educational materials on breastfeeding as well as a listing of local resources. The consultant tells Denise that she will call in a few days to find out how things are going and to answer any questions.

# CHILDREN AND ADOLESCENTS WITH SPECIAL HEALTH CARE NEEDS

The Maternal and Child Health Bureau has defined children and adolescents with special health care needs as those “who have or are at increased risk for chronic physical, developmental, behavioral, or emotional conditions and who require health and related services of a type or amount beyond that required by children generally.”<sup>1</sup>

## Significance

It is estimated that approximately 18 percent of children and adolescents have a chronic condition or disability.<sup>2</sup> These children and adolescents are at increased risk for nutrition-related health problems because of (a) physical disorders or disabilities that may affect their ability to consume, digest, or absorb nutrients; (b) biochemical imbalances caused by long-term medications or internal metabolic disturbances; (c) psychological stress from a chronic condition or physical disorder that may affect a child’s appetite and food intake; and/or (d) environmental factors, which are often controlled by parents, who may influence the child’s access to and acceptance of food.

Young children with special health care needs have been found to be particularly vulnerable to nutrition problems. A screening project of infants and young children with developmental delays in the Massachusetts Early Head Start Program found that 92 percent of the infants and children had at least one nutrition risk factor, and 67 percent met more than one of the criteria for referral to nutri-

tion services.<sup>3</sup> Nutrition reports of children and adolescents with special health care needs estimate that up to 40 percent have nutrition risk factors that warrant a referral to a dietitian.<sup>4,5</sup>

Common nutrition problems in children and adolescents with special health care needs include the following:<sup>6,7</sup>

- Altered energy and nutrient needs
- Delayed growth
- Feeding delays or oral-motor dysfunction
- Elimination problems
- Drug/nutrient interactions
- Appetite disturbances
- Unusual food habits (e.g., pica, restrictive food choices, rumination)
- Early childhood caries, gum disease

## Screening

As with any type of health or medical concern, early identification and treatment are important to correct, control, or prevent additional harm from a nutrition problem. Table 7 outlines basic nutrition-screening parameters and criteria for referral for children and adolescents with special health care needs.

**Table 7. Nutrition-Screening Parameters and Criteria for Referral for Children and Adolescents with Special Health Care Needs**

Screening Data	Criteria for Referral to a Dietitian
<b>Anthropometric<sup>a</sup></b> Birthweight (for infants and children < 18 months) Weight/[length or height]  Height/length  Body mass index (BMI) Triceps skinfold	Birthweight $\leq$ 1,500 g Weight/[length or height] $\leq$ 5th percentile Weight/[length or height] $\geq$ 95th percentile Inappropriate growth or weight change [Length or height]/age $\leq$ 5th percentile BMI > 85th percentile Triceps skinfold (if atrophy of lower extremities > 85th percentile)
<b>Biochemical<sup>b</sup></b> Hemoglobin Hematocrit	Hemoglobin $\leq$ 11 g/100 dL Hematocrit $\leq$ 34%
<b>Clinical/Medical</b> Medical condition known to affect nutrition (e.g., vomiting, reflux), elimination problems, medications, and appetite or dental problems	A diagnosis of heart disease, cancer, diabetes mellitus, HIV/AIDS, cerebral palsy, inborn error of metabolism, cleft lip and palate, malabsorption syndrome, cystic fibrosis, renal disease, or spina bifida  Recurring vomiting or reflux, chronic diarrhea or constipation, severe dental caries, early childhood caries (baby bottle tooth decay), long-term use of medications that could affect nutrition, megavitamin use, or prolonged decrease in appetite, with weight loss or growth failure
<b>Diet/Feeding</b> Feeding method (e.g., mouth, tube, parenteral) Therapeutic diet Feeding delays or problems Significant food aversions or allergies	Tube feeding or parenteral nutrition Therapeutic diet Inability to self-feed by age 2 years Limited diet because of food aversion or allergies
<b>Other</b> Parental or professional concern	Unresolved concerns regarding diet, nutrition, or growth

Sources: Compiled from Screening Tool,<sup>8</sup> Campbell and Kelsey,<sup>9</sup> Cialone,<sup>10</sup> New Mexico Health and Environmental Health,<sup>11</sup> and Isaacs et al.<sup>12</sup>

<sup>a</sup>Growth data should be recorded and plotted on a standard growth chart; growth charts are also available for specific conditions.

<sup>b</sup>Set lab levels according to your program standards.

## Nutritional Adequacy

The energy and nutrient requirements of children and adolescents with special health care needs will vary according to their individual metabolic rate, activity level, and medical status. Specific energy calculations for certain metabolic conditions have been reported in the scientific literature. Some of the more common energy calculations are listed in Table 8. Once a desired energy level has been established and achieved, the child or adolescent should be routinely monitored to (1) ensure adequate nutrition for growth, development, and health; and (2) make adjustments for periods of stress and illness.

## Counseling

The goal of nutrition counseling for children and adolescents with special health care needs is to enable them to achieve optimal nutrition to support their growth, development, health, and level of functioning. Because of the complex nature of childhood neurodevelopmental and related disabilities, an interdisciplinary team approach to counseling and services is frequently needed to address multifaceted nutrition and feeding problems. In addition to dietitians, other health professionals (e.g., physicians; nurses; dentists; psychologists; social workers; occupational, physical, and speech therapists) may contribute to the child's or adolescent's nutrition plan and to the family's nutrition education.

Beyond general pediatric nutrition, the following additional topics should be discussed during nutrition assessments and counseling sessions for families of children and adolescents with special health care needs:

- *Effect of certain conditions on growth parameters.* Appropriate measuring equipment (e.g., wheelchair or chair scales, length boards) or alternative measurements (e.g., arm span or upper-arm segmental measurements, skinfold measurements) should be used to accommodate children and adolescents who cannot stand independently or cannot be evaluated with traditional assessment tools. Growth charts for specific conditions and illnesses may be useful (see the reference list of disorder-specific growth charts at the end of the chapter).
- *Physical activity and dietary intake.* Children and adolescents with special health care needs may have physical limitations that increase their risk of obesity.
- *Developmental level.* Children and adolescents with special health care needs may have developmental delays or neuromuscular problems that affect their eating skills. Some may need feeding evaluations and swallowing studies to determine the safest and most efficient method for feeding; some may require special eating equipment or modified textures; others may need tube feedings to supplement or replace oral feedings, especially if they have neurologic impairments.<sup>13</sup>
- *Elimination patterns.* Some children and adolescents with special health care needs have chronic elimination problems requiring medical attention. A number of factors can influence bowel function: diet, hydration, activity level, muscle tone, recent illness/health status, and use of medications. These parameters should be explored when evaluating chronic constipation or diarrhea.

**Table 8. Selected Energy Calculations for Children and Adolescents with Special Health Care Needs, by Diagnosis**

Medical Diagnosis	Energy Calculation
Down syndrome <sup>14</sup>	For children ages 5–11 years: Girls: 14.3 kcal/cm (36.3 kcal/inch) Boys: 16.1 kcal/cm (40.9 kcal/inch)
Spina bifida <sup>15,16,17</sup>	For children > 8 years who are minimally active: To maintain weight: 9–11 kcal/cm, or 50 percent of the RDA for a child of the same age To promote weight loss: 7 kcal/cm
Prader-Willi syndrome <sup>18</sup>	For all children and adolescents: To maintain growth within a growth channel: 10–11 kcal/cm To create a slow rate of weight loss and support linear growth: 8.5 kcal/cm
Cystic fibrosis <sup>19</sup>	For all children and adolescents: Calculate ideal weight based on height, using the pediatric growth chart. Multiply by the RDA for energy for age. Multiply by a factor of 1.3–1.5 (depending on the severity of the disease) to compensate for increased energy demands.
Pediatric HIV infection or AIDS <sup>20</sup>	For all children and adolescents: Monitor closely for growth, caloric intake, and clinical symptoms. Adjust energy requirements accordingly. For children and adolescents with mild or no symptoms related to HIV infection, adjust calories to 1½–2 times the RDA if growth velocity is inappropriate for age. For children and adolescents with moderate or severe symptoms, increase calories beyond those required for children and adolescents with mild or no symptoms, particularly in response to weight loss, wasting, or fever.

Source: Compiled from Culley et al.,<sup>14</sup> Ekvall,<sup>15</sup> Dustrude and Prince,<sup>16</sup> Cloud,<sup>17</sup> Pipes and Powell,<sup>18</sup> Wooldridge,<sup>19</sup> and Rothpletz-Puglia.<sup>20</sup>

■ **Medications and vitamin/mineral supplements.** Many children and adolescents with special health care needs take medications that may alter their appetite, food intake, digestion, absorption, and elimination patterns. It is important to review each medication and to educate parents about

drug/nutrient interactions or side effects that may affect nutrition. In addition, vitamin and mineral supplements should be reviewed for nutritional adequacy, safety, and need. Care should be taken to prevent unnecessary vitamin/mineral use and megadoses of certain nutrients.

■ *Nutrition and food assistance programs and community supports (as needed).* Children and adolescents with special health care needs may require many kinds of services and incur significant medical expenses. To effectively provide family-centered care, nutrition appointments should be available to families in their communities and should be coordinated with other medical appointments. Before prescribing dietary supplements or formulas for an infant, child, or adolescent, the health professional should make sure that the family has the necessary resources or can get assistance for obtaining these products. Resources for food assistance, special feeding equipment, and supplies for tube feedings or parenteral feedings will vary from state to state. Selected resources include the following: Title V Maternal and Child Health (MCH) program and Children with Special Health Care Needs (CSHCN) program; Special Supplemental Nutrition Program for Women, Infants and Children (WIC); medical assistance/Medicaid; Food Stamps Program; and private insurance. (See Tool J: Nutrition Resources.)

## Referral

Children and adolescents with special health care needs who have nutrition problems should be referred to a dietitian in their community, preferably to one who has experience in pediatric nutrition and disabilities. Pediatric dietitians may be located through university-affiliated programs, Title V-funded pediatric specialty clinics, pediatric units and outpatient departments of local hospitals, child development clinics, WIC clinics, dietitians in private practice, or the local pediatric and public-health nutrition practice groups of the American Dietetic Association. Two community-based services

for families of children with special health care needs are highlighted below.

## Early Intervention Programs

Infants and children with special health care needs who are enrolled in early intervention programs in their communities should have access to dietitians, occupational therapists, physical therapists, and speech and language pathologists with expertise in pediatrics who can address nutrition and feeding issues. Early intervention services provide community-based interdisciplinary evaluations and therapy services for infants and children with developmental delays. These programs were established through Part C of the Individuals with Disabilities Education Act (IDEA), which lists dietitians/nutritionists as personnel qualified to provide early intervention services. Nutrition outcomes and objectives should be incorporated into the Individualized Family Service Plan (IFSP) for those children with feeding and nutrition issues.

## Schools

The school system is an excellent community resource for families of children and adolescents with special health care needs. Through the National School Lunch Program and the National School Breakfast Program, children and adolescents may receive modified meals at school. Child and Adult Care Food Programs must provide meals at no extra cost for children and adolescents with special health care needs. Food substitutions and special meals to accommodate medical or special dietary needs are to be provided for children and adolescents identified by the educational system as having a disability. To receive these meal modifications, children and adolescents in special education pro-



grams must have a diet prescription on file from a health professional. The prescription must identify the disability and its effect on the child's or adolescent's diet and must state the required dietary changes and suggested meal modifications.

Children and adolescents with special health care needs who are not enrolled in a special education program must have a written order from a recognized medical authority (e.g., physician, physician assistant, nurse practitioner, or other specialist identified by the state). For children and adolescents who have chronic conditions but are not enrolled in the special education system (e.g., chil-

dren with spina bifida, cerebral palsy, diabetes mellitus, or cystic fibrosis), determinations about providing modified meals are made on a case-by-case basis. To ensure that nutrition issues are addressed in the child's or adolescent's school program, nutrition goals and objectives should be incorporated in the Individualized Education Plan or 504 Accommodation Plan for children and adolescents who have significant dietary or feeding problems.<sup>21</sup>

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# DIABETES MELLITUS

**D**iabetes mellitus is a chronic disease in which the body does not produce or properly use insulin. Insulin is a hormone manufactured by the beta cells of the pancreas that the body requires to maximally use glucose from digested food as an energy source. Diabetes mellitus is characterized by elevated glucose in the blood and urine. The goal of treatment is to manage the factors that affect blood glucose levels (e.g., insulin, food, and physical activity) to promote near-normal levels. Although the exact cause of diabetes is not known, a genetic component of the disease is recognized; environmental and immunologic factors may also play roles.

There are two types of diabetes mellitus. With type 1 diabetes mellitus, the body does not produce any insulin, and daily insulin injections are required. In contrast, persons with type 2 diabetes mellitus continue to produce insulin, but the body is unable to make enough or properly use what is made.

## Significance

More than 700,000 people in the United States have type 1 diabetes mellitus. Type 1 occurs in infants, children, adolescents, and young adults and accounts for 5 to 10 percent of all cases of diabetes mellitus.<sup>1</sup> Type 1 affects about 1 in every 600 children.<sup>2</sup>

Type 2 has typically been diagnosed after the age of 40 and accounts for 90 to 95 percent of all cases of diabetes mellitus; however, because of the increasing prevalence of childhood obesity, the

number of children and adolescents with type 2 is increasing. Community programs that promote healthy eating behaviors, regular physical activity, and healthy weight management are important for the prevention of type 2 diabetes mellitus. (See the Obesity chapter.)

The quality of care that children and adolescents with diabetes mellitus receive may affect their long-term health. Control of diabetes mellitus aims to prevent acute complications (e.g., diabetic ketoacidosis and severe hypoglycemia, which may be life threatening) and chronic microvascular and macrovascular complications, which can lead to blindness, kidney disease, nerve damage, amputations, heart disease, and stroke.

## Nutritional Adequacy

The treatment of type 1 diabetes mellitus involves careful attention to insulin administration, food intake, and physical activity to promote acceptable blood glucose and lipid levels. Many children and adolescents receive a mixed dose of rapid- and intermediate-acting insulin twice a day, before breakfast and before the evening meal. Other regimens include (a) injections of rapid-acting insulin before meals, and longer-acting insulin once or twice a day, and (b) using an insulin pump, which delivers a small dose of rapid-acting insulin continuously, and an injection of a larger dose of insulin before meals. Blood glucose monitoring two to four times per day is recommended to help identify blood glucose patterns and to adjust insulin and/or food intake.

The treatment of type 2 diabetes mellitus focuses on using the most effective method to lower blood glucose levels, whether it is lifestyle changes (e.g., eating healthy foods, increasing level of physical activity), insulin, glucose-lowering medications, or a combination of these methods. Blood glucose monitoring varies from two to four times per day depending on the method.

The goals of medical management and nutrition therapy for both types of diabetes mellitus include continued normal growth and development, sexual maturation, reduction of hyperglycemic and hypoglycemic episodes, promotion of healthy eating and physical activity, and improvement of overall health and diabetes mellitus control to reduce the risk or delay the progression of complications.

Specific guidelines for energy intake vary with the age of the child or adolescent and should be individualized on the basis of an in-depth nutrition assessment and nutrition and physical activity history. Energy requirements should initially be based on the child's or adolescent's typical food intake, pattern of growth, level of physical activity, and estimated energy allowance for age and sex.<sup>3</sup> A child or adolescent who has lost weight before diagnosis often requires additional energy for catch-up weight gain. An overweight child or adolescent diagnosed with type 2 diabetes mellitus needs guidelines for lower energy intake to promote healthy weight loss. The distribution of calories should be individualized according to desired glucose, lipid, and weight goals, but it should still be similar to those recommended for the entire population to promote a healthier lifestyle (approximately 55 to 60 percent carbohydrates, 10 to 20 percent protein, and 30 percent or less fat).<sup>4</sup>

Sucrose substituted for other carbohydrates does not promote adverse hyperglycemia in persons with diabetes mellitus; therefore, foods containing sucrose are allowed in moderation, and the variety of foods permitted in diabetic meal plans has increased.<sup>4</sup> Nutrition inadequacies may result from food intolerance or personal food preferences (e.g., lactose intolerance, vegetarian eating practices). For these circumstances, the dietitian needs to provide nutrition counseling about healthy food choices and appropriate alternatives.

## Screening

During the early course of type 1 diabetes mellitus, children and adolescents may present with symptoms of polyuria, polydipsia, polyphagia, and weight loss. At this time, a random blood glucose level over 200 mg/dL (11.1 mmol/L) or a fasting plasma glucose over 126 mg/dL (7.0 mmol/L) is sufficient to make a diagnosis.<sup>5</sup> Early diagnosis reduces the risk of more dangerous conditions (e.g., increased weight loss, dehydration, diabetic ketoacidosis).

Children and adolescents should be screened for type 2 diabetes mellitus if they are overweight (i.e., BMI greater than the 85th percentile for age and gender, weight for height greater than the 85th percentile, or weight greater than 120 percent of ideal [50th percentile] for height) and have two of the following risk factors:

- A history of type 2 diabetes mellitus in first and second-degree relatives
- Belonging to a certain race/ethnic group (i.e., American Indian, African American, Hispanic American, Asian/South Pacific Islander)



- Signs of insulin resistance or conditions associated with insulin resistance (e.g., acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome)

Screening should be done every 2 years starting at age 10 or at the onset of puberty, whichever occurs first.<sup>6</sup>

## Counseling

Nutrition counseling is essential to the effective self-management of both types of diabetes mellitus and should be presented in stages.<sup>2</sup> Family members will need to help young children with type 1 diabetes mellitus administer insulin and help young children with type 2 administer glucose-lowering medications. In addition, family members will need to help young children monitor their blood glucose levels, food intake, and physical activity. The daily tasks of diabetes mellitus management should be

taught gradually, and the responsibility for care should be shared with the maturing older child or adolescent.

Initial nutrition counseling is provided at diagnosis and prepares the child or adolescent and family for living with diabetes mellitus. During this stage, the family should be taught basic management skills (e.g., insulin administration, blood glucose monitoring, meal and snack planning). Nutrition counseling should focus on eating meals and snacks at consistent times every day, being consistent in the amount of carbohydrates eaten at each meal and snack, learning to identify food groups and portion sizes, and knowing how to recognize and treat low blood glucose levels. Recommended educational materials for the initial and subsequent stages are available from the American Diabetes Association and American Dietetic Association.<sup>7-10</sup>

Once the child (if old enough) or adolescent and family demonstrate a basic understanding of diabetes mellitus and can follow the day-to-day tasks required for its control, nutrition counseling should be offered to teach insulin adjustment, expand food choices, and allow flexibility in scheduling meals and physical activity. The family can be given guidelines on adjusting the dose of rapid-acting insulin when necessary and on varying food intake and physical activity. The dietitian can provide nutrition counseling on eating away from home, buying school lunches, eating at fast-food and other restaurants, converting nutrient information on food labels to exchanges or carbohydrate equivalents, increasing food intake for increased physical activity, and planning sick-day meals.

Counseling for intensive diabetes mellitus management should be provided to those who demonstrate competency in daily management and are highly motivated to achieve near-normal blood

glucose levels.<sup>11</sup> The focus at this stage is blood-glucose pattern identification and evaluation and the promotion of increasingly sophisticated decision-making about adjusting insulin, food intake, and physical activity. The dietitian can provide more information about the effect of food on blood glucose levels, ways to estimate carbohydrate intake more precisely, and ways to calculate carbohydrate-to-insulin ratios. Because the documented side effects of improved glucose control are an increase in hypoglycemic episodes and unwanted weight gain, intensive nutrition counseling should also include guidance on preventing and managing low blood sugar and managing weight.

## Infancy

Infants are dependent on parents to manage their diabetes. Because they cannot communicate when they experience symptoms of hypoglycemia, blood glucose goals are more liberal (100 to 220 mg/dL). Hypoglycemia should be first treated by giving the infant one-half of a carbohydrate serving (e.g., 2 oz apple juice), but more may be given if the infant's blood glucose is still low after 15 minutes. Breastmilk or infant formula is recommended throughout the first year of life, and new supplemental foods and textures should be introduced as appropriate. Parents should be taught how to read nutrition labels to determine the carbohydrate content of infant formula and baby foods (e.g., one carbohydrate serving equals 15 g carbohydrate). Rapid-acting insulin is often given after feeding to offset the infant's food intake.

## Early Childhood

Young children may exert their independence by refusing to eat certain foods or meals, and the

amount and variety of food eaten may vary considerably depending on food habits, changes in routines, and level of physical activity. Younger children may also have difficulty recognizing and verbally labeling symptoms of hypoglycemia; therefore, blood glucose goals are usually higher for this age group than for older children.

With a focus on the child's consistency of carbohydrate intake, the dietitian can provide meal patterns that specify the number of carbohydrate servings and ranges for meat and fat exchanges. Families should be taught that, in terms of the carbohydrate content of food exchanges, one bread exchange equals one fruit exchange equals one milk exchange. This information helps increase food choices and may avert food battles and rejection of food. Families should also be advised that most young children need at least three snacks per day and that flexibility in food choices will help ensure the child's cooperation.

## Middle Childhood

Children become more emotionally independent between the ages of 7 and 12 years. Motor, reading, math, and reasoning skills increase quickly, as do independence and pride in one's accomplishments. Eating at school needs to be managed carefully to promote the child's sense of well-being. Children want to eat what the other children are eating. The dietitian can help plan a meal pattern for lunch that matches the standard lunch served at school. The dietitian can also recommend convenient, favorite foods for snacks at school (e.g., granola bars, crackers, cookies) to promote consistency of food intake. On gym days, an extra snack should be provided before the physical activity to help prevent exercise-induced hypoglycemia. However, this

additional carbohydrate may not be necessary if the child's blood glucose level is greater than 100 mg/dL.<sup>12</sup> It is often helpful for the dietitian to collaborate with school personnel (e.g., teachers, food service workers) to explain the dietary management goals for the child.

Children with type 2 diabetes mellitus need continuous support and encouragement from the family to promote healthy eating behaviors, including a moderate carbohydrate intake, and regular physical activity.

## Adolescence

Adolescence is a time for further developing one's sense of identity and increasing autonomy and independence. More time is spent with friends, and the family's influence is diminished. Because social activities often revolve around food, adolescents with type 1 diabetes mellitus need a flexible meal plan that permits choice and spontaneity. Snacks may be omitted in the morning and the afternoon depending on blood glucose levels, physical activity, and weight management goals. However, the evening snack should always be kept to help decrease the risk of hypoglycemia during the night. The risk of eating disorders needs to be recognized and addressed; adolescents with diabetes mellitus may try to manage their weight by reducing or skipping their insulin. Older adolescents with varying work and school schedules may decide to begin the more flexible multiple daily insulin-injection regimens. This intensification of management will need to be coordinated with the health professional, and additional education about carbohydrates and insulin adjustment will need to be provided.

Adolescents with type 2 diabetes mellitus need continuous support and encouragement from the

family to promote healthy eating behaviors, including a moderate carbohydrate intake, and regular physical activity.

## Referral

Referral to an interdisciplinary pediatric diabetes mellitus management program with a pediatric endocrinologist, nurse, dietitian, and social worker should be considered for these groups (see Tool J: Nutrition Resources):

- Infants, children, and adolescents with newly diagnosed type 1 or type 2 diabetes mellitus
- Infants, children, and adolescents who receive multiple daily insulin injections for improved glucose control
- Older children and adolescents with frequent hospitalizations for ketoacidosis or severe hypoglycemia
- Children and adolescents with psychosocial problems

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# EATING DISORDERS

Unhealthy eating behaviors and preoccupation with body size can lead to life-threatening eating disorders (e.g., anorexia nervosa, bulimia nervosa), as described in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR).<sup>1,2</sup> (DSM-IV-TR criteria for anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified follow on pp. 160–161.)

## Significance

Eating disorders have been observed in both sexes and across socioeconomic and racial/ethnic groups. The prevalence of anorexia nervosa and bulimia nervosa is thought to be 1 to 2 percent among adolescent females. With anorexia nervosa, estimates of mortality rates from all causes vary greatly, averaging 5 to 8 percent, with some as high as 20 percent.<sup>3,4</sup> Death may be due to cardiac arrhythmia, acute cardiovascular failure, gastric hemorrhaging, or suicide. The major medical complications seen include the following:<sup>5</sup>

Cardiac arrhythmia

Dehydration and electrolyte imbalances

Delayed growth and development

Endocrinological disturbances (e.g., menstrual dysfunction, hypothermia)

Gastrointestinal problems

Oral health problems (e.g., enamel demineralization, salivary dysfunction)

Osteopenia, osteoporosis

Protein/calorie malnutrition and its consequences

## Nutritional Adequacy

The actual food intake of children and adolescents with eating disorders varies considerably and is difficult to assess. Food intake is greatly influenced by food avoidance, the duration of restrictive eating episodes, the presence of binge-eating, and other factors. Although children and adolescents with eating disorders often have unhealthy eating behaviors, supplements are not a substitute for a healthy balanced diet.

Following are the nutrition inadequacies commonly seen in children and adolescents with eating disorders:

- **Energy.** Low energy intake, sometimes less than 500 calories per day, is a hallmark of anorexia nervosa.
- **Protein.** Protein intake is often low enough to result in clinical signs of protein deficiency in children and adolescents with restrictive types of eating disorders. Meat, poultry, fish, eggs, and dairy products are good sources of protein that are sometimes avoided by children and adolescents with eating disorders.
- **Calcium.** Because children and adolescents with eating disorders typically have insufficient dietary calcium intake, which can cause bone mineral loss, it is essential to maximize intake of milk, yogurt, and other dairy products, and to use calcium supplements if needed.
- **Zinc.** When protein intake is low, zinc intake is usually limited as well. It is especially important to promote zinc- and protein-rich foods (e.g., milk, meat, whole grains) because of zinc's role in taste dysfunction and appetite.

## Diagnostic Criteria for 307.1 Anorexia Nervosa

- A. Refusal to maintain body weight at or above a minimally normal weight for age and height (e.g., weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body weight less than 85% of that expected).
- B. Intense fear of gaining weight or becoming fat, even though underweight.
- C. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.
- D. In postmenarcheal females, amenorrhea, i.e., the absence of at least three consecutive menstrual cycles. (A woman is considered to have amenorrhea if her periods occur only following hormone, e.g., estrogen, administration.)

*Specify type:*

**Restricting Type:** During the current episode of Anorexia Nervosa, the person has not regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

**Binge-Eating/Purging Type:** During the current episode of Anorexia Nervosa, the person has regularly engaged in binge-eating or purging behaviors (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

## Diagnostic Criteria for 307.51 Bulimia Nervosa

- A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - (1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances
  - (2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)
- B. Recurrent, inappropriate compensatory behavior in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.
- C. The binge eating and inappropriate compensatory behaviors both occur, on average, at least twice a week for 3 months.
- D. Self-evaluation is unduly influenced by body shape and weight.
- E. The disturbance does not occur exclusively during episodes of Anorexia Nervosa.

*Specify type:*

**Purging Type:** During the current episode of Bulimia Nervosa, the person has regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

**Nonpurging Type:** During the current episode of Bulimia Nervosa, the person has used other inappropriate compensatory behaviors, such as fasting or excessive exercise, but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

## Diagnostic Criteria for 307.50 Eating Disorder Not Otherwise Specified

The Eating Disorder Not Otherwise Specified category is for disorders of eating that do not meet the criteria for any specific eating disorder. Examples include

1. For females, all of the criteria for Anorexia Nervosa are met except the individual has regular menses.
2. All of the criteria for Anorexia Nervosa are met except that, despite significant weight loss, the individual's current weight is in the normal range.
3. All of the criteria for Bulimia Nervosa are met except that the binge-eating and inappropriate compensatory mechanisms occur at a frequency of less than twice a week or for a duration of less than 3 months.
4. The regular use of inappropriate compensatory behavior by an individual of normal body weight after eating small amounts of food (e.g., self-induced vomiting after the consumption of two cookies).
5. Repeatedly chewing and spitting out, but not swallowing, large amounts of food.
6. Binge-eating disorder: recurrent episodes of binge-eating in the absence of the regular use of inappropriate compensatory behaviors characteristic of Bulimia Nervosa.

Source: Reprinted, with permission, from the American Psychiatric Association.<sup>2</sup> © 2000, American Psychiatric Association.

- *Vitamin B<sub>12</sub>*. Intake of vitamin B<sub>12</sub> may be a concern only in those with restrictive eating practices who are also strict vegetarians and who may not consume enough dairy products or eggs to obtain the RDA of vitamin B<sub>12</sub>.

## Screening and Assessment

Early identification of children and adolescents with eating disorders has been linked to better long-term outcomes. However, it can be difficult to identify children and adolescents who have eating disorders because they may avoid medical visits; present with gastrointestinal complaints, amenorrhea, or sports injuries; or ask for a diet or drugs to help them lose weight. Parents sometimes seek medical help for their children or adolescents because of concerns about unexplained weight loss or suspicion of self-induced vomiting.

## Screening

Eating disorder screening, which can be incorporated into any health visit, includes many components of an annual physical or sports checkup. In addition to conducting the physical examination (including determination of body mass index [BMI]), the health professional should talk with the child or adolescent to obtain information about body image and weight history, eating behaviors and meal patterns, physical activity, and health history, and should administer a brief psychosocial assessment. If any warning indicators of eating disorders are present (see Tables 9 and 10), the health professional needs to evaluate further, with the use of assessments listed below.

However, the presence of a warning sign does not always indicate an eating disorder. Physically active children and adolescents may experience

**Table 9. Anorexia Nervosa: Screening Elements and Warning Signs**

Screening Elements	Warning Signs
Body Image	<ul style="list-style-type: none"> <li>■ Distorted body image</li> <li>■ Extreme dissatisfaction with body shape or weight</li> <li>■ Profound fear of gaining weight or becoming fat</li> </ul>
Eating and Related Behaviors	<ul style="list-style-type: none"> <li>■ Very low caloric intake</li> <li>■ Fasting or restrictive dieting</li> <li>■ Denial of hunger cues</li> <li>■ Erratic meal patterns or frequent meal skipping</li> <li>■ Poor appetite</li> <li>■ Difficulty eating in front of others</li> <li>■ Food seen as good or bad</li> </ul>
Health History/Examination	<ul style="list-style-type: none"> <li>■ BMI less than 20th percentile</li> <li>■ Unexplained weight change</li> <li>■ Amenorrhea</li> <li>■ Fainting episodes or frequent lightheadedness</li> <li>■ Constipation or diarrhea</li> <li>■ Bloating/nausea</li> <li>■ Hypothermia; cold intolerance</li> <li>■ Orthostatic hypotension (greater than 10 mm Hg after posture changes)</li> <li>■ Bradycardia (resting heart rate of 60 beats/minute or less)</li> </ul>
Physical Activity Behaviors	<ul style="list-style-type: none"> <li>■ Participation in physical activity with weight or size requirement (e.g., gymnastics, wrestling, ballet)</li> <li>■ Overtraining or compulsive attitude about physical activity</li> </ul>
Psychosocial	<ul style="list-style-type: none"> <li>■ Depressed affect</li> <li>■ Frequent thoughts about food or weight</li> <li>■ Feeling pressure from others to be a certain shape or weight</li> <li>■ Perfectionist</li> <li>■ History of physical or sexual abuse or other traumatizing life event</li> </ul>

Sources: Perkins et al.,<sup>6</sup> Adams and Shafer,<sup>7</sup> and American Medical Association.<sup>8</sup>

**Table 10. Bulimia Nervosa: Screening Elements and Warning Signs**

Screening Elements	Warning Signs
Body Image	<ul style="list-style-type: none"> <li>■ Distorted body image</li> <li>■ Extreme dissatisfaction with body shape or weight</li> <li>■ Profound fear of gaining weight or becoming fat</li> </ul>
Eating and Related Behaviors	<ul style="list-style-type: none"> <li>■ Wide variations in caloric intake</li> <li>■ Fasting or restrictive dieting (episodic)</li> <li>■ Binge eating</li> <li>■ Unexplained disappearance of large quantities of food</li> <li>■ Denial of hunger cues</li> <li>■ Erratic meal patterns or frequent meal skipping</li> <li>■ Poor appetite</li> <li>■ Difficulty eating in front of others</li> <li>■ Food seen as good or bad</li> </ul>
Health History/Examination	<ul style="list-style-type: none"> <li>■ Unexplained weight change or fluctuations greater than 10 lbs</li> <li>■ Irregular menses</li> <li>■ Constipation or diarrhea</li> <li>■ Bloating/nausea/abdominal pain</li> <li>■ Dental caries</li> <li>■ Orthostatic hypotension (changes greater than 10 mm Hg after posture changes)</li> </ul>
Physical Activity Behaviors	<ul style="list-style-type: none"> <li>■ Participation in physical activity with weight or size requirement (e.g., gymnastics, wrestling, ballet)</li> <li>■ Overtraining or compulsive attitude about physical activity</li> </ul>
Psychosocial	<ul style="list-style-type: none"> <li>■ Depressed affect</li> <li>■ Frequent thoughts about food or weight</li> <li>■ Feeling pressure from others to be a certain shape or weight</li> <li>■ Perfectionist</li> <li>■ History of physical or sexual abuse or other traumatizing life event</li> </ul>

Sources: Perkins et al.,<sup>6</sup> Adams and Shafer,<sup>7</sup> and American Medical Association.<sup>8</sup>

occasional gastrointestinal complaints, dizziness, irregular meal patterns, and menstrual irregularities without having an eating disorder. Consultation with health professionals experienced in eating disorders can help distinguish “typical” child or adolescent eating behaviors from a more serious eating disorder.<sup>9</sup>

Note that bulimia nervosa can also damage teeth. Vomiting exposes the teeth to acidic vomitus, which demineralizes the enamel and slowly dissolves the teeth. The health professional should refer an individual to a dentist if damage is apparent. With bulimia nervosa, enlargement of the parotid glands may also be present.

## Assessment

If the child or adolescent is at high risk for an eating disorder (based on the warning signs listed in Tables 9 and 10), a number of assessments should be performed in addition to the initial screening. These assessments are best done by an interdisciplinary team of health specialists working together to evaluate the child or adolescent at high risk.

## Medical History and Physical Assessment

- Rule out organic illness as an explanation for weight loss or menstrual abnormalities.
- Ask about history of binge-eating and/or compensatory behaviors (e.g., self-induced vomiting; laxative, diuretic, or diet pill use; excessive physical activity). If the child or adolescent is diabetic with elevated hemoglobin A<sub>1c</sub> levels, evaluate the possibility of insulin-withholding as a means of weight control.

- Repeat assessment for orthostatic changes in pulse and blood pressure.
- Laboratory tests are not definitive markers for diagnosing the presence of eating disorders; children and adolescents with eating disorders often have results within the normal range when screened with the following tests:

- *Amylase*. Pancreatic amylase is elevated in some children or adolescents who vomit regularly.
  - *Calcium and magnesium*. Hypocalcemia (decreased calcium in the blood) and hypomagnesemia (decreased magnesium in the blood) may be observed with laxative abuse, malnutrition, and inadequate nutrition intake.
  - *Potassium*. Hypokalemia (decreased potassium in the blood) may be observed with prolonged malnutrition or with purging.
  - *Urine ketones*. These compounds may be elevated because of chronic fasting or inadequate intake.
  - *Urine specific gravity*. This measurement may be elevated (suggesting dehydration) or may be low because of excessive fluid intake.
  - *Other tests*. Although liver function tests and thyroid tests may be abnormal, both will usually return to normal if the child or adolescent resumes eating healthy foods regularly.
- Assess the need for hospitalization.<sup>10</sup> (See the Referral and Management section on the following page.)

## Nutrition Assessment

- Request a 3- or 5-day food/physical activity record that provides information on the specific types and quantities of food consumed, as well as

the places and times food was eaten, the number of other people present, and the types of physical activities performed during the time period.

Some children and adolescents do not want to talk about their eating and physical activity behaviors, and are more likely to answer health-focused questions phrased in a supportive, non-blaming way. For example, “To make sure your body is getting everything it needs, I’m going to ask you a couple of questions about what you are eating and drinking. Can you tell me everything you had to eat and drink yesterday?”

- Take the child’s or adolescent’s health and weight history, including history of binge eating, purging (e.g., self-induced vomiting), use of laxatives or diuretics, and level of physical activity.
- Rule out clinical nutrition deficiencies as causes of symptoms such as hair loss or dry skin.
- Assess triceps skinfold and arm-muscle circumference for estimate of body fat stores and muscle mass.

### **Psychosocial Assessment**

- Interview the child or adolescent and the parents about circumstances surrounding the onset of changes in eating behavior or weight.<sup>11</sup>
- Assess for depression, and rule out other psychiatric disorders (e.g., anxiety disorder, obsessive-compulsive disorder, bipolar disorder) as primary or comorbid conditions that might explain changes in eating behavior and preoccupation with body weight and shape.<sup>11</sup>
- Assess risk of suicide.<sup>11</sup>

## **Referral and Management**

Comprehensive assessment and treatment require an interdisciplinary team that has experience in treating eating disorders in children or adolescents and that can provide nutrition counseling, medical care and monitoring, psychiatric evaluation, and individual and/or family therapy. Referral to an eating disorder treatment program should be considered if an interdisciplinary team is not available or if hospitalization is indicated.

Hospitalization may be needed if the child or adolescent is severely malnourished, shows metabolic disturbances, or is at risk for suicide.<sup>10</sup> If the child or adolescent has anorexia nervosa, it is essential to ensure a gradual and carefully planned return to normal eating to prevent the “refeeding syndrome” associated with hypophosphatemia. Close monitoring of food intake and output, fluid status, physical activity, and body weight is necessary to accurately adjust the dietary recommendations for steady weight gain.

At minimum, children and adolescents with eating disorders need to be evaluated and followed long-term by a physician, a mental health professional (including at least one evaluation by a psychiatrist), and a dietitian. Because of the complexity of these disorders and the need to set clear, consistent behavioral limits, teamwork is essential.

## **Counseling**

The main goals in counseling children and adolescents with eating disorders are to enable them to achieve and maintain a BMI within the normal range (between the 15th and 85th percentiles), function well at school or work, and resume healthy eating behaviors. Nutrition counseling

needs to be individually tailored, and coordinated with the medical and psychiatric/psychological management of the child or adolescent. Following are four interim nutrition goals for children or adolescents who have eating disorders, with specific strategies dietitians can use to help them achieve these goals:

- Improve and restore nutritional adequacy.
  - Set guidelines for food intake, based on the number of servings of specific foods (not calories).
  - Recommend taking a vitamin and mineral supplement daily.
  - Encourage children and adolescents to select foods that meet daily nutrition needs.
- Maintain body weight (avoid additional weight loss or large weight fluctuations).
  - Challenge the child's or adolescent's body image, comparing it with appropriate body weights and shapes.
  - Encourage the child or adolescent to avoid self-weighing.
  - Dispel myths about how weight loss occurs and explain why bodies store fat and why some fat from food is essential.
- Decrease the frequency of binge-eating and compensatory behaviors.
  - Encourage the child or adolescent to eat three scheduled meals and one or two snacks each day.
  - Help the child or adolescent identify situations that may trigger binge-eating (e.g., parties), and plan ways to manage these situations.
- Seek support from the family.

Discourage family members from making comments to the child or adolescent about appearance, weight, or eating behaviors.

Ask parents to remove all diet products and books, diet foods, and diet pills from the home.

Establish and maintain regular family meals.

Health professionals can help prevent eating disorders by promoting a positive body image and healthy attitudes toward food and physical activity.

## **Infancy and Early Childhood**

Parents are usually very aware of their young children's eating habits and may have concerns about their nutritional adequacy, their risk of obesity, or their avoidance of foods. Eating disorders are not evident during this time.

- Emphasize the wide range of normal body weights for infants and children, and reassure parents who mistakenly believe their infant or child is overweight.
- Discourage restricted eating regimens for healthy infants and children.
- Promote feeding relationships that let infants and children respond to hunger and satiety cues.
- Encourage families to eat meals together regularly. Discuss ways to keep mealtimes pleasurable and to minimize struggles around food.
- Encourage parents to emphasize regular physical activity and promote a positive body image.
- Discourage the use of food to manipulate behavior, either as punishment or as incentive.

## Middle Childhood

The eating and physical activity behaviors of children ages 5 to 10 years are affected a great deal by their expanding social world, and parents may feel they do not have much influence during this time. Parents need to be reminded that family behaviors and attitudes still significantly shape children's behaviors, and children should be encouraged to have a positive attitude toward food and a positive body image. Although eating disorders are less common in middle childhood than in adolescence, attitudes about body shape and size are developing, and experimentation with dieting has been observed.

- Suggest that parents review the kinds of foods available at home, especially snack foods and foods packed in school lunches. Encourage a balance of healthy foods.
- Discourage meal skipping or other restrictive eating behaviors, and encourage families to eat meals together whenever possible, at least once a day.
- Instruct family members not to tease the child about body weight, shape, or physical appearance and to avoid unhealthy dieting themselves.
- For 8- to 10-year-olds, briefly outline the ways their bodies will be changing as they experience puberty.
- Encourage regular physical activity for both the child and the family, with an emphasis on activities that the child enjoys and that contribute to overall fitness (see the Healthy Eating and Physical Activity chapter).



## Adolescence

Puberty is the major physical hallmark of adolescence, with the normal biological changes sometimes viewed negatively by females (e.g., body fat deposits, menses) or more positively by males (e.g., greater height and muscle mass). Food and physical activity behaviors are often driven by the desire for physical attractiveness, by sports performance, and by friends' behaviors. Eating disorders develop most often during adolescence. Both adolescents and their families need nutrition counseling, but it is recommended that adolescents receive guidance individually.

- Describe pubertal changes, preferably before they occur, and be available as a “safe” person with whom adolescents can talk about body issues. With females, emphasize that body fat increases during this growth period; with males, discuss the wide variability in the timing of growth and maturation.
- Use BMI charts to assess an adolescent’s relative weight, and discuss the broad range of weights considered normal for body shape and size.
- Discourage restrictive dieting or meal-skipping.
- Encourage regular but not excessive physical activity to maintain health and weight.
- Instruct family members to avoid teasing the adolescent about body weight, shape, or physical appearance and to avoid unhealthy dieting themselves.
- For overweight adolescents, carefully phrase recommendations for weight loss, and help them identify behaviors they can change.

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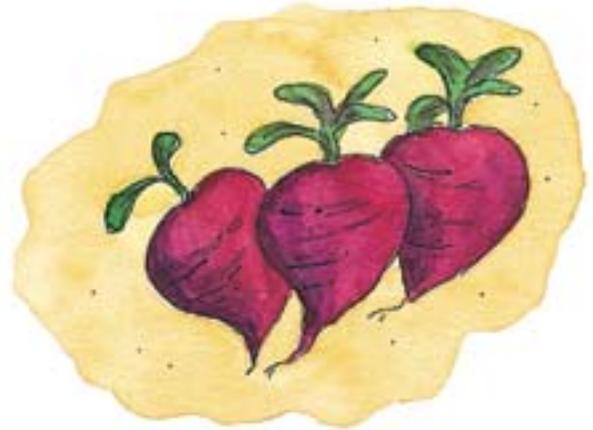
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# FOOD ALLERGY

The term “food allergy” is often misused. Only about 5 percent of all adverse reactions to foods and food additives in the general population are true allergies.<sup>1</sup>

Generally, there are two broad categories of adverse reactions to foods: food allergy/hypersensitivity, and food intolerance.<sup>2</sup>

Food allergy/hypersensitivity refers to a condition in which a person’s immune system responds to the ingestion of a particular food protein. (This reaction may or may not be mediated by immunoglobulin E [IgE].) Trace amounts of the allergenic food may be sufficient to trigger an adverse reaction. Symptoms can occur within seconds or as long as 72 hours after exposure and can include itching, hives, rash (eczema), vomiting, diarrhea, abdominal pain, or swelling of the lips, tongue, and face.

All non-immune-mediated reactions to foods are referred to as food intolerance. This condition includes (a) intolerance because of a lack of an essential enzyme (e.g., lactose intolerance); (b) reactions to pharmacologically active chemicals in foods (e.g., MSG); (c) reactions to naturally occurring pharmacologically active agents in foods (e.g., phenylethylamine in chocolate); and (d) reactions to toxic compounds in foods (e.g., aflatoxin). The adverse response is usually dose-dependent.

The terms “food sensitivity” and “adverse reaction to food” are synonymous and may be used to describe either immune-mediated or non-immune-mediated responses to food.



## Significance

Food allergies are particularly prevalent in infants and children because their digestive and immune systems are still immature.<sup>1,3</sup> As children mature, food allergies are often outgrown. Food allergies diagnosed in children are more likely to be outgrown than those diagnosed in older children. However, the more severe the initial reaction to the food, the longer it takes for the child to become tolerant of the food.<sup>2</sup> Some food allergies are lifelong.

Three nutrition-related issues emerge with food allergies. First, food allergies may be greatly reduced or delayed in children when families at high risk for food allergies are identified through screening and when appropriate dietary and environmental measures are taken early in the child’s life.<sup>4,5</sup> Second, the most effective means of preventing adverse reactions and developing tolerance is removing the

offending food or substance from the child's diet.<sup>3</sup> Third, children's risk of nutrition deficiencies and feeding problems is greater when any restricted diet is used during this critical time of growth and development.<sup>3,6</sup>

## Diagnosis

Diagnosis and management of food allergy ideally involve a partnership between a physician trained in food allergy diagnosis and a dietitian with expertise in food allergy management. Diagnosis requires a medical history, diet history, and physical examination, and may include immunologic testing (e.g., skin tests, radioallergosorbent test [RAST]) and an elimination diet and food challenge.

When taking an infant's or child's medical history, the health professional must rule out medical conditions that may mimic food allergies (e.g., gastroesophageal reflux). Parents should come prepared to describe the infant's or child's allergic symptoms (including their timing, duration, and frequency) and the circumstances under which the infant or child was exposed to the food (including the quantity of food involved and other foods that might be involved). It may be helpful for parents to keep a diary of the infant's or child's baseline diet and signs and symptoms for 5 to 7 days; all feedings, meals, and snacks (including the amount of formula, medications, vitamin/mineral supplements, and actual foods consumed) and allergic signs and symptoms should be recorded.<sup>1</sup> For exclusively or partially breastfed infants, a similar diary of the mother's diet and the infant's signs and symptoms should be kept. A diary will not only provide objective dietary information but also be invaluable when potential food culprits are not obvious from the medical history, and a food elimi-

nation diet and food challenge need to be considered.

In the case of a severe life-threatening reaction, the potential offending agent may often be clearly identified in the history by the timing of the response. Because a food challenge would never be used to confirm an allergy in this situation, a blood test for IgE-specific food antibody may be used to support a presumed diagnosis of food allergic reactions (i.e., anaphylactic reaction). Families of infants, children, and adolescents with a severe food allergy should be instructed in emergency procedures, such as providing a shot of epinephrine, followed by a visit to the hospital emergency room.<sup>1</sup>

Most of the standard immunologic tests are of limited value in detecting food allergies, unless used with the child's medical and dietary history.<sup>1</sup> With few exceptions (e.g., eggs, nuts, fish), skin tests and blood tests for food allergens may be misleading or unreliable because a child may have IgE antibodies without symptoms, the reaction may not be mediated by IgE antibodies, or the food may cause a nonspecific skin irritation.<sup>3</sup>

Once a food allergy is suspected, the only reliable way to diagnose it is to use an elimination diet, followed by a challenge or a reintroduction of foods one by one, unless the expected reaction (e.g., anaphylaxis) is life threatening.<sup>3</sup> Although the process of gradually eliminating and then reintroducing foods may be tedious, the ultimate goal is to identify the antagonistic foods and develop a diet that will provide optimal nutrition without those foods.

An elimination diet can vary in the number of foods eliminated. Because an infant's or child's diet should not be more restricted than is absolutely necessary, even for a short time, the number of foods to be eliminated should be carefully consid-

ered. Factors in the decision include the severity of the infant's or child's symptoms, the number of potentially unsafe foods, the availability of affordable alternative infant formulas or foods, and the family's level of commitment and ability to carry out the elimination. If several foods are considered potential culprits, they may need to be prioritized, with the most likely offenders eliminated first.<sup>1</sup>

The elimination diet should not be followed indefinitely, only long enough for the child to become symptom-free. This period may vary depending on the severity and variability of the symptoms. Seven to 14 days may be enough in some circumstances; up to 4 weeks may be required in others. With children younger than 7 years, highly restricted diets should never be used for longer than 10 days.<sup>1</sup>

With the exclusively breastfed infant, it may be necessary for the mother to follow an individualized elimination diet (with appropriate supplementation) until the infant shows maximum relief from symptoms. A formula change may be all that is necessary for the exclusively formula-fed infant.<sup>1,3</sup>

Complete or partial symptom relief during the elimination phase strongly suggests that the infant's or child's symptoms were triggered by one or more of the eliminated foods. If there is no measurable improvement during the elimination period, several explanations are possible: (a) No food sensitivity exists, or at least none to the eliminated items; (b) there was poor compliance with the elimination diet, either intentionally or unintentionally; (c) other foods are causing the reaction; or (d) the symptoms were produced by other conditions or illnesses during the elimination phase.<sup>1</sup>

Challenges of the eliminated food(s) should be performed before restricted diets are implemented. No food challenge is without risks. If there is even a

remote chance of a severe adverse reaction, the challenge should be carried out with appropriate medical support. Challenges should never be done with potentially life-threatening foods. Generally, a challenge involves testing one food (or one food component at a time) in its purest form, starting with a very small amount and gradually (every 4 hours) increasing the portion size to an equivalent meal-sized portion. If an adverse response occurs, no further testing of that food is required. New foods should be tested only when symptoms from previous challenges have cleared.<sup>3</sup>

## Nutritional Adequacy

For infants and children with food allergies, achieving a nutritionally adequate diet that supports growth and development can be difficult. Unless foods with equal nutrient value are substituted for the allergenic foods, or appropriate supplementation is given, there is an increased risk of insufficiency for some nutrients. For example, the diets of children who are allergic to dairy products should be checked for calcium and vitamin D content, as well as for protein, vitamin A, and riboflavin adequacy. The child who is allergic to wheat or grain may be at risk for iron deficiency.

Malabsorption (i.e., inadequate intestinal absorption of nutrients from food) may occur secondary to food allergy and sensitivity, increasing the likelihood of a nutritional deficiency.<sup>5</sup> A deficiency may also occur with diets that are more restrictive than necessary because of parents' concern about the infant's or child's safety or their incomplete follow-through with the necessary food challenges after the elimination diet.

Achieving a nutritionally adequate diet is further complicated by many children's aversion to

new foods. Alternatives to the eliminated foods may be refused. Anxious about their child's diet, parents may pressure the child to eat, which may lead to food struggles, an increase in the child's pickiness, and frustration all around.

Periodic nutrition counseling is essential for children with food allergies and their families to assess the nutritional adequacy of the child's diet and to prevent or address eating problems.

## Counseling

Nutrition counseling for children with food allergies and their families should address food selection and the feeding relationship (i.e., all of the interactions between the parents and the child that involve food). The logistics of avoiding the allergenic foods may take priority at the start of counseling; helping the parents provide a reasonable framework for healthy eating behaviors may be more pertinent at follow-up sessions.

Once the food allergy has been diagnosed, eliminating the offending food from the infant's or child's diet is the best way to manage the allergy.<sup>5,7</sup> The child's family will need to be shown how to avoid the allergenic food, including how to identify potential hidden sources and read labels. Families should be given practical advice on substituting other foods to provide missing nutrients, cooking with alternative foods, altering recipes and meals, avoiding cross-contamination, and coping with special occasions and restaurant meals; they should also be given resources for support.<sup>1,7</sup> The issue of finding suitable alternative products will require ongoing attention. Parents should be taught how to conduct periodic food challenges to see if the child has developed any tolerance to allergenic foods. (These should be done under medical supervision if

there is a risk of serious reaction.) To ensure nutritional adequacy, a comprehensive assessment of the child's growth and diet is suggested twice a year for the young child and annually for the older child.

Feeding-behavior problems are more likely to develop in children who are on special diets, who have been ill, who are at risk for health or nutrition disorders, and whose parents are excessively concerned about their child's diet.<sup>6</sup> Parents will be better prepared to prevent eating problems when they understand how these problems develop and are equipped with strategies to avoid them. Despite the allergy's extensive impact on the child's daily life, the parents must try to prevent distortions in how the child approaches food and to keep eating as much of a non-issue as possible. Although the parent decides which foods to offer and provides the meal and snack structure, the child is always responsible for how much he eats.<sup>6</sup>

Depending on the family's coping skills, having a child with a food allergy can be quite stressful, demanding considerable time and emotional energy. Health professionals can help families feel competent to handle the diet and eating problems.

## Prenatal

It is usually unnecessary to restrict a woman's diet during pregnancy beyond eliminating the foods to which she is allergic. Infants are at high risk for developing food allergies if there is a family history of food allergies (i.e., both parents are atopic, one parent and one sibling are atopic, one sibling is atopic). To minimize the risk of an infant developing a food allergy, pregnant woman can reduce (not eliminate entirely) their intake of the most highly allergenic foods (e.g., dairy products, eggs, nuts, fish, shellfish), particularly during the third trimester. Nutritionally equivalent foods or

supplements should be substituted for the restricted items.<sup>3</sup>

For families with a history of food allergies, this is an important time to make decisions about infant feeding, because the mother's and infant's diets may minimize, delay, or prevent food allergies in the infant. Recommendations to restrict the diet should be cautiously given only to those at risk and with the support of a dietitian or other health professional.<sup>4,5</sup>

## Infancy

For the infant at risk for developing food allergy, exclusive breastfeeding should be encouraged for a minimum of 6 months.<sup>1,3-5</sup> Foods confirmed to cause allergy symptoms in the infant (as determined by elimination and challenge) should be eliminated from the mother's diet while she is breastfeeding.<sup>3</sup> When the risk of allergy is high, the mother can avoid all sources of the most highly allergenic foods (e.g., dairy products, eggs, nuts, fish, shellfish) in an effort to delay the onset of food allergy.<sup>3,4</sup> The mother's diet should be supplemented with 1,500 mg of calcium, and she should receive nutrition counseling to promote nutritional adequacy.

If infant formula is required either to supplement breastmilk or to be used exclusively, a hypoallergenic formula is the best choice. Regardless of the parents' concern about their infant's allergy and diet restrictions, the mother should feed the infant on demand.

Ideally, the introduction of solid foods should be delayed until 6 months of age.<sup>1,3,4</sup> One new single-ingredient food can be introduced every 7 days or more, after which parents should look for signs of intolerance (e.g., rash, vomiting, diarrhea). The introduction of cow's milk should be delayed

until 1 year of age; eggs until 2 years of age; and peanuts, other nuts, fish, and shellfish until 3 years of age.

## Early Childhood

A clear division of responsibility in feeding must be established at this age, one in which the parent determines the structure of meals and snacks and selects the foods to be offered, and the child determines the amount eaten.<sup>6</sup> Some parents of children with food allergies are anxious about food and may pressure their children to eat. Food-refusal or food-control issues may result. When a child with a food allergy is able to choose freely from the foods offered at family meals, or when family members have accommodated a food allergy by changing the way they eat, there is less likelihood of food-related struggles. Other caregivers should be encouraged to provide an approach to feeding consistent with that of the parents.

Children may be taught about allergen avoidance through stories and games (e.g., guessing games at the grocery store). Because many food allergies are outgrown, children may be tested for tolerance every 3 to 6 months, if medically appropriate.

## Middle Childhood and Adolescence

Because older children and adolescents with food allergies have an increasing number of opportunities to eat away from home, they need to gradually assume responsibility for avoiding the foods they are allergic to. In assuming this responsibility, they will be less likely to perceive the avoidance as a restriction imposed by their parents. The health professional can discuss the food allergy with the older child or adolescent and do controlled chal-

lenges, if medically appropriate, so that he or she recognizes the adverse effects and understands the need to avoid the food.

## Referral

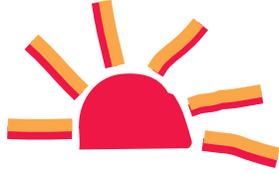
Families of children and adolescents with food allergies can be referred to organizations such as the Food Allergy Network. (See Tool J: Nutrition Resources.)

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## Managing a Child's Severe Food Allergy

**M**iya Kim is 4 years old and about to start a half-day preschool program that meets three times a week. Miya's mother is apprehensive because Miya has serious allergic reactions to some foods. When Miya was 6 months old, she ate a spoonful of mashed potatoes that contained milk and cheddar cheese; she immediately developed hives and within minutes had difficulty breathing. Miya was rushed to the hospital, where she was diagnosed with a severe allergy to cow's milk. So far, it has been determined that she is allergic to milk and other dairy products, peanuts, and shellfish. Mrs. Kim has learned how to treat Miya's anaphylactic reactions (severe allergic reactions) with a shot of epinephrine, followed by a visit to the hospital emergency room.

Because of the severity of Miya's allergic reactions, her mother has monitored Miya's food intake very carefully. Mrs. Kim is concerned that when Miya begins the preschool program, she will be exposed to allergenic foods that may be served as a classroom snack.

Mrs. Kim discusses her concerns with a dietitian, Sue Panzarine, at her preschool screening visit. Ms. Panzarine tells Mrs. Kim that she can understand her concerns. She is pleased to learn that Mrs. Kim has taught Miya how to ask about ingredients in the foods she is offered, and that Mrs. Kim and her daughter have practiced these skills at restaurants and friends' homes. Miya also understands the symptoms of her allergic reactions and knows the importance of telling an adult as soon as the symptoms occur. Ms. Panzarine shows Mrs. Kim a videotape for parents that explains food allergies and how to treat them. She suggests that Mrs. Kim meet with the teachers and program director at the preschool to discuss these concerns and to show the videotape to Miya's teachers.

One week before preschool is scheduled to begin, Mrs. Kim meets with the teachers and program director to discuss Miya's needs. Together, they view the videotape on allergic reactions and Mrs. Kim explains how to treat an anaphylactic reaction.

Mrs. Kim also gives the staff a list of snack foods that are safe for Miya and a list of allergenic ingredients of concern.

On the first day of class, Miya and her mother arrive early. Mrs. Kim meets with the other parents and gives each of them a letter that introduces Miya and explains her food allergies. Mrs. Kim stays during the first class to answer questions from the teachers and parents. She is reassured to discover that everyone is willing to ensure a safe and healthy learning environment for Miya.

# HUMAN IMMUNODEFICIENCY VIRUS

**H**uman immunodeficiency virus (HIV) attacks the immune system, the body's defense against infection, making the body less able to fight disease. HIV infection is considered to have progressed to acquired immune deficiency syndrome (AIDS) when the infected person develops an opportunistic infection or cancer (i.e., one that might not have developed if HIV had not been present) or when the person has a "helper" T-cell count of less than 200/mm<sup>3</sup> of blood. T-cells help infection-fighting antibodies form in the blood and are weakened or killed by HIV.

## Significance

The first cases of pediatric AIDS were reported in 1982. Since then, 12,969 cases of AIDS in infants, children, and adolescents have been reported to the Centers for Disease Control and Prevention (CDC). Males account for 53 percent of AIDS cases in this group, and females account for 47 percent. African Americans are disproportionately affected by AIDS, constituting 56 percent of AIDS cases reported to CDC. In contrast, the percentage of cases reported among Hispanics is 22 percent, 20 percent among non-Hispanic whites, and 2 percent among Asian/Pacific Islanders and American Indians/Alaska Natives.<sup>1</sup>

Cultural and racial factors must be considered in HIV prevention and intervention efforts, as well as other social and economic factors (e.g., poverty, underemployment, lack of access to health care). These factors affect the health status of all Americans, but disproportionately affect the health status

of African Americans, Hispanics, Alaska Natives, and American Indians.<sup>2</sup>

## Symptoms

Symptoms of HIV infection in infants, children, and adolescents include the following:

- Failure to gain weight and grow
- Chronic diarrhea without a specific cause
- Enlarged liver and spleen
- Swollen lymph nodes
- Chronic yeast infections (e.g., candidiasis, thrush)
- Pneumonia and other bacterial, viral, fungal, and parasitic infections

In addition, developmental delays are common in children and adolescents with HIV. However, many are infected with HIV for many years before developing symptoms.<sup>3</sup>

## Transmission

Almost all infants, children, and adolescents with HIV get the virus from their mothers in the period shortly before and after birth, a process called perinatal transmission. Approximately 25 percent of pregnant women with HIV not receiving zidovudine or other preventive therapy transmit the virus to their infants. Most perinatal transmission, which causes 50 to 80 percent of HIV infections in infants, children, and adolescents, occurs late in pregnancy or during birth.<sup>4</sup> Although the precise mechanisms are unknown, researchers believe that HIV may be

transmitted when maternal blood enters the fetal circulation, or by mucosal exposure to the virus during labor and delivery. The role of the placenta in maternal-fetal and maternal-infant HIV transmission is unclear and the focus of current research.

HIV may also be transmitted from mothers with HIV to their infants through breastmilk. Recent studies suggest that breastfeeding increases the risk of HIV transmission to infants by approximately 14 percent. The World Health Organization (WHO) recommends that all women with HIV be advised of both the risks and benefits of breastfeeding so that they can make an informed decision. In countries where safe alternatives to breastfeeding are readily available and economically feasible, this alternative should be encouraged. In general, in developing countries, the benefits of breastfeeding, in terms of reduced risk of illness or death caused by other infectious diseases greatly outweigh the potential risk of HIV transmission.<sup>5</sup>

HIV is not transmitted by casual contact. In addition to maternal transmission of HIV to the fetus, HIV is commonly transmitted in the following ways:<sup>6</sup>

- Sharing of HIV-contaminated needles for intravenous drug use
- Exchange of body fluids (i.e., semen, vaginal fluid) during sexual activity with a person who has HIV
- Receipt of HIV-infected blood or blood products (e.g., during treatment for coagulation disorders)

HIV is less commonly transmitted in these ways:<sup>6</sup>

- Breastfeeding
- Puncturing of skin with a needle containing HIV-infected blood

- Exposure of open skin or mucous membranes to body fluids (i.e., blood, semen, vaginal fluid) of someone infected with HIV

A small number of children and adolescents are infected through sexual or physical abuse by HIV-infected adults.<sup>7</sup>

## Treatment

There is no cure for HIV/AIDS. Researchers are still trying to develop a vaccine for HIV.<sup>8</sup> A number of drugs have been developed that fight HIV by inhibiting its growth. Protease inhibitors have been proven to be effective in lowering the amount of HIV in the blood. Four protease inhibitors—nelfinavir, ritonavir, indinavir, and saquinavir—are now approved for infants, children, and adolescents with HIV.

Highly active antiretroviral therapy (HAART) is helping people with HIV/AIDS live longer. This aggressive treatment, developed to reduce a person's viral load to undetectable levels, usually includes a combination of protease inhibitors and reverse transcriptase inhibitors. HAART is strong enough to reduce HIV levels in the blood to very low levels and maintain these levels longer than was previously possible.

Herbal products are not recommended for infants, children, and adolescents. Parents considering giving their infant, child, or adolescent with HIV an herbal product are encouraged to first discuss their plans with a health professional.<sup>9</sup> It is important for parents and health professionals to maintain open communication regarding the use of these products, because little is known about their safety and efficacy, and how they interact with HIV medications. Herbs may increase the body's ability to absorb medications; others may interfere with

absorption. Herbs that interfere with the body's absorption of antiviral medications may allow HIV to multiply and become resistant. Herbs that increase medication potency may cause severe medication side effects. In addition, the smaller bodies of infants, children, and adolescents with HIV increase the risk of giving them toxic dosages. Those who are malnourished are at even higher risk for side effects when exposed to potentially harmful products.<sup>9</sup>

## Nutrition Supervision

Many infants, children, and adolescents with HIV do not gain weight or grow normally. Infants and children with HIV frequently are slow to reach important milestones in motor skills (e.g., crawling, walking) and cognitive development (e.g., talking). As the disease progresses, many children and adolescents develop neurologic problems such as difficulty walking, seizures, mental retardation, and cerebral palsy.<sup>10</sup>

Infants, children, and adolescents with HIV are at high risk for compromised nutrition status from numerous causes (e.g., anorexia nervosa, involuntary weight loss or wasting, chronic infection, fever, inadequate nutrition intake, nausea, vomiting, diarrhea, malabsorption, metabolic disturbances, lack of food, depression, side effects of medications and other treatments).<sup>11</sup> As infants, children, and adolescents with HIV become more ill, they may suffer from chronic diarrhea caused by opportunistic pathogens (e.g., salmonella, cryptosporidiosis).

Eating healthy foods to promote weight gain and growth is especially important for infants, children, and adolescents with HIV. Not only are these infants, children, and adolescents growing, they are dealing with the impact of HIV on their bodies and coping with the side effects of treatment. Good

nutrition helps prevent infections related to weight loss or wasting. Good nutrition is also vital for optimal growth and development, which may be more difficult for infants, children, and adolescents with HIV to achieve.

## Assessment

A dietitian should complete a baseline nutrition assessment as soon as possible after an infant, child, or adolescent is diagnosed with HIV, in order to initiate appropriate interventions aimed at the prevention or treatment of malnutrition and compromised growth. A nutrition assessment should be conducted at least every 6 months. More frequent evaluation and intervention are warranted when clinical symptoms or growth abnormalities are present.

A complete nutrition assessment includes measuring and plotting weight, length or height, head circumference (up to 3 years of age), and body composition. Body composition can be evaluated using skinfold measurements or bioelectrical impedance. Weight and length or height growth velocities should be evaluated. Deceleration of growth velocities indicates the need to evaluate for nutrition intervention.<sup>12,13</sup>

The biochemical markers that should be a standard component of evaluation are albumin, prealbumin, hemoglobin or hematocrit, cholesterol, and triglycerides. If micronutrient deficiencies are suspected, specific serum assays should be conducted.<sup>12,14</sup>

The nutrition intake of an infant, child, or adolescent with HIV should be assessed using 24-hour recall, food records, and/or food frequency questionnaires. Signs of inadequate nutrition intake or excessive nutrient losses through diarrhea or vomiting are important to investigate, and nutrition intervention should be incorporated in the infant's, child's, or adolescent's nutritional care plan.

## Counseling

- Consult a dietitian for assistance in designing a healthy eating plan.
- Serve three healthy meals per day. Encourage snacks, especially if weight loss and nutrient deficiencies are apparent.
- Offer healthy foods high in protein. Meat products (e.g., beef, fish, poultry) and dairy products (e.g., milk, cheese, yogurt) are good sources of protein.<sup>15,16</sup> Soy products are also good sources of high-biological-value protein and can be used to augment, or used as a substitute for, meat and dairy products.
- Encourage the consumption of plenty of fluids.
- Keep the consumption of foods containing simple carbohydrates (e.g., candy, soda) to a minimum.

Infants, children, and adolescents with HIV are at increased risk for nausea, diarrhea, weight loss, difficulty taking medications, and vitamin and mineral deficiency. Following are tips to ensure proper nutrition:

### ***Nausea***

- Offer small meals every 2 hours and fluids as tolerated every 1 to 2 hours.
- Serve plain foods (e.g., rice or pasta, potatoes, cooked or canned fruit and vegetables, baked chicken or turkey, sherbet, toast, crackers, cereal).
- Serve fluids after meals, because they can increase the feeling of fullness. Try cool or slightly chilled fluids.
- Serve noncarbonated beverages or soda that has gone “flat.”

- Avoid serving foods with strong flavors, odors, or spices and foods that are high in fat.

### ***Diarrhea***

- Offer small meals every 2 hours and fluids, especially diluted fruit juices, as tolerated every 1 to 2 hours.
- Serve simply prepared foods (e.g., plain rice or pasta, cooked cereal, soft-cooked eggs, bananas, canned fruit packed in juice, baked chicken or turkey, white bread, saltines, toast).
- Avoid serving dairy products if diarrhea worsens.
- Offer foods that are high in sodium (e.g., bouillon, broth) and potassium (e.g., bananas, peaches, apricots, potatoes) to replace lost minerals.
- Avoid serving spicy foods and foods that are high in fat.
- Do not offer foods that contain caffeine (e.g., chocolate, coffee, tea, soda).

### ***Weight Loss***

- Offer foods that are high in calories (e.g., ice cream, pudding, custard, whole milk, half and half, macaroni and cheese, dried fruit, cooked cereal made with whole milk).

- Increase the caloric content of foods:

Use sweetened condensed milk or evaporated milk in puddings, milkshakes, and baked foods.

Add powdered milk to puddings, mashed potatoes, soups, and cooked cereals.

Add “instant breakfast” powder to milk.

Prepare milkshakes made with whole milk, fresh or frozen fruit, and ice cream.

Melt butter or margarine onto foods.

## Difficulty Taking Medications

Infants, children, and adolescents with HIV can have a particularly difficult time taking medications because of their odor and taste and the size of pills. The following suggestions may make it easier for them to take medications:

- Refrigerate liquid medications to minimize their odor and taste.
- Offer ice chips or an ice-based snack (e.g., ice pops) to dull the taste buds before giving medication.
- Use foods to minimize the taste of medication. But first, check with the infant's, child's, or adolescent's physician to ensure that the foods will not compromise the effectiveness of the medication.

Add liquid medications to thick foods (e.g., peanut butter, pudding).

Add medications (that can be dissolved) to soft foods (e.g., applesauce, milk, ice cream).

## Vitamin and Mineral Deficiency

A diet for infants, children, and adolescents who do not have HIV may not be adequate for those with HIV, either because of nutritional losses as a result of vomiting or diarrhea or because of increased demands on the body to fight infection.

- Recommend a dietary supplement with multivitamins and minerals in liquid or pill form for children and adolescents with HIV who are 1 year of age or older. The supplement should provide no more than 100 percent of the Recommended Dietary Intake (RDI) or Recommended Daily Allowance (RDA).<sup>12,15</sup>

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# HYPERLIPIDEMIA

**H**yperlipidemia or hyperlipoproteinemia typically refers to any elevation of blood lipid levels (e.g., total cholesterol, triglycerides, or lipoproteins).<sup>1</sup>

Although terms such as hypercholesterolemia are often used interchangeably with hyperlipidemia, there are subtle differences. Hypercholesterolemia refers to elevated blood cholesterol. Dyslipoproteinemia or dyslipidemia describes abnormal levels of blood lipoproteins (e.g., low levels of high-density lipoprotein [HDL cholesterol], elevated low-density or very-low-density lipoprotein [LDL or VLDL cholesterol]). Table 11 lists the range of acceptable, borderline, and high cholesterol levels for at-risk children and adolescents.

## Significance

At least one-quarter of children and adolescents are estimated to have borderline or high cholesterol levels.<sup>2</sup> In adults, elevated blood-cholesterol levels are strongly associated with atherosclerosis (hardening of the arteries) and death from coronary heart disease (CHD).<sup>3</sup> The process of atherosclerosis begins in childhood, with the appearance of fatty streaks in the arteries. Dietary interventions can lower total and LDL cholesterol levels and is considered the initial therapy for hyperlipidemia.<sup>1</sup>

## Prevention

The following dietary recommendations have been issued for the prevention of atherosclerosis in children 2 years of age and older:<sup>4,5</sup>

- Children younger than 2 years of age should not have their fat or dietary cholesterol intake restricted because of the high energy required during this time of rapid growth and development.
- Children 1 year of age and older should eat a variety of foods to ensure adequate nutrition. At age 2, children gradually need to begin eating fewer high-fat foods, so that by age 5, they receive no more than 30 percent of their calories from fat.
- Children should be encouraged to maintain or increase their levels of regular physical activity.
- Older children and adolescents need to be counseled on the consequences of tobacco use and provided with strategies for avoiding it.

To promote lower cholesterol levels in all healthy children and adolescents ages 2 to 18, the following pattern of nutrient intake is recommended:<sup>5</sup>

- Saturated fat should be less than 10 percent of the total number of calories consumed.
- Over several days, total fat should average not more than 30 percent but not less than 20 percent of total calories.
- Dietary cholesterol should be no more than 300 mg per day.

## Screening

Early identification and treatment of children and adolescents with elevated lipid levels may reduce their risk of developing premature CHD.

**Table 11. Classification of Cholesterol Levels in High-Risk Children and Adolescents<sup>a</sup>**

	Total Cholesterol mg/dL	LDL Cholesterol mg/dL
<b>Acceptable</b>	< 170	< 110
<b>Borderline</b>	170–199	110–129
<b>High</b>	≥ 200	≥ 130

Source: National Cholesterol Education Program.<sup>1</sup>

<sup>a</sup>i.e., children and adolescents from families with hypercholesterolemia or premature cardiovascular disease.

A family history of premature cardiovascular disease and/or high blood cholesterol are the most significant risk indicators for screening lipid levels in children and adolescents. Health professionals need to identify children and adolescents at highest risk for developing accelerated atherosclerosis by screening cholesterol levels in those who meet any of the following criteria:<sup>5</sup>

- A parent or grandparent (≤ 55 years of age) who has been diagnosed with coronary atherosclerosis (on the basis of a coronary arteriography), including those who have undergone balloon angioplasty or coronary artery bypass surgery
- A parent or grandparent (≤ 55 years of age) with documented myocardial infarction, angina pectoris, peripheral vascular disease, cerebrovascular disease, or sudden cardiac death
- A parent with a high blood cholesterol level (≥ 240 mg/dL)

Children and adolescents whose family history cannot be reliably obtained—particularly those with

other risk factors—should also be screened to determine their need for medical and nutrition guidance.<sup>5</sup>

Other risk factors that contribute to early onset of CHD include the following:<sup>5,6</sup>

- Family history of premature CHD, cerebrovascular disease, or occlusive peripheral vascular disease
- Cigarette smoking
- Elevated blood pressure
- Low HDL cholesterol concentrations (< 40 mg/dL)
- Severe obesity (BMI ≥ 95th percentile)
- Diabetes mellitus
- Physical inactivity

## Medical Screening

- Evaluate for and treat secondary causes of hyperlipidemia (e.g., corticosteroids, anabolic steroids, certain oral contraceptives, anorexia nervosa, hypothyroidism, diabetes mellitus, pregnancy).<sup>7,8</sup>
- Evaluate for familial lipid disorder and clinical signs of hyperlipidemia.<sup>7,8</sup>
- Identify other risk factors.<sup>7,8</sup>
- Screen all family members.<sup>7,8</sup>

## Nutrition Screening

- Interview the child or adolescent and parents to assess food purchasing and preparation habits as well as eating patterns. Provide nutrition counseling.<sup>8,9</sup>
- Ask the child or adolescent to complete a 3-day food record to supplement the dietary interview. (If the child is younger than 10, the parent should complete the food record.)<sup>8,9</sup>

## Monitoring

Children and adolescents with hyperlipidemia need to have their blood cholesterol, eating behaviors, and other risk factors monitored regularly. Those with borderline cholesterol levels should be rechecked within 1 year, but those with high LDL or high total cholesterol values should be seen 1 to 2 months after initial nutrition counseling to reevaluate their status. Three-day food records can be collected at least twice a year to help assess progress. If blood lipid levels have not improved or dietary goals have not been achieved, more intensive counseling may be required. With familial lipid disorders, blood lipid levels may not improve appreciably, even with excellent adherence to a regimen. This may be an appropriate time for referral to a lipid center and/or consideration of drug therapy.

## Counseling

Following are the major components of nutrition counseling for children and adolescents with hyperlipidemia.

- Seek support from the child's or adolescent's family.
- Explain and encourage adherence to the National Cholesterol Education Program Step-One Dietary Guidelines<sup>1</sup> (see Table 12). The guidelines emphasize eating fruits and vegetables, whole grain products, legumes, lower-fat dairy products, lean red meat, poultry, and fish.
- Ensure the nutritional adequacy of the child's or adolescent's diet.
- Teach skills for appropriately selecting and preparing food.



- Help the child or adolescent and the family plan ahead for special occasions and provide flexibility in food choices.
- Encourage the reduction of other CHD risk factors.
- Encourage regular physical activity and sound approaches to weight management. If the child or adolescent is overweight, encourage daily physical activity.

Following are age-appropriate strategies for preventing or treating hyperlipidemia.

### Infancy and Early Childhood

When infants are introduced to cow's milk at about 1 year, whole milk should be given because of their need for higher levels of fat. Children older than 2 years can be given reduced-fat (2 percent), low-fat (1 percent), or fat-free (skim) milk.

Serving three healthy meals plus three snacks each day is the best way to satisfy the young child's appetite.

**Table 12. National Cholesterol Education Program Step-One Dietary Guidelines—  
Servings per Day for Different Age Groups**

Food Group	Age of Child or Adolescent (years)						
	2–3	4–6	7–10	11–14 Males	11–14 Females	15–18 Males	15–18 Females
Meat, poultry, fish (oz)	2	5	6	6	6	6	6
Eggs (per week)	3	3	3	3	3	3	3
Dairy products (serving)	3	3	4	4	4	4	4
Fruits (serving)	2	3	3	3	3	5	3
Vegetables (serving)	3	3	3	4	3	4	3
Breads and cereals (serving)	5	6	7	9	8	12	8
Fats and oils (serving)	4	5	5	7	5	10	5
Sweets and modified desserts (serving)	1	2	2	4	3	4	3

Source: National Cholesterol Education Program<sup>1</sup>

- Dairy products serving = 1 cup milk or yogurt, 1 oz cheese, 1/2 cup frozen dairy dessert
- Fruits serving = 1 medium piece, 1/2 cup juice
- Vegetables serving = 1/2 cup raw or cooked, 1 cup salad
- Breads and cereals serving = 1 slice bread, 1/2 hamburger or hot dog bun, 1 cup cereal, 1 tortilla, 1/2 cup rice or pasta, 1 muffin, 1 4-inch pancake
- Fats and oils serving = 1 teaspoon oil or margarine, 1 tablespoon salad dressing
- Sweets serving = 6 oz fruit-flavored beverage, 3/4 oz hard candy, 2 cookies, 1 slice cake, 1 1/2 tablespoons jam/jelly

## Middle Childhood

The dietary recommendations of the National Cholesterol Education Program and the American Academy of Pediatrics are more than adequate to support growth in middle childhood, as long as meals are not skipped and snacks are available.<sup>1,5</sup> It is important to determine that foods are not being eliminated because of the child's refusal to try a lower-fat item. For example, a child may drink less

milk because of refusing to try reduced-fat (2 percent), low-fat (2 percent), or fat-free (skim) milk. Gradually introducing lower-fat milk (e.g., mixing equal portions of higher-fat milk and lower-fat milk for a week) or using it first in milkshakes (made with lower-fat milk and lower-fat ice cream) may encourage acceptance.

During middle childhood, it is more difficult to monitor and control the food intake of a child with hyperlipidemia because of additional eating oppor-

tunities (e.g., at school, friends' houses, the movies, fast-food and other restaurants, and the neighborhood store). The health professional needs to weigh both the severity of the hyperlipidemia and the risk of developing CHD against the child's feelings of being deprived of favorite foods, and to build as much flexibility as possible into the child's diet.<sup>1,8</sup>

## Adolescence

The National Cholesterol Education Program's dietary recommendations for adolescents with hyperlipidemia are nutritionally adequate, even during the rapid growth and development associated with puberty.<sup>1</sup> The need for flexibility in the diet is even greater for the adolescent with hyperlipidemia, who is eating away from home more frequently and assuming greater responsibility for selecting and preparing foods. Because elevated lipid levels are not associated with any pain or visible signs, it is challenging for adolescents to resist favorite foods to prevent health consequences far in the future. Consistent support from the family and health professionals for the adolescent's food choices is important in order to continue and reinforce dietary change. Adolescents in foster homes or halfway houses may face additional obstacles in trying to maintain a healthy, low-fat diet.<sup>7,8,10</sup>

Health professionals need to weigh the severity of the adolescent's hyperlipidemia against the relative risk that the adolescent may develop an eating disorder. Many adolescents with eating disorders initially justify their restrictive eating as an attempt to "eat healthy," denying they are trying to lose weight. In addition, secondary causes of hyperlipidemia include the metabolic changes seen in anorexia nervosa or the use of anabolic steroids for enhanced muscle mass. It may be useful to briefly

screen for eating disorders in adolescents with hyperlipidemia.

## Referral

Referral to a specialized lipid center should be considered for children and adolescents with a significant family history of premature heart disease or familial lipid disorders. Comprehensive nutrition counseling for the family is needed to help the child or adolescent adhere to the diet. Children and adolescents with LDL cholesterol higher than 130 mg/dL should be referred to a dietitian, who can tailor the diet to meet individual needs.

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# HYPERTENSION

In children and adolescents, primary or essential hypertension is diagnosed when persistently elevated blood pressure cannot be explained by any underlying organic cause. According to the recommendations of the Task Force on Blood Pressure Control in Children, children and adolescents 1 to 17 years of age are considered hypertensive if their average systolic and/or diastolic blood pressure readings are at or above the 95th percentile (based on age, sex, and height) on at least three separate occasions.<sup>1</sup> Definitions of normal blood pressure and hypertension are as follows:

- Normal blood pressure: < 90th percentile
- High-normal blood pressure:  $\geq$  90th and < 95th percentiles
- Hypertension:  $\geq$  95th percentile (on three separate occasions)

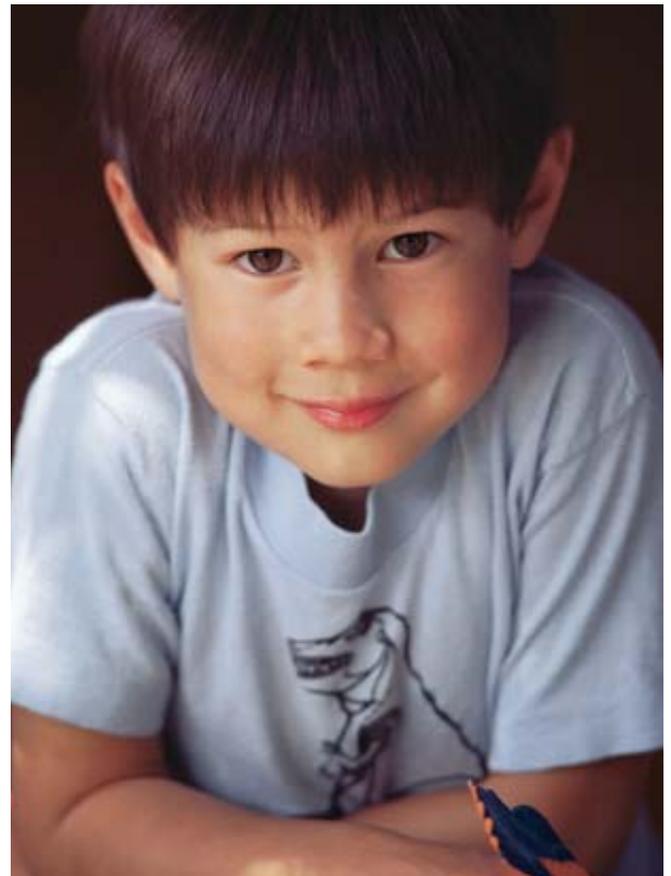
In 1987 the Second Task Force on Blood Pressure Control in Children reported that children and adolescents with frequent blood pressure readings between the 90th and 95th percentiles for their age, sex, and height (unless tall for their age) are at risk for developing hypertension.<sup>2</sup> The task force advised that these children and adolescents with high-normal blood pressure should be followed regularly for early detection of further elevation in blood pressure. Tables 13 and 14 present the current blood pressure standards for the 90th and 95th percentiles for males and females ages 1 to 17 years, by percentile of height.<sup>3</sup>

For adolescents ages 18 and older, the severity of elevated blood pressure, when observed on two

or more occasions, is evaluated on the basis of the adult criteria in Table 15.<sup>4</sup>

## Significance

Primary hypertension is an independent risk factor for cardiovascular disease. Familial patterns for primary hypertension have established that high blood pressure has its origins in childhood and adolescence; left untreated, high blood pressure generally will persist into adulthood. Primary hypertension is now considered the most common form



**Table 13. Blood Pressure Levels for the 90th and 95th Percentiles for Male Children and Adolescents Ages 1 to 17**

BP Age Percentile <sup>a</sup>		Systolic BP (mm Hg), by Height Percentile from Standard Growth Curves							Diastolic BP (mm Hg), by Height Percentile from Standard Growth Curves						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	90th	94	95	97	98	100	102	102	50	51	52	53	54	54	55
	95th	98	99	101	102	104	106	106	55	55	56	57	58	59	59
2	90th	98	99	100	102	104	105	106	55	55	56	57	58	59	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
3	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	111	112	113	63	63	64	65	66	67	67
4	90th	102	103	105	107	109	110	111	62	62	63	64	65	66	66
	95th	106	107	109	111	113	114	115	66	67	67	68	69	70	71
5	90th	104	105	106	108	110	112	112	65	65	66	67	68	69	69
	95th	108	109	110	112	114	115	116	69	70	70	71	72	73	74
6	90th	105	106	108	110	111	113	114	67	68	69	70	70	71	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
7	90th	106	107	109	111	113	114	115	69	70	71	72	72	73	74
	95th	110	111	113	115	116	118	119	74	74	75	76	77	78	78
8	90th	107	108	110	112	114	115	116	71	71	72	73	74	75	75
	95th	111	112	114	116	118	119	120	75	76	76	77	78	79	80
9	90th	109	110	112	113	115	117	117	72	73	73	74	75	76	77
	95th	113	114	116	117	119	121	121	76	77	78	79	80	80	81
10	90th	110	112	113	115	117	118	119	73	74	74	75	76	77	78
	95th	114	115	117	119	121	122	123	77	78	79	80	80	81	82
11	90th	112	113	115	117	119	120	121	74	74	75	76	77	78	78
	95th	116	117	119	121	123	124	125	78	79	79	80	81	82	83
12	90th	115	116	117	119	121	123	123	75	75	76	77	78	78	79
	95th	119	120	121	123	125	126	127	79	79	80	81	82	83	83
13	90th	117	118	120	122	124	125	126	75	76	76	77	78	79	80
	95th	121	122	124	126	128	129	130	79	80	81	82	83	83	84
14	90th	120	121	123	125	126	128	128	76	76	77	78	79	80	80
	95th	124	125	127	128	130	132	132	80	81	81	82	83	84	85
15	90th	123	124	125	127	129	131	131	77	77	78	79	80	81	81
	95th	127	128	129	131	133	134	135	81	82	83	83	84	85	86
16	90th	125	126	128	130	132	133	134	79	79	80	81	82	82	83
	95th	129	130	132	134	136	137	138	83	83	84	85	86	87	87
17	90th	128	129	131	133	134	136	136	81	81	82	83	84	85	85
	95th	132	133	135	136	138	140	140	85	85	86	87	88	89	89

Source: Reprinted from National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents.<sup>3</sup>

<sup>a</sup>Blood pressure percentile determined by a single measurement.

**Table 14. Blood Pressure Levels for the 90th and 95th Percentiles for Female Children and Adolescents Ages 1 to 17**

		Systolic BP (mm Hg), by Height Percentile from Standard Growth Curves							Diastolic BP (mm Hg), by Height Percentile from Standard Growth Curves						
Age	BP Percentile <sup>a</sup>	5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	90th	97	98	99	100	102	103	104	53	53	53	54	55	56	56
	95th	101	102	103	104	105	107	107	57	57	57	58	59	60	60
2	90th	99	99	100	102	103	104	105	57	57	58	58	59	60	61
	95th	102	103	104	105	107	108	109	61	61	62	62	63	64	65
3	90th	100	100	102	103	104	105	106	61	61	61	62	63	63	64
	95th	104	104	105	107	108	109	110	65	65	65	66	67	67	68
4	90th	101	102	103	104	106	107	108	63	63	64	65	65	66	67
	95th	105	106	107	108	109	111	111	67	67	68	69	69	70	71
5	90th	103	103	104	106	107	108	109	65	66	66	67	68	68	69
	95th	107	107	108	110	111	112	113	69	70	70	71	72	72	73
6	90th	104	105	106	107	109	110	111	67	67	68	69	69	70	71
	95th	108	109	110	111	112	114	114	71	71	72	73	73	74	75
7	90th	106	107	108	109	110	112	112	69	69	69	70	71	72	72
	95th	110	110	112	113	114	115	116	73	73	73	74	75	76	76
8	90th	108	109	110	111	112	113	114	70	70	71	71	72	73	74
	95th	112	112	113	115	116	117	118	74	74	75	75	76	77	78
9	90th	110	110	112	113	114	115	116	71	72	72	73	74	74	75
	95th	114	114	115	117	118	119	120	75	76	76	77	78	78	79
10	90th	112	112	114	115	116	117	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
11	90th	114	114	116	117	118	119	120	74	74	75	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	79	79	80	81	81
12	90th	116	116	118	119	120	121	122	75	75	76	76	77	78	78
	95th	120	120	121	123	124	125	126	79	79	80	80	81	82	82
13	90th	118	118	119	121	122	123	124	76	76	77	78	78	79	80
	95th	121	122	123	125	126	127	128	80	80	81	82	82	83	84
14	90th	119	120	121	122	124	125	126	77	77	78	79	79	80	81
	95th	123	124	125	126	128	129	130	81	81	82	83	83	84	85
15	90th	121	121	122	124	125	126	127	78	78	79	79	80	81	82
	95th	124	125	126	128	129	130	131	82	82	83	83	84	85	86
16	90th	122	122	123	125	126	127	128	79	79	79	80	81	82	82
	95th	125	126	127	128	130	131	132	83	83	83	84	85	86	86
17	90th	122	123	124	125	126	128	128	79	79	79	80	81	82	82
	95th	126	126	127	129	130	131	132	83	83	83	84	85	86	86

Source: Reprinted from National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents.<sup>3</sup>

<sup>a</sup>Blood pressure percentile determined by a single measurement.

**Table 15. Classification of Blood Pressure for Adults Ages 18 Years and Older<sup>a</sup>**

Category	Blood Pressure, mm Hg		
	Systolic		Diastolic
Optimal <sup>b</sup>	< 120	and	< 80
Normal	< 130	and	< 85
High-normal	130–139	or	85–89
Hypertension <sup>c</sup>			
Stage 1	140–159	or	90–99
Stage 2	160–179	or	100–109
Stage 3	≥ 180	or	≥ 110

Source: Reprinted from Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.<sup>4</sup>

<sup>a</sup> Not taking antihypertensive drugs and not acutely ill. When systolic and diastolic blood pressures fall into different categories, the higher category should be selected to classify the individual's blood pressure status.

<sup>b</sup> Optimal blood pressure with respect to cardiovascular risk is less than 120/80 mm Hg. However, unusually low readings should be evaluated for clinical significance.

<sup>c</sup> Based on the average of two or more readings taken at each of two or more visits after an initial screening.

of mild hypertension among adolescents, particularly those who are overweight and/or have a family history of high blood pressure.

## Screening and Assessment

### Blood Pressure

Blood pressure screening is recommended at periodic physical examinations beginning at 3 years of age (using the method described in the *Update on the Task Force Report*<sup>3</sup>). Screening should be repeated at subsequent health supervision visits. Correct measurement of blood pressure in children requires

a cuff sized appropriately for the child's upper right arm; the right arm is preferred for consistency and for comparison with the standardized tables.<sup>3</sup>

When an elevated systolic or diastolic blood pressure reading is first obtained, two or more measurements at a comparable level, taken consecutively over weeks or months, must be obtained before a diagnosis of hypertension is confirmed. When standardized techniques for measuring blood pressure in children and adolescents are followed, an estimated 1 to 3 percent will be found to have persistent hypertension.

### Obesity

Obesity and an excess distribution of fat in the midsection of the body ("central obesity") are recognized as significant risk factors in the development of primary hypertension. Obesity in children and adolescents can be assessed through body mass index (BMI). BMI is a weight-stature index ( $BMI = \text{kg}/\text{m}^2$ ) correlated with subcutaneous and total body fat in children and adolescents.

### Blood Lipid

Overweight hypertensive children and adolescents may also have abnormal blood lipid levels, which increase their risk of developing cardiovascular disease as adults. It is advisable to obtain fasting blood lipid levels for all overweight children and adolescents with primary hypertension.

### Dietary Factors

Dietary modifications that reduce sodium intake and encourage a healthy weight can help lower blood pressure.<sup>5</sup> Hypertensive children and adolescents who also have elevated blood lipid levels should be advised to modify their intake of total

fat, saturated fat, and cholesterol. Although there is some evidence that an increased intake of calcium, potassium, and magnesium and a decreased intake of caffeine will lower blood pressure, the findings are inconclusive.

The goals of dietary screening and assessment are as follows:

- Evaluate children's and adolescents' diets for nutritional adequacy, based on the dietary guidelines in the Food Guide Pyramid,<sup>6</sup> with particular emphasis on including milk and other dairy products, fruits, and vegetables.
- Identify regularly or frequently eaten foods that are high in sodium and/or fat, and suggest strategies for modifying the diet.
- Identify the family member(s) with the primary responsibility for purchasing food and preparing meals, to ensure their involvement in counseling sessions.

## Physical Activity

Children and adolescents who are physically fit are reported to have lower blood pressure levels than those who are not physically active. Regardless of whether they are overweight, hypertensive children and adolescents can improve their blood pressure level by participating in more aerobic physical activity on a regular basis. Children and adolescents with primary hypertension typically can participate in sports and strenuous physical activity without restrictions, except for intense isometric exercise (e.g., power lifting and some weight training, which can dramatically increase blood pressure).

Health professionals should screen for physical activity by asking questions about the type, frequency, and duration of physical activity performed

alone, with family members, with peers, at school, and at community recreational facilities.

The goals of physical activity screening and assessment are as follows:

- Identify age-appropriate aerobic physical activities that are acceptable, attainable, and enjoyable for the child or adolescent to pursue regularly.
- Assess the child's or adolescent's level of physical inactivity (i.e., sedentary behavior) in order to help families set appropriate limits for activities such as watching television and videotapes, playing computer games, and spending time on the telephone.

## Tobacco

Nicotine exposure is associated with elevated blood pressure in adults. Thus, it is essential for hypertensive children and adolescents to avoid any form of tobacco.

## Counseling

Modifying dietary and physical activity behaviors is the initial strategy used in treating primary hypertension in children and adolescents. Overweight children and adolescents with hypertension need effective weight-management strategies to improve their health. Introducing medication to lower blood pressure is considered only when the recommended changes do not significantly improve blood pressure after 6 to 12 months. If medication is prescribed, it is still important to adhere to the dietary and physical activity recommendations for primary hypertension.<sup>3</sup>

## Sodium and Salt

The effect of dietary sodium on increased blood pressure is more pronounced in individuals who are “salt sensitive.” Because there is no simple way to screen for salt sensitivity, children and adolescents with primary hypertension or those with high-normal blood pressure should be advised to follow a moderate sodium-restricted diet.<sup>3</sup>

Some U.S. dietary surveys have estimated sodium intake as high as 5,000 mg per day. This intake far exceeds the estimated adequate daily intake for sodium needed to support growth and development during childhood and adolescence.<sup>7</sup> A moderate sodium-restricted diet for children and adolescents is considered to be 1,500 to 2,500 mg per day.

To achieve this moderate intake of sodium, the following measures are advised:

- Do not add salt to food at the table.
- During cooking, omit added salt and other seasonings with sodium.
- Reduce intake of processed or packaged foods high in salt and other sodium compounds, including salted snacks (e.g., chips, pretzels, popcorn, nuts, crackers); processed cheeses; condiments (e.g., ketchup, mustard); cured meats (e.g., bacon, sausage, hot dogs, lunch meats); soups; and most commercially prepared soups and main-course foods that are frozen, boxed, or canned.
- Limit intake of foods from fast-food restaurants because some items contain one-third or more of the recommended daily sodium intake.

## Physical Activity

Counseling hypertensive children and adolescents (particularly those who are sedentary and overweight) to become more active can be difficult. Helping families make regular physical activity a priority, enlisting the involvement of school physical education instructors, and using community recreational facilities all encourage children and adolescents to make physical activity an enjoyable part of their life.

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## IRON-DEFICIENCY ANEMIA

**I**ron-deficiency anemia typically involves red blood cells that are abnormally small in size, with decreased hemoglobin or hematocrit, and a reduced capacity to deliver oxygen to body cells and tissues. In 1998, the Centers for Disease

Control and Prevention (CDC) updated the criteria for defining anemia in a healthy reference population (Table 16). The distribution of hemoglobin and hematocrit values for anemia differs in children and adolescents and in males and females.

**Table 16. Maximum Hemoglobin Concentration and Hematocrit Values for Anemia<sup>a</sup>**

Sex/Age, Years	Hemoglobin, < g/dL	Hematocrit, < %
<b>Males and Females</b>		
1 to < 2 <sup>b</sup>	11.0	32.9
2 to < 5	11.1	33.0
5 to < 8	11.5	34.5
8 to < 12	11.9	35.4
<b>Males</b>		
12 to < 15	12.5	37.3
15 to < 18	13.3	39.7
≥ 18	13.5	39.9
<b>Females<sup>c</sup></b>		
12 to < 15	11.8	35.7
15 to < 18	12.0	35.9
≥ 18	12.0	35.7

Source: Adapted from Table 6, Centers for Disease Control and Prevention.<sup>1</sup>

<sup>a</sup>Age- and sex-specific cutoff values for anemia are based on the 5th percentile from the third National Health and Nutrition Examination Survey (NHANES III).

<sup>b</sup>Although no data are available from NHANES III to determine the maximum hemoglobin concentration and hematocrit values for anemia among infants, the values listed for children ages 1 to < 2 years can be used for infants ages 6 to 12 months.

<sup>c</sup>Nonpregnant and lactating adolescents.

**Table 17. Adjustment of Maximum Hemoglobin Concentration and Hematocrit Values for Iron-Deficiency Anemia**

	Hemoglobin Concentration, < g/dL	Hematocrit, < %
<b>Altitude, feet</b>		
3,000–3,999	+0.2	+0.5
4,000–4,999	+0.3	+1.0
5,000–5,999	+0.5	+1.5
6,000–6,999	+0.7	+2.0
7,000–7,999	+1.0	+3.0
8,000–8,999	+1.3	+4.0
9,000–9,999	+1.6	+5.0
10,000–11,000	+2.0	+6.0
<b>Cigarette smoking</b>		
0.5 to < 1.0 pack per day	+0.3	+1.0
1.0 to < 2.0 packs per day	+0.5	+1.5
≥ 2.0 packs per day	+0.7	+2.0
<b>All smokers</b>	+0.3 <sup>a</sup>	+1.0

Source: Reproduced from Table 7, Centers for Disease Control and Prevention.<sup>1</sup>

<sup>a</sup>In place of the adjustments based on packs per day, a single hemoglobin concentration adjustment of 0.3 g/dL may be used for all smokers.

High altitudes and cigarette smoking increase anemia cutpoints (Table 17). Altitudes above 3,000 feet raise the cutpoint for anemia because of lower oxygen partial pressure, a reduction in oxygen saturation of blood, and an increase in red cell production. Cigarette smoking also raises the cutpoint for anemia because carboxyhemoglobin formed from carbon monoxide during smoking has no oxygen-carrying capacity.

## Significance

Iron deficiency is the most prevalent form of nutrition deficiency in this country. The risk of iron-deficiency anemia is highest during infancy and adolescence because of the increased iron requirements from rapid growth. In healthy full-term infants, iron stores are adequate until age 4 to 6 months. Iron requirements may exceed dietary

iron intake after this time. The onset of menarche and low dietary iron intake also contribute to a higher risk of iron-deficiency anemia among adolescent females. Iron-deficiency anemia is more common in populations with low incomes.

Iron-deficiency anemia has been associated with delayed psychomotor development, cognitive deficits, and behavioral disturbances in young children. Iron-deficiency anemia has also been associated with impaired growth and development, depression of the immune system, fatigue, decreased resistance to infection, decreased physical performance, decreased levels of endurance, reduced attention span, decreased school performance, and increased susceptibility to lead poisoning. Among pregnant adolescents and women, iron deficiency in early gestation may increase the risk of giving birth to a preterm or low-birthweight infant.<sup>1</sup>

## Risk Factors

Increased demand for iron, decreased intake of iron, and/or greater loss of iron from the body are associated with a higher risk of iron-deficiency anemia. The following conditions are associated with an increased risk of developing iron-deficiency anemia:

- Periods of rapid growth
- Preterm or low-birthweight birth
- Low dietary intake of meat, fish, poultry, or foods rich in ascorbic acid
- Macrobiotic diets
- Inappropriate consumption of cow's milk (infants should not consume cow's milk; children should not consume more than 24 oz of cow's milk per day)

- Use of non-iron-fortified infant formula for more than 2 months
- Exclusive breastfeeding after age 6 months without the addition of iron-fortified supplemental foods in the infant's diet
- Meal skipping, frequent dieting
- Pregnancy
- Participation in endurance sports (e.g., long-distance running, swimming, cycling)
- Intensive physical training
- Recent blood loss, recent pregnancy, heavy/lengthy menstrual periods
- Chronic use of aspirin or nonsteroidal anti-inflammatory drugs (e.g., ibuprofen)
- Parasitic infections

## Screening

Following are the CDC recommendations for iron-deficiency anemia screening (based on the hemoglobin and hematocrit values in Table 16).<sup>1</sup>

### Infants and Children Ages 1 to 5

Health professionals should assess all infants and children for risk of iron-deficiency anemia.<sup>1</sup> Those at high risk or those with known risk factors need to be screened for iron-deficiency anemia with a standard laboratory test.

## **Universal Screening (Those at High Risk)**

At 9 to 12 months, 6 months later (at 15 to 18 months), and annually from ages 2 to 5 years, screen those at high risk for iron-deficiency anemia, including

- Infants and children in families with low incomes
- Infants and children who are eligible for WIC
- Infants and children who are migrants or recently arrived refugees

## **Selective Screening (Those with Known Risk Factors)**

In populations of infants and children not at high risk, screen only those individuals who have known risk factors for iron-deficiency anemia.

Before age 6 months, screen preterm and low-birthweight infants who are fed infant formula that is not fortified with iron.

At 9 to 12 months, and 6 months later (at 15 to 18 months), screen the following:

- Infants born preterm or with low birthweight
- Infants fed non-iron-fortified infant formula for more than 2 months
- Infants fed cow's milk before 12 months of age
- Breastfed infants who do not receive adequate iron from supplemental foods after 6 months of age
- Children who consume more than 24 oz of cow's milk per day
- Children with special health care needs who use medications that interfere with iron absorption (e.g., antacids, calcium, phosphorus, magnesium), or those with chronic infection, inflam-

matory disorders, restricted diets, or extensive blood loss from a wound, an accident, or surgery

At ages 2 to 5 years, annually screen the following:

- Children who consume a diet low in iron
- Children with limited access to food because of poverty or neglect
- Children with special health care needs

## **Children Ages 5 to 12 and Adolescent Males Ages 12 to 18**

Screen only those with known risk factors (e.g., low iron intake, special health care needs, previous diagnosis of iron-deficiency anemia).

## **Adolescent Males Ages 18 to 21**

Adolescents 18 or older should be screened if risk factors are present.

## **Adolescent Females Ages 12 to 21**

Screen annually those with known risk factors (e.g., extensive menstrual or other blood loss, low iron intake, a previous diagnosis of iron-deficiency anemia).

Screen every 5 to 10 years during routine health examinations.

## **Assessment and Treatment**

Low hemoglobin values should be confirmed by a repeat hemoglobin or hematocrit test. This is especially true when screening with capillary samples (fingerstick), because of the reported variability in capillary samples.

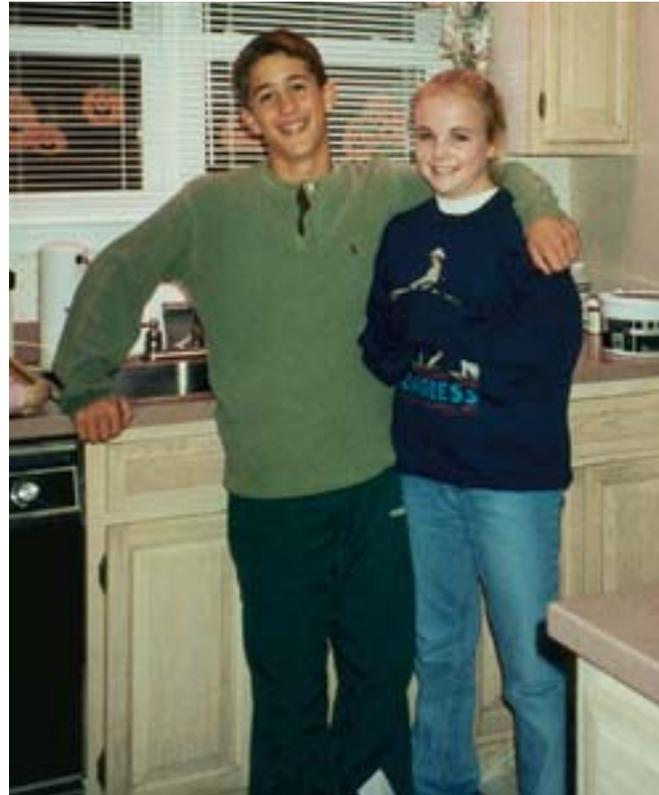
Parents of infants, children, and adolescents should receive information on the treatment of iron-deficiency anemia. Treating iron deficiency involves both iron therapy and improving eating behaviors. After anemia of dietary origin has been treated successfully, recurrence can be prevented with an improved diet.

## Iron Therapy

If low hemoglobin is confirmed, the following treatment is recommended:<sup>1</sup>

- Infants and children younger than 5 years: 3 mg/kg body weight of elemental iron drops per day
- Children ages 5 to 12 years: one 60-mg elemental iron tablet per day
- Adolescent males ages 12 to 18 years: two 60-mg elemental iron tablets per day
- Adolescent females ages 12 to 18 years: one to two 60-mg elemental iron tablets per day

Iron preparations are absorbed most effectively when taken between meals or at bedtime. If gastrointestinal intolerance (e.g., nausea, cramping, diarrhea, constipation) occurs, iron can be taken with meals. Tolerance may also be improved by using a lower dosage, gradually increasing the dosage, or using a different form (e.g., ferrous gluconate). Since iron absorption occurs primarily in the duodenum, timed-release iron preparations may be less effectively absorbed. Iron preparations should not be taken within 1 hour of substances that may inhibit iron absorption (e.g., dairy products, casein, antacids, calcium supplements, coffee, tea, bran, whole grains). To prevent accidental poisoning, iron preparations should be stored out of the reach of infants and children.



Iron-deficiency anemia can usually be resolved effectively through 6 to 8 weeks of treatment with ferrous sulfate. If the hemoglobin does not respond to iron therapy (increase of 1 g within approximately 1 month), iron deficiency should be confirmed by a serum ferritin determination. Values less than or equal to 15  $\mu\text{g/L}$  in infants older than 6 months, children, and adolescents indicate depleted iron stores. Ferritin values may be falsely elevated when infection or inflammation is present. Serum transferrin-receptor concentration may be a more reliable indicator of iron stores because it is not influenced by chronic infection, inflammation, or disease.<sup>1,2</sup> To replace iron stores, iron therapy should be continued for an additional 3 months after the hemoglobin has returned to normal (i.e., when serum ferritin is greater than 15  $\mu\text{g/L}$ ).

## Dietary Strategies

Dietary strategies can improve iron status and help prevent recurrence of iron-deficiency anemia.

Iron status can be improved through increased consumption of lean meat, fish, and poultry, which contain heme, an effectively absorbed form of iron from hemoglobin and myoglobin; meat, fish, and poultry also enhance absorption of the less-bioavailable plant sources of iron (e.g., grains, dried peas and beans, spinach).

Sources of vitamin C (e.g., citrus and fortified fruit juices, citrus fruit, strawberries, cantaloupe, green peppers, broccoli, cabbage) taken with meals increase the absorption of nonmeat sources of iron by maintaining the iron in its reduced, more soluble form. The use of highly fortified breakfast cereals can also improve iron intake. Liver is not recommended because of its high cholesterol content and potentially high level of environmental toxins.

## Counseling

Primary prevention of iron-deficiency anemia should be achieved through diet. The following general guidelines are based on CDC recommendations for preventing iron-deficiency anemia in infants, children, and adolescents.<sup>1</sup>

### Infancy

- Breastfeed throughout the first year of life, with exclusive breastfeeding for the first 4 to 6 months (without supplementary liquid, formula, or food).
- When exclusive breastfeeding is stopped, provide a supplemental source of iron (approximately 1 mg/kg body weight per day), preferably from supplementary foods.
- Use iron-fortified infant formula for infants who are not breastfed or who are partially breastfed.
- Provide iron supplement (2 to 4 mg of iron drops per kg body weight per day, not to exceed 15 mg per day) for preterm or low-birthweight breastfed infants, beginning at age 1 month and continuing through age 12 months.
- Encourage use of only breastmilk or iron-fortified infant formula for any milk-based part of the diet and discourage use of low-iron milk (e.g., cow's, goat's, soy) for infants.
- Provide iron-containing foods when exclusive breastfeeding is stopped (e.g., 4 tablespoons [dry measure, before adding milk<sup>3</sup>] of iron-fortified infant cereal per day).
- Supplement with iron drops (1 mg per kg body weight per day) for breastfed infants who receive insufficient iron from foods by age 6 months.
- Encourage one feeding per day of foods rich in vitamin C by age 6 months.
- Introduce pureed or soft fruits, vegetables, and meats after age 6 months or when the infant is developmentally ready to consume such foods.

## Early Childhood, Middle Childhood, and Adolescence

- Children ages 1 to 5 years should consume no more than 24 oz of cow's, goat's, or soy milk per day.
- Include sources of iron-rich foods (e.g., fortified breakfast cereals, meat, fish, poultry) and vitamin C-rich foods (e.g., citrus and fortified fruit juices, citrus fruit, strawberries, cantaloupe, green peppers, broccoli, cabbage) to enhance iron absorption.
- Limit snacks that are low in nutrients.
- Avoid skipping meals or chronic dieting.
- Limit coffee, tea, and colas.

## Referral

Referral to a dietitian is helpful in cases of severe or prolonged iron-deficiency anemia. All infants, children, and pregnant or lactating adolescents who are eligible should be referred to WIC. (See Tool J: Nutrition Resources.)

## References

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# NUTRITION AND SPORTS

**I**n competitive sports, strength training, and fitness activities, nutrition plays an important role in the promotion of healthy eating and weight management strategies. These strategies enhance performance and endurance while ensuring optimal growth, health, and physical and emotional development.

## Significance

Children and adolescents are encouraged to participate in regular physical activity to promote lifelong fitness. The benefits of appropriate physical activity include the following:

- Decreased risk of cardiovascular and other chronic diseases
- Maintenance of healthy body weight
- Promotion of an appropriate level of body fat
- Increased cardiopulmonary health
- Increased muscular strength, flexibility, and endurance
- Decreased anxiety, stress, and depression
- Enhanced self-esteem

Young athletes are particularly vulnerable to misinformation about nutrition and to claims about unsafe practices that promise enhanced performance. Pressure to achieve that “competitive edge” encourages athletes to experiment with ergogenic aids (e.g., instant protein beverages; weight-gain powders; amino acid, herbal, vitamin, and mineral supplements). Many ergogenic aids offer no benefits, and some are actually harmful.

Inappropriate use of dietary supplements, unsafe weight-control methods, and unhealthy eating practices can adversely affect strength and endurance, jeopardize health, and negate the benefits of training. Research continues to support recommendations to improve performance through a combination of safe training and healthy eating practices.

## Nutritional Adequacy

Children and adolescents who are physically active and those who compete in sports can achieve an adequate, balanced intake of nutrients by following the Dietary Guidelines for Americans.<sup>1</sup> The nutrient needs of young athletes are similar to those of noncompeting children and adolescents, with the exception of energy, water, and, in some cases, protein.<sup>2</sup>

## Energy

Physical activity increases the body’s need for energy in relation to the type, frequency, intensity, and duration of the activity. Most young athletes need approximately 500 to 1,500 additional calories per day; adequacy of growth, appropriate body weight status, and appetite indicate whether the energy intake is sufficient.

## Carbohydrates

Carbohydrates are the preferred source of energy for exercising the muscles. Inadequate carbohydrate intake may be associated with fatigue and decreased performance. For those who are physically active or competing, a higher proportion of car-



bohydrates (especially complex carbohydrates such as grains, corn, and potatoes) is recommended, in addition to fruits, vegetables, low-fat dairy products, and moderate sugar intake.<sup>3</sup> For highly trained athletes competing at the national or international level, the recommended carbohydrate intake is 60 to 70 percent of total calories consumed; for young athletes, 55 to 65 percent is probably more realistic.

## Protein

The protein requirements of most young athletes can be met by consuming approximately 1 g protein per kg body weight per day. Athletes participating in intense endurance sports or strength training may require 1.5 to 2 g protein per kg body weight per day;<sup>3</sup> however, most children and adolescents consume 1.5 to 3 times their RDA

for protein, so it is likely that protein needs can be met by eating a variety of nutritious foods (unless an athlete is restricting food intake).

Higher consumption of proteins and the use of protein or amino acid supplements (misleadingly promoted as “safe” alternatives to steroids) are not beneficial and may cause dehydration, renal stress, increased urinary excretion of calcium, and excessive caloric intake and fat storage. Athletes who eat increased amounts of protein or take amino acid supplements may tend to view these as substitutes for other foods, and thus neglect important nutrients.

## Vitamins and Minerals

A balanced variety of foods that meet the body’s energy needs also meet the requirement for sufficient vitamins and minerals. Adequate amounts of iron should be consumed to prevent iron-deficiency anemia, especially in menstruating females. If the athlete does not consume sufficient quantities of dairy products, a calcium supplement should be added.<sup>4</sup> Children and adolescents who perform strenuous activity may have a slightly increased need for zinc, but adequate zinc intake usually can be achieved by eating meats and whole grains.

## Pregame and Postgame Meals

Consuming a light meal high in complex carbohydrates (e.g., rice, pasta, bread) and ample caffeine-free beverages (e.g., fruit juice, water) is recommended 3 to 4 hours before an event to prevent hunger, provide energy, ensure gastric emptying, and prevent respiratory and cardiac stress. During physical activities involving several events, energy can be obtained by consuming sports drinks or

unsweetened fruit juice diluted to one-half strength with water up to 1 hour before physical activity. If events are 1 to 3 hours apart, carbohydrate snacks (e.g., cereal bars, sports bars, crackers, fruit) or liquid meals are recommended. After exercise, it is important to replace muscle and liver glycogen stores by consuming carbohydrates within 2 hours. Drinking beverages containing carbohydrates should be encouraged if foods are not well tolerated or not available within 2 hours after physical activity.

## Fluids and Electrolytes

Adequate fluid intake and prevention of dehydration are critical for effective energy metabolism, performance, and body cooling. The risk of dehydration becomes greater with increased heat, humidity, intensity or duration of exercise, body surface area, and sweating. Children are at greater risk for dehydration and heat-related illness than adolescents or adults because children generate more heat, sweat less, take longer to acclimatize, and absorb more heat from the environment.

Inadequate fluid intake can result in dehydration and heat-related illness (see Table 18). To ensure adequate hydration in children and adolescents, note the following key principles:

- Adequate fluid intake must be ensured to prevent dehydration and serious problems, but thirst is not an adequate indication of the body's need for fluids.
- Drinking 16 oz of water 1 to 2 hours before the event is recommended, followed by 12 oz of water 15 minutes before the event and 4 to 8 oz of water every 15 to 20 minutes during the event.<sup>3</sup>
- During hot or humid weather, strenuous physical activity or events lasting more than 60 minutes,

muscle glycogen can be conserved and fatigue reduced by consuming drinks containing 4 to 8 percent carbohydrates (10–18 g carbohydrates per 8 oz). Examples include (1) unsweetened fruit juice diluted with an equal amount of water and (2) sports drinks.

- Cool water (40–50°F) is absorbed most quickly.
- Water can be more palatable for some children and adolescents if flavoring (e.g., lemon slices) is added.
- After physical activity, drinking 16 oz of fluid per pound of weight lost will restore water balance and allow optimal performance in subsequent exercise sessions.
- Undiluted fruit juice, carbonated or caffeine-containing beverages, and fruit punches should not be consumed immediately before or during physical activity because they may cause cramping or diarrhea.
- During hot weather, closely monitor children and adolescents who use exercise equipment (e.g., helmets, padding). These kinds of equipment can prevent sweat from evaporating, thus increasing body temperature.

## Special Considerations

### Anemia

Strenuous physical activity or intensive training may be associated with iron-deficiency anemia. Contributing factors include decreased iron absorption, marginal iron intake, hemodilution, increased destruction of erythrocytes in circulation, and foot strike hemolysis.<sup>3</sup> Iron-deficiency anemia is not a contraindication to continued training; however,

**Table 18. Heat-Related Illness: Signs, Symptoms, and Treatment**

	<b>Signs and Symptoms</b>	<b>Treatment</b>
<b>Heat cramps</b>	<ul style="list-style-type: none"> <li>■ Disabling muscular cramps</li> <li>■ Thirst</li> <li>■ Chills</li> <li>■ Rapid heart rate</li> <li>■ Normal body temperature</li> <li>■ Alertness</li> <li>■ Normal blood pressure</li> <li>■ Nausea</li> </ul>	<ul style="list-style-type: none"> <li>■ Give child/adolescent 4–8 oz of cold water every 10–15 minutes</li> <li>■ Make sure child/adolescent avoids beverages that contain caffeine</li> <li>■ Move child/adolescent to shade</li> <li>■ Remove as much clothing and equipment as possible</li> </ul>
<b>Heat exhaustion</b>	<ul style="list-style-type: none"> <li>■ Sweating</li> <li>■ Dizziness</li> <li>■ Headache</li> <li>■ Confusion</li> <li>■ Lightheadedness</li> <li>■ Clammy skin</li> <li>■ Flushed face</li> <li>■ Shallow breathing</li> <li>■ Nausea</li> <li>■ Body temperature of 100.4–104°F</li> </ul>	<ul style="list-style-type: none"> <li>■ Give child/adolescent 16 oz of cold water for each pound of weight lost</li> <li>■ Move child/adolescent to a cool place</li> <li>■ Remove as much clothing and equipment as possible</li> <li>■ Cool child/adolescent (e.g., with ice baths, ice bags)</li> </ul>
<b>Heat stroke</b>	<ul style="list-style-type: none"> <li>■ Shock</li> <li>■ Collapse</li> <li>■ Body temperature &gt; 104°F</li> <li>■ Delirium</li> <li>■ Hallucinations</li> <li>■ Loss of consciousness</li> <li>■ Seizures</li> <li>■ Inability to walk</li> </ul>	<ul style="list-style-type: none"> <li>■ Call for emergency medical treatment</li> <li>■ Cool child/adolescent (e.g., with ice packs, ice bags, immersion in ice water)</li> <li>■ Give intravenous fluids</li> </ul>

Source: Compiled from Maughan and Shirreffs.<sup>5</sup>

the anemic child's or adolescent's iron status should be evaluated by a health professional. (See the Iron-Deficiency Anemia chapter.)

## Weight Status

Losing excess body fat is a long-term process involving healthy food choices as well as training. This process should be initiated several months before the start of the athletic season. Severe energy restriction and weight loss of more than 2 pounds per week can result in the loss of muscle mass and compromised growth and development. Weight maintenance and increased physical activity, rather than weight loss, are appropriate goals for growing athletes. Loss of body fat can be facilitated through physical activity (e.g., power walking, cycling) at 60 to 80 percent of maximum aerobic capacity (heart rate of 220 beats per minute minus age) for 45 to 60 minutes five to six times per week.

Rapid weight-loss techniques (e.g., severe food restriction, dehydration, purging) frequently practiced by athletes (e.g., wrestlers) are ineffective and dangerous. In addition to decreased muscle strength and endurance, side effects may include hypoglycemia, depletion of electrolytes and glycogen stores, nutrient deficiencies, risk of developing eating disorders, and compromised growth and development. Severe restriction can result in circulatory collapse and heat stroke. For example, wrestlers should be certified at their current weight unless they have excess body fat or are not experiencing growth; certification at a weight consistent with less than 7 percent body fat is contraindicated. Sufficient time should be allotted for gradual and appropriate weight loss.

Adolescents who wish to increase muscle mass should be advised to combine strength training

with a balanced intake of healthy foods providing an additional 500 to 1,000 calories per day. This should result in a weight gain of 1 to 2 pounds per week. Foods chosen should be low in fat, cholesterol, and sugar, and high in complex carbohydrates.

## Strength Training

Properly prescribed and supervised strength training as part of a total fitness program can improve body composition, increase muscular strength and endurance, reduce risk of injury, and enhance overall fitness and performance in sports and recreational activities. Strength training can increase muscle size in adolescents, but increased muscle mass beyond normal growth is not possible in children. To prevent injury of the long bones and back, children should not lift maximum or near-maximum weights. Weights that can be lifted for six repetitions or more are considered appropriate.<sup>6</sup>

## Eating Disorders

Restricted food intake, binge-eating, purging, and an unhealthy body image can occur among young athletes in all sports, but are more common in weight-related activities (e.g., wrestling, running) and in "appearance" sports (e.g., gymnastics, ballet, figure skating). Eating disorders may be associated with electrolyte imbalances, nutrient deficiencies, amenorrhea, and impaired growth and development. (See the Eating Disorders chapter.)

An issue of major concern in female athletes is the interrelationship between eating disorders, amenorrhea, and osteoporosis, which has been labeled the "Female Athlete Triad." Some female athletes may develop eating behaviors that can lead

to weight loss, amenorrhea, and negative consequences for bone health (i.e., premature bone loss, decreased bone density, increased risk of stress fractures).<sup>4</sup> It is important to identify and treat this condition early, because bone disorders associated with anorexia may be irreversible despite estrogen replacement, calcium supplementation, and resumption of menstrual periods.

## Creatine

Although creatine may promote increased muscle mass when combined with strength training, possible side effects include nausea and muscle cramps. There is insufficient information on the long-term risks of using creatine, and it is not recommended for young athletes.

## Anabolic Steroids

Use of anabolic steroids by children and adolescents is dangerous and is banned by the National Collegiate Athletic Association and the International Olympic Committee. Although anabolic steroids may help build muscle, such steroids cause early closure of the epiphyseal plates, resulting in stunted growth. Children and adolescents who use such steroids are also at risk for sterility.

## Screening and Assessment

The nutritional adequacy of typical eating practices as well as specialized training diets can be evaluated with the Food Guide Pyramid. To screen and assess children and adolescents for adequate nutrition, it is important to determine the following:

- Intake of calcium, iron, and zinc (from foods)
- Pregame and postgame eating practices



- Fluid intake before, during, and after competition
- Use of vitamin and mineral supplements
- Weight-control practices, including restrictive eating and binge-eating/purging activity
- Use of ergogenic aids (e.g., caffeine, steroids, amphetamines, creatine, chromium picolinate)
- Measurement of height, weight, and BMI annually to evaluate height-weight status and growth
- Measurement of body fat percentage (e.g., triceps skinfold) annually to distinguish excess body fat from excess body weight related to high muscularity
- Menstrual history
- Evaluation of type, frequency, intensity, and duration of physical activity to help determine energy needs
- For wrestlers, the determination of desired weight classification for competition, the sexual maturity rating, and training activities (urine specific gravity measurements may be indicated if dehydration before weight certification is suspected)

## Counseling

Children, adolescents, parents, and coaches (when possible) should receive information about sound nutrition practices for those participating in sports and recreational physical activities. The following general guidelines may be helpful for health professionals when sharing information on nutrition and physical activity with children, adolescents, and their families.

### Children and Adolescents

- Discuss the risks of dehydration and the recommendations for fluid intake and fluid replacement needs after physical activity. Instruct competitive young athletes to check body weight before and after physical activity.
- Encourage eating practices consistent with the Dietary Guidelines for Americans, emphasizing the importance of consuming complex carbohydrates at each meal (e.g., rice, pasta, bread, bagels, corn, potatoes, sweet potatoes, tortillas, cereal, muffins).
- Maintain a diet in which fat intake is no less than 20 to 25 percent of total calories and no more than 30 percent.
- Caution against high protein intake and the use of protein or amino acid supplements.
- Discuss the dangers of using steroids and amphetamines, and the ineffectiveness of other ergogenic aids.
- Caution against rapid weight-loss techniques and explain their adverse effects on health and performance.

- Discuss pregame and postgame meals and recommended snacks, fast foods, and convenience store foods when traveling (e.g., low-fat yogurt; reduced-fat (2 percent), low-fat (1 percent), or fat-free (skim) milk; yogurt cones and shakes; bananas; string cheese; grilled chicken; submarine sandwiches; light tacos and burritos; thick-crust cheese or vegetable pizza; muffins; bagels).
- Demonstrate how to monitor pulse rate, and encourage aerobic physical activity at 60 to 80 percent of maximum heart rate while training.

### Parents

- Enlist parental support in making healthy foods available.
- Advise parents to discourage unhealthy weight-loss practices or supplements.
- Encourage parents of children and adolescents in team sports to purchase or prepare appropriate postgame snacks for the team (e.g., fruit, fruit juice, muffins, bagels, pretzels).

## Referral

Referral to a dietitian is recommended for young athletes who have the following conditions: eating disorders, unhealthy eating practices, strict vegetarian eating practices, obesity, underweight, or iron-deficiency anemia. (See Tool J: Nutrition Resources.)

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## The Importance of Drinking Sufficient Fluids in Hot Weather

*The physician explains that young children are at higher risk than adolescents or adults for dehydration and heat stroke because their bodies generate more heat.*

Roberto Garza is a 10-year-old boy who plays baseball in a community league coached by parents. He lives in an area where the summer weather is hot and humid, and practice is scheduled in the afternoon, when the temperature is quite hot. Roberto often complains of being thirsty during practice, and his father is concerned because the coaches do not schedule water breaks.

During a routine sports physical, Mr. Garza discusses his concerns with Roberto's physician, Dr. Rahman. The physician explains that children are at higher risk than adolescents or adults for dehydration and heat stroke because their bodies generate more heat. "Children need to drink additional fluids in hot weather to prevent dehydration and other serious problems," advises Dr. Rahman. "Thirst is not always an adequate indication of the body's need for fluids because physical activity can sometimes mask children's sense of thirst, making them even more vulnerable to dehydration."

Dr. Rahman gives Mr. Garza a pamphlet that discusses the importance of replacing fluids during physical activity and asks him to share the information with Roberto's coaches. She points out that the pamphlet recommends that children drink 4 to 8 oz of water or other fluids every 15 to 20 minutes during physical activity, and that they should be allowed water breaks as needed. The pamphlet also advises parents and coaches to monitor each child's weight before and after physical activity. Any weight that is lost during physical activity is probably due to loss of body water and should be replaced after activities by drinking fluids at the rate of 16 oz of water for each pound lost.

Mr. Garza shares the pamphlet with the coaches; as a result, the children are allowed both scheduled and unscheduled water breaks. In addition, the team manager has started to monitor the baseball players' fluid intake to be sure they are drinking sufficient amounts.

# OBESITY

**O**besity is defined as the presence of excess adipose (fatty) tissue in the body. The term “overweight” may connote a milder degree of excess fat than “obesity,” but there are no clearly defined criteria to distinguish between the two terms. Thus, the two are used interchangeably.<sup>1</sup>

Although the underlying causes are not fully understood, obesity is a complex chronic disease involving genetics, metabolism, and physiology, as well as environmental and psychosocial factors. Inappropriate eating behaviors and low levels of physical activity are contributing to the continuing rise in the prevalence of obesity among children and adolescents.<sup>2</sup>

## Significance

Obesity is a major public health problem. Studies over the past two decades have shown a dramatic increase in the prevalence of obesity among children (including those younger than 5 years of age) and adolescents.<sup>3,4</sup> Recent data from the National Center for Health Statistics (NCHS) indicate that more than one in five U.S. children and adolescents are overweight.<sup>3</sup>

Few studies have examined the long-term effect of child or adolescent obesity on adult morbidity and mortality. Longitudinal studies of children followed into young adulthood suggest that overweight children may become overweight adults, particularly if obesity is present in adolescence.<sup>5-7</sup> Overweight in adolescence is associated with current levels of and changes in blood pressure, blood lipids, lipoproteins, and insulin.<sup>8</sup> Perhaps the most

widespread consequences of childhood obesity are psychosocial, including discrimination.<sup>8,9</sup>

Health professionals should be aware of the demographic and personal risk factors for childhood and adolescent obesity, and they should be diligent in prevention strategies and screening.<sup>2</sup> Children and adolescents are considered at high risk for overweight if (1) one or both of their parents are overweight, (2) they live in families with low incomes, (3) they have chronic illness or disabilities that limit mobility, or (4) they are members of certain racial/ethnic minority groups (preadolescent and adolescent African-American females; Hispanic populations; and American Indian/Alaska Native populations).<sup>2,4</sup> Norms for a “healthy” appearance may vary across cultures; children, adolescents, and their families should be counseled within a cultural context.

## Prevention

Enough is known to guide efforts to reverse the trend of increasing obesity.<sup>2</sup> Because obesity is difficult to treat, efforts should focus on prevention. Although genetic influences largely determine whether a person may become overweight, environmental influences (e.g., eating behaviors, physical inactivity) may determine the manifestation and extent of the obesity.

The most important strategies for preventing obesity are healthy eating behaviors, regular physical activity, and reduced sedentary activity (e.g., watching television and videotapes, playing computer games). These preventive strategies are part of a healthy lifestyle that should be developed during early childhood. The goal is to teach and model

healthy and positive attitudes toward food and physical activity without emphasizing body weight. Behavioral techniques are needed to encourage healthy eating and physical activity behaviors.

## Healthy Eating

Parents need information on how to encourage their child to eat in a healthy manner, beginning when the child is very young.<sup>2</sup> Suggestions include limiting the duration of bottlefeeding; ensuring appropriate use of reduced-fat (2 percent), low-fat (1 percent), and fat-free (skim) milk after 2 years of age; limiting consumption of high-sugar foods (including juices); being aware of portion sizes of foods, especially high-fat and high-sugar foods; limiting the frequency of fast-food meals; and encouraging family members to drink water.

Achieving a modest reduction of fat in the family diet is a good way to prevent excess weight gain. Fat should not be restricted in children younger than 2 years of age; children older than 2 should gradually adopt eating practices so that by age 5 their fat intake is no more than 30 percent of their total calories.<sup>10</sup> The Dietary Guidelines for Americans provide an eating guide for healthy persons ages 2 years and older. (See the Healthy Eating and Physical Activity chapter.)

## Physical Activity

Physical activity (approximately 30 minutes) on most, if not all, days of the week is beneficial for people of all ages.<sup>11</sup> Health professionals routinely need to discuss physical activity practices with family members and to help them develop ways to increase physical activity and decrease sedentary activity in their lives. Solutions might include playfully chasing young children around the yard or playground,

dancing to music before dinner, or riding a stationary bike while watching television.<sup>2</sup> Involving children and adolescents in team sports can help build skill levels and self-confidence, foster teamwork, and increase energy expenditures.

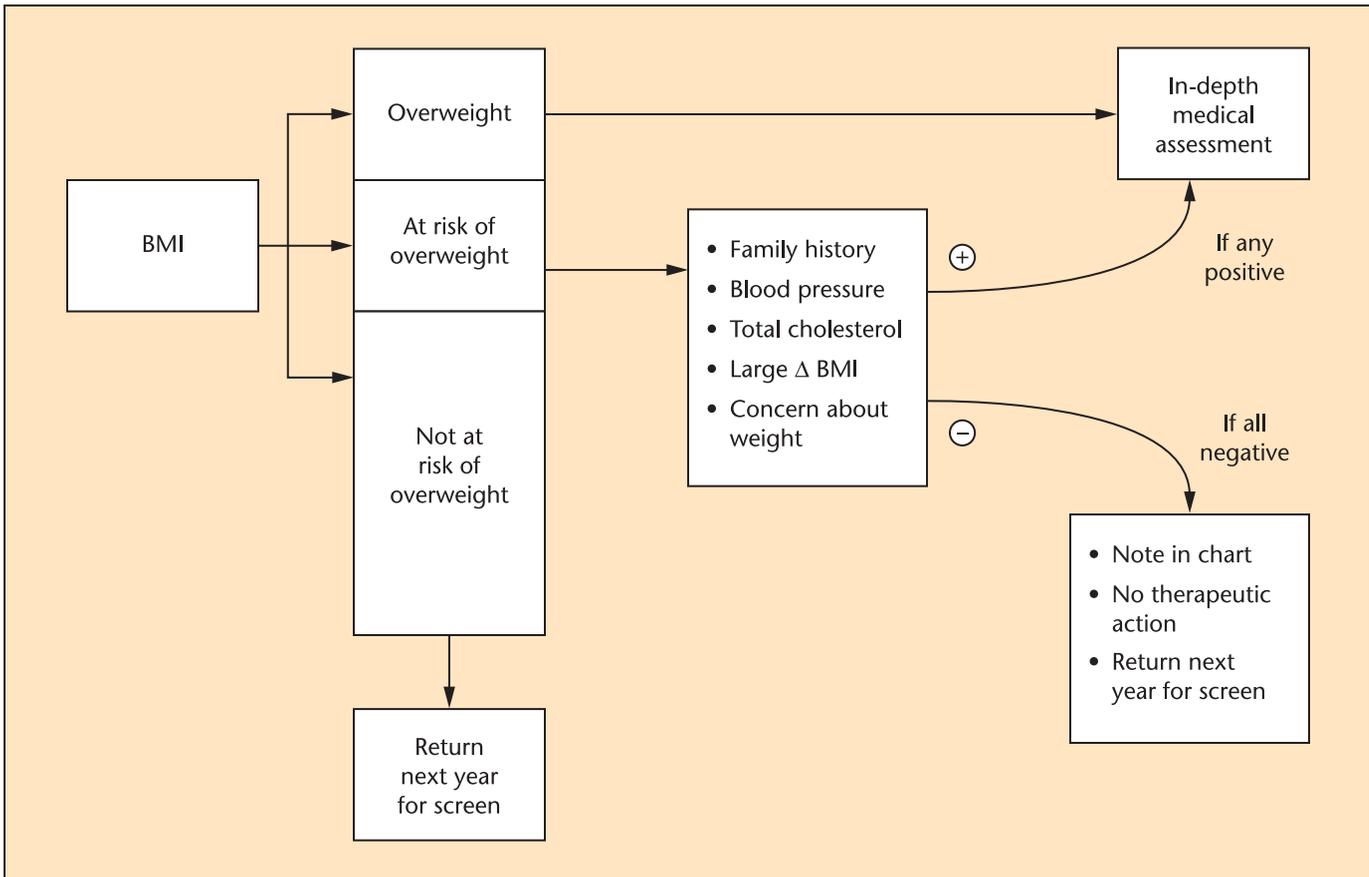
## Screening

Body mass index (BMI) is recommended for screening children and adolescents. BMI is easily calculated from weight and height measures (kg/m<sup>2</sup>) and can be plotted on a standard growth chart. (See Tool M: CDC Growth Charts.) BMI reflects body mass rather than body fat, but correlates with measures of subcutaneous and total body fat in children and adolescents. Some children and adolescents may have a high BMI because of a large, lean body mass from physical activity, high muscularity, or frame size. An elevated triceps skinfold (above the 95th percentile on the CDC growth chart) can confirm excess body fat in children or adolescents.<sup>1</sup>

The following screening guidelines are based on the recommendations of an expert committee of pediatric health professionals.<sup>1</sup>

- Children older than 2 and adolescents with BMIs at or above the 95th percentile for age and sex are considered overweight and should receive an in-depth assessment.
- Children older than 2 and adolescents with BMIs between the 85th and 95th percentiles for age and sex are considered at risk for becoming overweight and should be screened and evaluated carefully, with particular attention to family history and secondary complications of obesity, including hypertension and dyslipidemias.

**Figure 5. Recommended Overweight Screening Procedures**



Source: Reproduced, with permission, from Figure 1, Himes and Dietz.<sup>12</sup> ©1994, *American Journal of Clinical Nutrition*, American Society for Clinical Nutrition.

- Children (older than 2) and adolescents with an annual increase of 3 to 4 BMI units should be evaluated.

## Assessment

In-depth assessments (see Figure 5) are required to identify those children and adolescents with positive screens who are truly obese, to diagnose any underlying causes, and to provide a basis for a treatment plan.

## Medical History

A thorough medical history must be conducted to identify any underlying syndromes or secondary complications.

## Family History

To identify familial risks for obesity, a family history is needed. This should include the presence of obesity, eating disorders, type 2 diabetes mellitus, cardiovascular disease, hypertension, dyslipidemia,

and gallbladder disease in siblings, parents, aunts, uncles, or grandparents.<sup>7</sup>

## Dietary History

An assessment of the child's or adolescent's eating practices (quantity, quality, and timing) will identify both foods and patterns of eating that may lead to excessive caloric intake. If the health professional's dietary assessment skills are limited, a dietitian should obtain the dietary history.

## Physical Activity History

A careful history of physical activity is needed to quantify activity levels as well as time spent in sedentary behaviors. Any history of medical contraindications to physical activity should be noted (e.g., asthma, joint disease).

## Physical Examination

The physical examination will provide information about the degree of overweight and any potential underlying syndromes or complications of obesity. Height, weight, and BMI should be plotted on a standard growth chart to identify the degree of overweight. (See Tool M: CDC Growth Charts.)

## Laboratory Testing

Degree of overweight, family history, and the physical examination will guide the choice of laboratory tests.

## Psychological Evaluation

*Readiness to change.* A weight-management program for children, adolescents, or their families who are not ready to change may be both ineffective and harmful because it can affect the child's or adolescent's self-esteem and impair future weight-loss

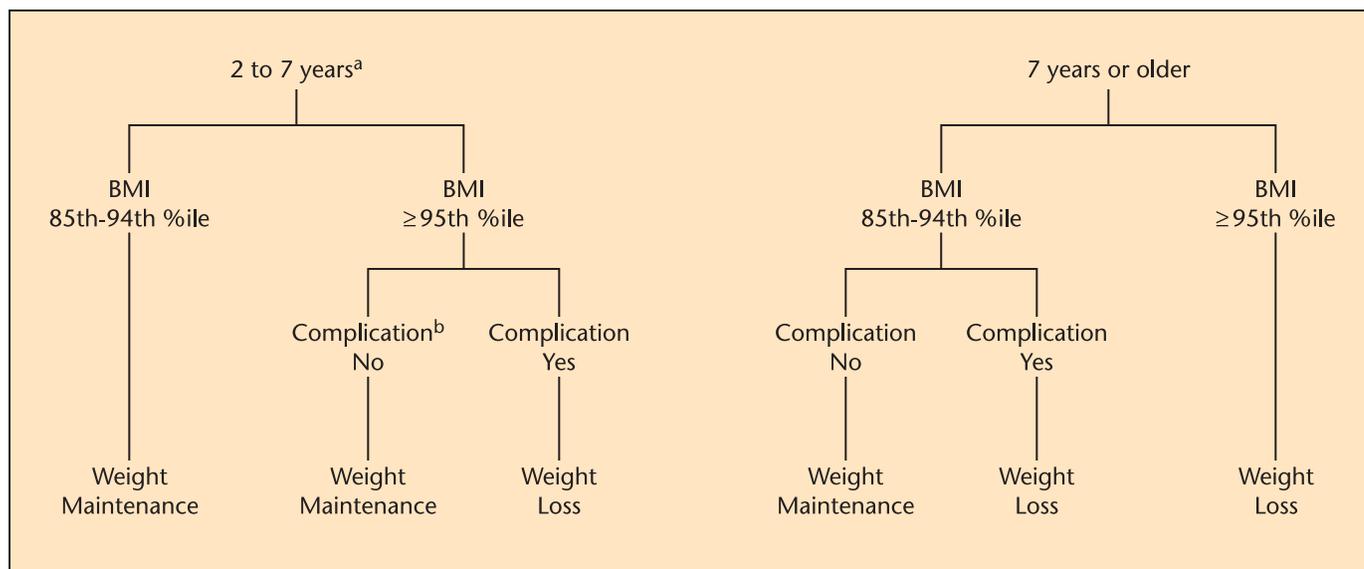
efforts. A practical way to address readiness is to ask members of the family how concerned they are about a family member's weight, whether they believe weight loss is possible, and what practices need to be changed. Assess family readiness with questions such as "How concerned are you about this issue?" "Have you thought about or tried to lose weight? If so, what did you try, and when did you try it?" In families with younger children, the parent who is ready to change can successfully modify the family diet and physical activity. Therapeutic efforts should focus on those families that are concerned about their child's weight and ready to make changes.

Families who are not ready to change may express a lack of concern about the child's or adolescent's obesity, may believe that obesity is inevitable and cannot be changed, or may lack interest in modifying eating practices or physical activities. Unless a serious complication of obesity already exists, families that are not ready to change should be given information about the health consequences of obesity and told that help is available when they are ready. Health professionals should continue to foster a positive relationship with the family so that treatment may be possible in the future.

*Eating disorders.* Children or adolescents who feel unable to control their consumption of large amounts of food or who report vomiting or use of laxatives to avoid weight gain may have an eating disorder. In this situation, the child or adolescent should be referred to an eating disorder program that incorporates psychological assessment/treatment, medical assessment/treatment, and nutrition counseling.

*Depression.* Overweight children or adolescents who are depressed may exhibit sleep disturbance,

**Figure 6. Recommendations for Weight Goals**



Source: Reproduced, with permission, from Figure 2, Barlow and Dietz.<sup>1</sup> Copyright © 1998 American Academy of Pediatrics.

<sup>a</sup>Indicates that children younger than 2 years should be referred to a pediatric obesity center for treatment.

<sup>b</sup>Indicates complications such as mild hypertension, dyslipidemias, and insulin resistance. Patients with acute complications, such as pseudotumor cerebri, sleep apnea, obesity hypoventilation syndrome, or orthopedic problems, should be referred to a pediatric obesity center.

hopelessness and sadness, and appetite changes. As with eating disorders, depression in children or adolescents requires psychological evaluation and treatment.

## Treatment

The primary goal of a program to treat uncomplicated obesity is to achieve healthy eating and physical activity behaviors, rather than obtaining ideal body weight. Treatment programs need to emphasize the skills necessary to change behaviors and to maintain those changes. The first step toward weight control for all overweight children (older than 2 years) and adolescents is weight maintenance, which can be achieved by modest changes in food intake and physical activity. Children and adolescents who are excessively overweight (weigh-

ing 180 percent or more of their ideal body weight) cannot be expected to increase activity levels dramatically. Small incremental changes should be the goal.

Weight loss, if warranted, should be only about 1 pound per month.<sup>1</sup> Recommendations for achieving weight goals are shown in Figure 6. An appropriate weight goal for all obese children and adolescents is a BMI at or below the 85th percentile, although such a goal should be secondary to the primary goal of healthy eating, regular physical activity, and psychological well-being.

## Approaches to Treatment

Children and adolescents receiving anticipatory guidance or treatment for obesity need to be monitored carefully by health professionals from a vari-

ety of disciplines, which can help families achieve many aspects of a weight-management program. Experience in cognitive-behavioral approaches to intervention are helpful. The following approaches are based on the recommendations of an expert committee of pediatric health professionals.<sup>1</sup>

- Intervention should begin early.
- The approach should involve family members. The goal is to help family members achieve healthy behaviors rather than to single out the overweight child or adolescent.
- Start slowly. Ask families to suggest one or two changes, then help them determine how to monitor the changes.
- Families should learn how to monitor eating and physical activity as part of the treatment process.
- Because weight maintenance is an important first step, families of children or adolescents who have maintained their weight should be praised for their success.
- Treatment programs should seek to institute permanent changes, avoiding short-term diets or physical activity programs aimed at rapid weight loss.
- Health professionals need to encourage and empathize rather than criticize.
- Health professionals need to educate families about the medical complications of obesity.
- Children and adolescents should never be placed on a restricted diet to lose weight except for medical reasons, when closely supervised by a health professional.

## Parenting Skills

Families can benefit from guidance on effective behavioral management and limit-setting. Parents need support and guidance in the skills required to help prevent or treat child or adolescent obesity. Health professionals can help support parents by emphasizing the following principles:<sup>1</sup>

- Find reasons to praise the child's or adolescent's behavior.
- Never use food as a reward. Plan activities and special times together to reward desired behavior.
- Be consistent.
- Establish daily times for family meals and snacks.
- Determine what types of foods are offered at what times, and allow the child or adolescent to decide whether to eat.
- Allow children developmentally appropriate control of food.
- Offer healthy food options.
- Model healthy eating and physical activity behaviors.
- Encourage regular physical activity, and make it fun.
- Limit the amount of time spent watching television and videotapes and playing computer games to 1 to 2 hours per day. Focus on ways to make television viewing more difficult.
- Assist the child or adolescent in dealing with teasing or hurtful social situations resulting from overweight.

## Referral

Children or adolescents who present with serious complications of obesity need to be closely monitored by a health professional and referred (if possible) to a pediatric obesity treatment program. Complications that indicate referral or consultation include pseudotumor cerebri, sleep apnea, obesity hypoventilation syndrome, Blount's disease (tibia vara), slipped capital femoral epiphysis, and severe overweight (above the 99th percentile).<sup>1</sup>

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# ORAL HEALTH

**O**ral health can be defined as a functionally sound mouth and jaw that are free of disease and supported by healthy behaviors. Because oral health requires a healthy body and healthy habits, nutrition is relevant to both the development and maintenance of oral health. Nutrition is important in the development of oral tissues that are functional, durable, and resistant to disease.<sup>1</sup> Nutrition plays a role in two oral infections that account for most tooth loss: dental caries and periodontal disease.<sup>2</sup> Nutrition also contributes to the healing and ecology of the mouth, including the salivary function.

## Significance

Some form of oral disease affects almost every American. By age 17, about 85 percent of adolescents have experienced dental caries,<sup>3</sup> and by age 18 or 19, about half have gum-tissue deterioration from early periodontal disease.<sup>4</sup> Both dental caries and periodontal disease are preventable and can be addressed through education. Because carbohydrate intake plays a major role in the development of these oral diseases, and yet carbohydrates form the foundation of nutrition recommendations, there may appear to be a conflict between oral and nutrition practices. However, a basic understanding of the role of nutrition in oral health can clarify carbohydrates' place in both good general health and good oral health.

The significance of nutrition in other aspects of oral health (e.g., the development and maintenance of functions) is less clear. Extreme nutrition defi-



ciency has been shown to result in problems such as malformed teeth and weakened periodontal structures. However, with the exception of fluoride, little is known about the effects of minor nutrition deficiencies or excesses on oral health.<sup>1</sup> Nutrition issues (e.g., special diets, intravenous and gastric feeding, bulimia nervosa, overconsumption of sports drinks) can have implications for oral health.

## Screening and Assessment

A generation ago, the relationship between nutrition and oral health was relatively simple in practice. Because dental caries were more prevalent and distributed more evenly across the population, and because carbohydrate intake (primarily sugar) was directly related to dental caries, nutrition coun-

seling for oral health focused mainly on reducing carbohydrate intake.

However, over the past 30 years, the widespread availability of fluoride in drinking water and toothpaste has weakened the direct connection between carbohydrate intake and dental caries.<sup>5</sup> Today, nutrition screening and assessment in the context of oral health usually focus on (1) general risk assessment or (2) treating children and adolescents who present with significant oral disease. Evaluating children and adolescents with established oral disease (or with a systemic disease that is affecting the mouth) consists chiefly of taking a diet history (usually for 5 days, including a weekend) to assess carbohydrate intake (amount, frequency, and form) and general nutritional adequacy. Other specific nutrients may also be assessed, although the effect of deficiencies of trace elements and various minerals on oral health is unclear.

General risk assessment gives the dental professional the opportunity to tailor oral health supervision to the child's or adolescent's level of risk for specific diseases, conditions, and injuries. The assessment consists of (1) an interview to identify general, nutrition, and medical risk and protective factors for oral disease, and (2) an analysis of these factors to establish an oral health supervision plan, one that includes age-appropriate anticipatory guidance and recommendations on the type and frequency of visits needed. *Bright Futures in Practice: Oral Health* discusses general risk assessment and provides guidelines on risk factors for all children and adolescents and on those factors that are most common at a particular age.<sup>6</sup>

## Counseling

For children and adolescents with dental caries, nutrition counseling should examine the amount, frequency, consistency (e.g., stickiness), and timing of carbohydrate intake, particularly sugar. Children and adolescents with significant dental caries should be advised to cut back on the frequency of their carbohydrate intake, eat foods that are less sticky, eat snacks in moderation, and decrease their consumption of carbonated beverages, candy, and sports drinks.

Nutrition counseling for periodontal disease is not as straightforward as that for dental caries because the condition is more complex and takes years to emerge, but any nutrition counseling should stress eating a balanced diet that maintains the integrity of the gums and bones, supports immunity and healing, and, if possible, minimizes plaque accumulation. For other nutrition deficiencies and general medical conditions, nutrition counseling should be based on the specific condition, because any systemic therapy will most likely also benefit the mouth.

Some nutrition recommendations for oral health (e.g., good general nutrition, appropriate carbohydrate intake, adequate fluoride) can be given to all children and adolescents. Health professionals can use the following information to provide anticipatory guidance to parents, children, and adolescents.

## Prenatal

Good maternal nutrition during pregnancy supports the formation of enamel of the infant's primary teeth. Extreme nutrition deficiencies in the mother can lead to malformed teeth in the infant,

but the effect of borderline deficiencies is unknown. A woman's prenatal use of fluoride does not appear to give her fetus protection against future dental caries, but as a part of her general oral health maintenance, fluoride may reduce the level of caries-causing bacteria passed to the infant.<sup>7</sup>

## Infancy and Early Childhood

When infants are 6 months old, the adequacy and method of their fluoride intake need to be addressed.<sup>8</sup> Systemic fluoride—which is ingested through fluoridated water or fluoride supplements—becomes very important because of its long-term benefits. The level of fluoride in the public water supply and in the infant's formula, the parents' use of bottled water, the choice of fluoride supplement, and the absence of fluoride in breastmilk all need to be considered when determining how much fluoride the infant is ingesting.

Early childhood caries (baby bottle tooth decay), which is exacerbated by the excessive and inappropriate use of a bottle and transitional methods of feeding (e.g., tippy cup to cup), is another important concern. To reduce the risk of early childhood caries, infants and children should not be put to bed with a bottle or allowed to drink from a bottle at will during the day. Sucking on a bottle with any liquid (except water) for a prolonged period can contribute to tooth decay. Frequent consumption (i.e., more than three times a day) of sugar or sweetened foods is associated with the development of dental caries in the first three years of life and can be a predictive risk factor. Encouraging family members to practice good oral hygiene may help reduce the level of caries-causing bacteria that can be passed through the saliva by sharing food or utensils.

For young children in child care programs, nutrition-related oral health issues include access to carbohydrates and the fluoride levels in their varying sources of drinking water. Nutrition safety concerns include fluoride toxicity (poisoning and fluorosis) and the potential for choking on foods (e.g., nuts, large pieces of meat).

## Middle Childhood and Adolescence

Children's and adolescents' access to carbohydrate snacks, their snacking patterns, their increasing freedom in food choice outside the home, and their increasing energy needs are nutrition-related oral health issues. Children's and adolescents' consumption of their school's drinking water and bottled or processed water needs to be considered when evaluating the adequacy of their fluoride ingestion.

The type and frequency of snacks consumed by children and adolescents remain a concern. Dietary fads such as sports drinks and high-citrus diets can compromise nutrition and oral health status (e.g., decalcify teeth). The increasing availability of car-



bonated beverages poses still another risk of carbohydrate exposure, plus exposure to highly acidic beverages, which displace milk and thus calcium in the diet. Bulimia nervosa can erode teeth through a demineralization process similar to dental caries.<sup>9</sup> Children's and adolescents' use of bottled and processed water may decrease their fluoride intake.

## **Children and Adolescents with Special Health Care Needs**

Many diseases and conditions can affect the nutrition and oral health status of children and adolescents with special health care needs. Children and adolescents with any systemic illness that is managed through diet or that may damage their nutrition or oral health status should see a dentist regularly. Following are some of the implications that specific conditions and nutrition challenges have for oral health:

- Preterm and low-birthweight infants can exhibit oral and dental malformations.<sup>10</sup>
- Children and adolescents with special health care needs may require high-carbohydrate diets, which may in turn encourage dental caries. The frequency of carbohydrate feeding may also accelerate dental caries. The consistency of the foods (e.g., carbohydrate pastes) may encourage plaque.<sup>11</sup>
- Children and adolescents who are fed through gastrostomy tubes can still develop calcified deposits on their teeth, which may lead to chronic inflammation in the mouth.<sup>12</sup>
- Children and adolescents with gastric reflux can have enamel erosion similar to that seen with bulimia nervosa.<sup>13</sup>

- Children and adolescents with intellectual and behavioral impairments may be at increased risk for dental caries when they are in behavioral modification programs that use carbohydrate-rich foods as reinforcement.<sup>14</sup>
- Children and adolescents who have difficulty chewing and swallowing may leave more food on their teeth, which can generate plaque.
- Children and adolescents with celiac disease and other gastrointestinal conditions may be at increased risk for tooth malformation and lesions in the mouth.<sup>15</sup>
- Children and adolescents who are fed intravenously may have premature bone loss.<sup>16</sup>
- Children and adolescents undergoing radiation and chemotherapy are at increased risk for oral disease.<sup>17</sup>

## **Other Special Considerations Vitamin Deficiencies**

Vitamin A deficiency is believed to contribute to problems in enamel formation and to weaken the epithelial attachment between the teeth and gums, which is a barrier to periodontal infection. Deficiencies of the various forms of vitamin B degrade the oral and surrounding soft tissue with oral ulcers and inflammation of the lip. Vitamin C deficiency causes scurvy and, if untreated, leads to breakdown of the gums and bones. Vitamin D deficiency can affect the enamel quality in developing teeth. Rectifying these deficiencies will reverse damage done to soft tissue and prevent further damage to the teeth.<sup>1</sup> A combination of vitamin and fluoride supplements should not be used because of the risk of excessive fluoride and enamel fluorosis.

## Table 19. Systemic Fluoride Supplements: Recommended Dosage

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### Fluoride

The widespread availability of fluoride is the primary reason why dental caries among children and adolescents have been significantly reduced in the last several generations. Fluoride increases teeth's resistance to demineralization, encourages the healing of nascent caries, and reduces plaque. The dental professional should determine the appropriate fluoride program on the basis of the child's or adolescent's age, history of and susceptibility to dental caries, and current level of exposure to fluoride.<sup>6</sup>

Children and adolescents receive fluoride in two ways: systemically and topically. Systemic fluorides (i.e., those ingested) include fluoridated water and fluoride supplements (drops, liquids, and tablets). Topical fluorides (i.e., those applied to the surfaces of the teeth) include fluoridated water, fluoride-containing toothpaste, over-the-counter fluoride rinses, and professionally applied fluoride treatments.<sup>6</sup>

Systemic fluorides are very important. Children who drink fluoridated water benefit by incorporating fluoride into their developing teeth. More important, people who drink fluoridated water, even adolescents and adults whose teeth are already formed, benefit from the topical effect of fluoride. Today, many families still do not have fluoridated water supplies, and many use multiple sources of water, complicating the delivery of fluoride to children. It is no longer sufficient for the health professional to ask families whether they live in a fluoridated community; it is more appropriate to ask about the source of their drinking and cooking water. If the water is bottled and/or processed, it must be assessed to determine whether the level of fluoride is optimal. Many children and adolescents spend a great deal of time outside the home and drink a mixture of waters, further complicating the delivery of fluoride. Fluoride supplements are recommended only when a child's or adolescent's systemic fluoride ingestion is less than optimal. After the drinking water is assessed and other fluoride

sources considered, the health professional can use the information in Table 19 to determine the appropriate supplementation for the child or adolescent.<sup>6</sup>

Topical fluoride is also very important. It is most effective when delivered at very low doses many times a day through water, foods containing fluoride, and fluoridated toothpaste. Almost all toothpaste manufactured in the United States provides topical fluoride.<sup>6</sup>

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# PEDIATRIC UNDERNUTRITION

The terms “pediatric undernutrition” and “failure to thrive” both refer to inadequate growth in infants and children. If a child’s growth is poor when plotted on a standard growth chart, this condition may be present. The usual criteria are growth measurements decreasing across percentiles or falling below the 5th percentile for age and gender in weight, length, or weight-for-length. “Failure to thrive” is a well-established term that implies a disease process and sometimes social pathology and blame. “Pediatric undernutrition” is more neutral and emphasizes nutrition. With either term, it is important to consider multiple factors. Often assumed to be a disorder of either medical (organic) origin, the condition is likely to originate from a combination of nutritional, psychosocial, medical, economic, and policy factors.

Undernutrition typically occurs in the first 3 years of life and can often be identified around age 1 by careful monitoring of the infant’s growth. Assessment and treatment should begin as soon as the problem is identified.

Approximately 3 to 5 percent of infants and children in the United States meet the growth criteria for undernutrition,<sup>1</sup> although the prevalence may be higher in some communities. Many of these children are growing within norms, but all warrant assessment.

## Significance

Pediatric undernutrition may impair a child’s growth and development. The condition is also associated with diminished immunologic resistance,

decreased physical activity, and long-term problems in cognitive development, academic performance, and socio-affective competence. These effects are of greater concern if the undernutrition is severe or occurs during infancy, when brain growth is most rapid. However, undernourished infants and children can benefit at any age from intervention that includes improved nutrition.

## Contextual Issues

Health professionals need to work closely with families when pediatric undernutrition is a concern. Issues can be complex and require extra time. A health professional should observe the infant or child eating. Home visits by dietitians, nurses, or other health professionals can increase their understanding of the family’s lifestyle and enhance their ability to advise the family.

## Biological and Developmental Factors

Infants born with low birthweight are likely to continue to be small and to require extra care with nutrition to ensure that they have the best possible opportunity to grow and develop. Special growth charts are available to monitor their growth.

In addition to low birthweight, a diagnosis of inadequate growth may derive from familial patterns of normal growth (e.g., parents who are short or thin, or who experienced delayed growth and sexual maturation). Inadequate growth may also result from medical conditions (e.g., otitis media, diarrhea) and a wide variety of uncommon condi-

tions, most of which can be identified after a careful medical history and physical examination. Zinc deficiency (common in undernourished children) should be treated, and children should be screened for iron-deficiency anemia and treated if it is present.

A few children may have trouble swallowing (manifested by gagging, excessive drooling, and other symptoms) and may require help from an occupational therapist or speech-language pathologist. In addition to undernutrition, some children have delays in speech and language or other aspects of development and should be referred to early intervention programs.

## **Behavioral and Familial Factors**

Food choice may be another factor that contributes to impaired nutrition in children. Some cases of undernutrition have been associated with excessive intake of fruit juice. In children with chronic diarrhea, it is helpful to obtain a dietary history, including the volume of fruit juice consumed. Parents can begin to assess this factor by keeping a 3-day food diary and asking a dietitian or other health professional to review it to determine whether the child's food intake is well balanced and contains sufficient calories, protein, and fat necessary to sustain growth. (Fat should not be restricted in the first 2 years of life.) Health professionals can learn about the frequency and regularity of the feedings by reviewing the family's food diary and asking the parents to describe a typical day. (For further information about eating behaviors, see the *Infancy and Early Childhood* chapters.)

## **Cultural, Economic, and Psychosocial Factors**

Cultural beliefs affect many aspects of infant and early childhood nutrition (e.g., breastfeeding and weaning, expectations about the child's weight, family food preferences, ways to deal with the child's independence). Health professionals need to listen attentively, become aware of their own assumptions, and be open to the practices of other cultures. They may also observe cultural differences in professional-parent relationships, learn to negotiate culturally based disagreements, and learn new languages or use interpreters. (For further information about culture and food choices, see the *Cultural Awareness for Nutrition Counseling* chapter.)

Health professionals should try to sensitively determine whether the family has enough money and other resources (e.g., transportation) to obtain food. Federal food assistance and nutrition programs can provide a substantial part of an infant's or child's daily nutrition requirements. (See Tool K: *Federal Food Assistance and Nutrition Programs*.) Food shelves and pantries, churches and other places of worship, and businesses can also provide food.

Much of what health professionals do is factual: They obtain information and provide anticipatory guidance. For many families, this educational approach is sufficient; for others, a psychosocial approach may be needed. If health professionals feel frustrated and worried about a family, their feelings may be a sign that more than guidance is needed. Family stressors, psychological issues, or a disturbance in the parent-child relationship may need to be addressed. In these instances, both the health professional and the family can benefit from the services of a mental health professional. If the

parents fail to follow through with the recommended guidance and the health professional suspects neglect, it may be necessary to contact protective services.

## Treatment and Management

Because multiple factors can be involved in helping an infant or child with undernutrition, several professionals—dietitians, nurses, other health professionals, child care providers, and specialists in child development or mental health—may be needed. They must learn to understand and embrace both the individuality and the complexity that children and families present. Ideally, these professionals work as a team; however, in many communities they work in different agencies. Coordination among agencies in the community is a significant challenge that must be addressed. It is important that they work closely with one another and with

families to share understanding and information and to plan effective interventions. They can also work at the interagency level to coordinate services and to identify gaps and deficiencies that require additional help.

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# VEGETARIAN EATING PRACTICES

Vegetarian eating practices are chosen for religious, health, environmental, cultural, and ethical reasons. Infants and children on vegetarian diets are following their parents' eating practices, but adolescents may choose vegetarianism independently of family members. Adolescence is a time of experimentation, and as adolescents experience cognitive changes and broaden their perspectives, they often become

concerned about social and environmental issues. Adolescents tend to be attracted to vegetarian eating practices, especially during middle or late adolescence, because of their concerns about animal welfare, ecology, the environment, or personal health.

Concerns about body weight also motivate some adolescents to adopt a vegetarian diet, since this is a socially acceptable way to reduce dietary



fat. Vegetarian eating is often seen in adolescents with anorexia nervosa, who adopt the diet in an attempt to hide their unnecessary restrictions on food intake.

Vegetarian diets usually include at least a few foods of animal origin, most commonly dairy products and eggs. Vegan diets exclude the use of animal foods of any type. Table 20 describes the different types of vegetarian eating practices.

## Potential Benefits

Vegetarian diets often provide more fruits, vegetables, and fiber, as well as less fat and cholesterol, than mixed diets. Children and adolescents who are vegetarians may also have lower levels of serum cholesterol and body fat than nonvegetarians.

## Potential Risks

Vegetarian diets that include dairy products and eggs are generally high in essential nutrients and are unlikely to pose health risks. Strict adherence to a vegan diet (which excludes all foods of animal origin) may place infants, children, and ado-



lescents at nutrition risk. Unless specially fortified foods or supplements are added, the vegan diet lacks vitamins B<sub>12</sub> and D.

Animal foods are particularly rich sources of certain nutrients needed for growth: protein, iron, calcium, zinc, vitamin B<sub>12</sub>, vitamin A, and vitamin D. If animal foods are eliminated, these nutrients must be obtained from other sources to ensure good health.

Overly restricted or inappropriately selected vegetarian diets can result in significant malnutrition. In infants and children, malnutrition from insufficient intake of protein and energy (calories), failure to thrive, growth deficits, rickets, iron-deficiency anemia, and vitamin B<sub>12</sub> deficiency have been reported. Infants consuming a macrobiotic diet who are fed inappropriate infant formula are particularly at risk for severe nutrition problems. In adolescents, a delayed growth spurt, iron-deficiency anemia, and vitamin B<sub>12</sub> deficiency have been observed.<sup>1</sup>

## Nutritional Adequacy

Vegetarian diets are consistent with the Dietary Guidelines for Americans and can meet the RDAs for nutrients.<sup>2</sup> With careful planning, vegetarian diets can provide a variety of nutrient-dense foods that promote healthy growth and development. See Tables 21 and 22 for suggested daily food guides for lacto-ovo-vegetarian and vegan children and adolescents.

Although slower growth rates have been reported in infants and children who followed vegan and macrobiotic diets during the first 5 years of life, “catch-up” growth usually occurred in these children by age 10. In adolescents who are vegetarians,

**Table 20. Vegetarian Diets**

<b>Lacto-ovovegetarian</b>	Includes grains, fruits, vegetables, legumes, nuts, seeds, milk, and eggs; excludes meat, poultry, and fish and other seafood.
<b>Lactovegetarian</b>	Includes grains, fruits, vegetables, legumes, nuts, seeds, and milk; excludes eggs, meat, poultry, and fish and other seafood.
<b>Strict, total, or pure vegetarian</b>	Includes grains, fruits, vegetables, legumes, nuts, and seeds; excludes all foods of animal origin.
<b>Vegan</b>	The term vegan is also used to describe total vegetarians. Originally, this term was used to describe persons who refrained from not only eating foods of animal origin, but also using animal products such as leather. The term is often used today to denote someone who excludes all animal products from his or her diet without implication regarding their use of other types of animal products.
<b>Semivegetarian</b>	Includes grains, fruits, vegetables, nuts, seeds, milk, and eggs; usually excludes red meat, but may include small amounts of fish or fowl on limited occasions.
<b>Macrobiotic</b>	Emphasizes whole grains and vegetables, including beans and sea vegetables (seaweeds). Uses only locally grown fruits. Foods of animal origin are limited to small amounts of white-meat or fish once or twice a week. This diet may be similar to a vegan diet in its nutritional profile.

Source: Reprinted, with permission, from Table 4.1, Johnson and Haddad.<sup>3</sup> © 1996 Aspen Publishers.

menarche has been observed at a slightly later age, which may be related to a lower percentage of body fat.<sup>1</sup>

## Energy

Adequate food intake, which supplies energy from sources of carbohydrates, protein, and fats, is essential for growth, development, and activity. Decreased energy (caloric) intake may occur if food choices are excessively low in dietary fat and excessively high in fiber and bulk (e.g., bran, raw fruits and vegetables). Infants and children younger than 5 years of age who consume a vegan diet are at spe-

cial risk for low energy supply because they must rely on their parents for their food.<sup>4</sup> Fat should not be restricted in infants and children younger than 2 years of age and should not be overly restricted in older children and adolescents.

## Protein

Breastmilk is an ideal source of protein throughout the first 1 to 2 years of life. For infants who are not breastfed or who are partially breastfed, fortified soy infant formula promotes growth and is recommended during the first year of life (first 2 years, if consuming a vegan diet). At 4 to 6 months

of age, the addition of foods rich in amino acids (e.g., mashed legumes, lentils, tofu) will provide adequate protein for infants who are consuming a vegan diet.<sup>4</sup>

When energy needs are adequately met through the consumption of a variety of plant foods, protein needs are also likely to be met. When energy supply is inadequate, protein will be used to meet energy needs rather than for tissue synthesis. Because infants and children have small stomach capacities, small amounts of nutrient-dense foods are recommended five or six times a day. Dairy products and eggs provide high-quality protein. Mixtures of plant proteins also provide balanced, complete sources of amino acids to adequately meet protein requirements.

Metabolic needs can be met by drawing on the body's amino acid pools if a variety of protein-containing foods (as indicated in the Food Guide Pyramid) are eaten throughout the day; consuming precise combinations of plant proteins at the same meal to achieve complete proteins is not necessary.<sup>5</sup> However, foods containing protein in sufficient quality and quantity, or complementary proteins consumed within a few hours of one another, are recommended for infants and children younger than 2 years of age who are not fed breastmilk or infant formula. Soy, amaranth, and quinoa have amino acid patterns similar to those of cow's milk and therefore are important protein sources.

## Calcium

Calcium absorption and retention may be 30 to 50 percent higher among vegetarians who consume moderate amounts of protein. Dairy products are excellent sources of calcium. Vegan diets, if not well planned, may contain insufficient calcium. Many

vegetarian foods contain moderate amounts of calcium.

Sources of calcium in vegetarian diets include calcium-fortified soy milk, calcium-fortified orange juice, tofu processed with calcium, blackstrap molasses, sesame seeds, tahini (sesame butter), almonds and almond butter, and certain vegetables (e.g., broccoli, okra, collard and mustard greens, kale, rutabaga). Calcium in plant foods that contain high amounts of oxalates (e.g., spinach, Swiss chard, beet greens, rhubarb) is not well absorbed since insoluble calcium oxalate is formed. Fermentation, roasting, and yeasting increase calcium absorption from products (e.g., miso, nuts, leavened bread).<sup>4</sup> Calcium supplements may be necessary if dietary intake is inadequate.

## Vitamin D

In addition to calcium, adequate intake of vitamin D is essential for bone health. Although vitamin D can be produced through exposure of the skin to sunlight (20 to 30 minutes two or three times per week), this source of vitamin D cannot be relied on in northern climates during the winter. Dark-skinned persons require longer exposure to sunlight (30 minutes to 3 hours per day) to produce adequate amounts of vitamin D.<sup>4</sup> Sunscreens, smog, and sunlight exposure through glass inhibit vitamin D synthesis.

Breastfed infants who do not have adequate exposure to sunlight should receive a vitamin D supplement (5.0 mg per day); for infants who are not breastfed, soy infant formula provides vitamin D. Children and adolescents can obtain vitamin D from fortified soy milk, fortified breakfast cereals, and fortified margarines.

## Vitamin B<sub>12</sub>

An adequate intake of vitamin B<sub>12</sub> is essential for growth, red blood cell maturation, and central nervous system functioning. Because of rapid growth and limited nutrient stores in infancy, infants on a vegan diet are at high risk for vitamin B<sub>12</sub> deficiency, which may be manifested as irritability, apathy, failure to thrive, or developmental regression. Vitamin B<sub>12</sub> deficiency has been reported in breastfed infants of women on a vegan diet who do not supplement their diet with vitamin B<sub>12</sub>. If untreated in early stages, vitamin B<sub>12</sub> deficiency can lead to serious and permanent neurologic damage.<sup>1</sup> High folate intake, which may occur in children and adolescents who follow a vegan diet, can mask hematological changes associated with vitamin B<sub>12</sub> deficiency, while neurologic damage progresses.

Vitamin B<sub>12</sub> occurs naturally in animal products, including dairy products and eggs. Although unfortified plant foods (e.g., miso, tempeh, tamari, sauerkraut, seaweed, spirulina, algae) may contain some vitamin B<sub>12</sub>, it appears to be present in inactive forms, some of which function as antivitamin. Thus, these sources of vitamin B<sub>12</sub> are considered unreliable.<sup>4</sup>



To ensure adequate vitamin B<sub>12</sub> status, breastfed infants of women who consume a vegan diet should receive a vitamin B<sub>12</sub> supplement (0.3 µg per day); if these infants are not breastfed, they should be given soy infant formula. Children and adolescents who consume a vegan diet should receive a vitamin B<sub>12</sub> supplement or regularly consume one of the following: breakfast cereals, textured soy protein, or soy milk fortified with vitamin B<sub>12</sub>, or Red Star T-6635+ nutritional yeast flakes.<sup>4</sup>

## Iron

Iron needs increase during periods of rapid growth. Although non-heme iron in plant products, dairy foods, and eggs has a lower absorption rate (2 to 20 percent) than that of heme iron in meat, fish, and poultry (15 to 35 percent), vegetarians do not have a higher incidence of iron-deficiency anemia than persons consuming a mixed diet. Iron deficiency has been reported in children fed a macrobiotic diet. The high fiber content of vegetarian diets may make it more difficult for children and adolescents to meet iron needs.

Ascorbic, citric, and malic acid found in fruits and vegetables enhance iron absorption. Foods that decrease iron absorption include wheat bran, nuts, seeds, whole grain cereals, soybeans, spinach, and dairy products. Processes involved in leavening and baking whole grain bread, fermenting soy products (e.g., miso, tempeh), roasting nuts, sprouting seeds, and coagulation with gluconic acid (e.g., tofu) decrease phytates and enhance iron absorption.<sup>4</sup>

Foods high in iron should be consumed daily (e.g., fortified breakfast cereals, instant oatmeal, blackstrap molasses, legumes, tofu, dried fruits, enriched pasta, bread). Iron inhibitors (e.g., coffee, tea, wheat bran) should be avoided.



To ensure adequate iron status, breastfed infants should receive a low-dose iron supplement or iron-fortified infant cereal at 6 months of age. Infants on a vegan diet who are not breastfed should receive iron-fortified soy formula for the first 1 to 2 years of life. Children and adolescents should consume juices, fruits, and vegetables high in ascorbic acid daily with meals.

## Zinc

Zinc is essential for growth and development. Infants fed breastmilk or soy infant formula will receive adequate amounts of zinc. Milk and eggs are good sources of zinc in lactovegetarian and lacto-ovovegetarian diets. Plant sources of zinc include legumes, tofu, miso, tempeh, nuts, seeds, wheat germ, and whole grains.<sup>4</sup>

To increase the bioavailability of zinc and ensure adequate zinc intake, raw wheat bran should be avoided and the consumption of unleavened bread limited. Legumes should be soaked 1 to 2 hours before cooking, and the water discarded before cooking. Yeast-leavened bread and whole

grains, roasted nuts, and sprouted seeds can be used. Because calcium interferes with zinc absorption, consuming calcium supplements with phytate-containing zinc sources (e.g., legumes, nuts, whole grains) should be avoided, but dairy foods are fine in moderation.

## Screening and Assessment

The nutritional adequacy of vegetarian and vegan diets can be assessed by asking a few targeted questions. Vegetarian diets vary widely, so it is important to assess precisely what foods are eaten and eliminated from the diet and what supplements are used.

## Counseling

Vegetarian eating practices need to be carefully planned to provide enough energy, protein, calcium, iron, zinc, and vitamins B<sub>12</sub> and D. The bioavailability of calcium, iron, and zinc should also be ensured. Careful planning of vegan diets is especially important because it is more difficult to meet nutrient needs from plant foods alone. Parents of infants, children, and adolescents who are vegetarians should be given information on how to plan and provide a nutritionally adequate diet.

When adolescents become vegetarians, parents are often concerned about the diet's nutritional adequacy, especially about meeting protein requirements. Parents need reassurance that a vegetarian diet can meet their adolescent's nutrition needs, and they should receive information on the principles of healthy vegetarian eating for adolescents.

The following guidelines for vegetarian eating practices are based on the references listed at the end of this chapter.

## Infancy

- Breastfeed for at least 12 months, and thereafter for as long as the mother and infant wish to continue.
- If breastfeeding is discontinued before 12 months, or breastfeeding occurs fewer than three times a day, feed fortified soy infant formula (20 to 30 oz per day) until the infant is 12 months, or until age 2 if the infant is consuming a vegan diet.
- Avoid cow's milk during the first year of life and reduced-fat (2 percent), low-fat (1 percent), and fat-free (skim) milk during the first 2 years.
- Avoid inappropriate substitutes for breastmilk or infant formula (e.g., unfortified soy milk, rice milk, almond milk, formula prepared from grains).
- Avoid corn syrup or honey.
- Provide a vitamin D supplement to breastfed infants before 6 months of age if their mothers are vitamin D–deficient or if infants are not exposed to adequate sunlight.
- Provide an iron supplement or a supplemental food source of iron (e.g., infant cereal, tofu) for breastfed infants at 4 to 6 months of age.<sup>6</sup>
- Provide a vitamin B<sub>12</sub> supplement to breastfed infants of mothers who consume a vegan diet.
- Feed nutrient-dense solid foods (e.g., mashed legumes, tofu, cottage or ricotta cheese, yogurt, soy cheese, soy yogurt) at 4 to 6 months of age.

## Early Childhood and Middle Childhood

- Provide three meals and two to three snacks per day.
- Avoid bran and excessive intake of bulky foods (e.g., raw fruits and vegetables).
- Encourage eating nutrient-dense foods (e.g., avocado, cheese, soy cheese, hummus, nut butters, tahini, tofu).
- Provide an omega-3 fatty acid source (e.g., canola oil, soy oil, tofu, soybeans, walnuts, wheat germ).
- Avoid excessive restriction of dietary fat.
- Ensure an adequate intake of calcium, zinc, iron, and vitamins B<sub>12</sub> and D.

## Adolescence

- Avoid skipping meals.
- Avoid excessive restriction of dietary fat.
- Limit low-nutrient snacks high in fat and sugar.
- Encourage eating healthy, nutrient-dense snacks (e.g., bagels, bean burritos, falafel, hummus and pita, nachos, nuts, nut butters [almond, cashew, peanut, soy], sunflower and pumpkin seeds, tofu dogs, tofu spreads, trail mix, veggie burgers, veggie pizzas, yogurt shakes).
- Provide an omega-3 fatty acid source (e.g., canola oil, soy oil, tofu, soybeans, walnuts, wheat germ).
- Ensure an adequate intake of calcium, zinc, iron, and vitamins B<sub>12</sub> and D.
- Avoid inappropriate weight-loss practices.

**Table 21. Suggested Daily Food Guide for Lacto-ovovegetarians at Various Intake Levels**

Food Groups	Servings per Day, by Age and Daily Caloric Intake			
	1–2 Years (1,300 kcal)	3–6 Years (1,800 kcal)	7–10 Years (2,000 kcal)	11+ Years (2,200–2,800 kcal)
Breads, grains, cereal	5	5	6	9–11
Legumes	1/2	1	1	2–3
Vegetables	2	3	3–5	4–5
Fruits	3	3	4	4
Nuts, seeds	1/2	1/2	1	1
Milk, yogurt, cheese	3	3	3	3
Eggs (limit 3/week)	1/2	1/2	1/2	1/2
Fats, oils (added)	2	4	4	4–6
Sugar (added teaspoons)	3	4	6	6–9

Source: Based in part on Table 3, Haddad.<sup>7</sup>

Note: Serving sizes are based on Haddad.<sup>7</sup>

- Bread, grains, and cereals: 1 slice of bread; 1 biscuit, small roll, pita, tortilla, or muffin; 1/2 bagel, English muffin, or bun; 1/2 cup cooked pasta, rice, quinoa, or couscous; 1/4 cup bulgur; 3/4–1 cup ready-to-eat cereal or 1/2 cup cooked cereal; 4–6 small or 2 large crackers; 1 medium pancake or waffle; 1/3 cup wheat berries; 2 tablespoons wheat germ.
- Legumes: 1/2 cup cooked dry beans (red, navy, kidney, pinto, black, garbanzo, soy); 1/2 cup cooked lentils, split peas, or black-eyed peas; 1/2 cup tofu or tempeh.
- Vegetables: 1/2 cup cooked or 1 cup raw; 3/4 cup juice.
- Fruits: 1 medium piece fresh; 1/2 cup cooked, chopped, or canned; 1/4 cup dried; 3/4 cup juice.
- Nuts and seeds: 1/4 cup; 2 tablespoons nut butter or tahini.
- Milk, yogurt, cheese, or milk alternative: 1 cup milk, yogurt, tofu fortified with calcium, or soy milk fortified with calcium and vitamins B<sub>12</sub> and D; 1 1/2 oz cheese; 1/2 cup ricotta cheese; 1 1/3 cups cottage cheese.
- Eggs: 1.
- Fats and oils: 1 teaspoon oil, margarine, or mayonnaise; 2 teaspoons salad dressing.
- Sugars: 1 teaspoon sugar, honey, jelly, jam, or syrup.

**Table 22. Suggested Daily Food Guide for Vegan Children and Adolescents at Various Intake Levels**

Food Groups	Servings per Day, by Age and Daily Caloric Intake			
	1–2 Years (1,300 kcal)	3–6 Years (1,800 kcal)	7–10 Years (2,000 kcal)	11+ Years (2,200–2,800 kcal)
Breads, grains, cereals	5	6	7	10–12
Legumes	1/2	1	1	2–3
Vegetables, dark-green leafy	1	1	1	1
Vegetables, other	1	2	2	3–4
Fruits	2	4	5	4–6
Nuts, seeds	1/2	1/2	1	1
Milk alternatives <sup>a</sup>	3	3	3	3
Fats, oils (added)	2	4	4	4–6
Sugar (added teaspoons)	3	4	6	6–9

Source: Based in part on Table 4, Haddad.<sup>7</sup>

Note: See note to Table 10 for serving sizes.

<sup>a</sup>Fortified with calcium and vitamins B<sub>12</sub> and D.

## Referral

Referral to a dietitian is helpful in assessing dietary intake and planning healthy vegetarian diets. For infants, children, and adolescents consuming vegetarian diets, referral to a dietitian is essential if the health professional does not have training in or adequate knowledge of nutrition. (See Tool J: Nutrition Resources.)



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## Suggested Reading

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