## **Why** **is pediatric obesity harmful, and what can be done?**

Although the prevalence of obesity has stabilized for U.S. children and adolescents since 2007, rates remain unacceptably high.1 The problem can begin as early as the toddler years: Over 20% of children 2 to 5 years old are classified as overweight, while 8% are categorized as obese.1 As mentioned at the beginning of this chapter, overall, about 17% of U.S. children and adolescents ages 2 to 19 years--nearly 13 million children--are currently classified as obese.

**Obesity Impairs Children's Health**

We may feel shocked at the sight of an obese child, but children's health experts point out that we should be more concerned by underlying medical issues.27 Even in early childhood, obesity can worsen asthma, increase risk of dental caries, cause sleep apnea, impair the child's mobility, reduce academic performance, and lead to intense teasing, low self-esteem, depression, and social isolation. Fatty liver is diagnosed in one-half of obese adolescents, and increasing numbers of obese children are experiencing abnormal blood lipids, high blood pressure, high blood glucose, metabolic syndrome, skeletal disorders, and other medical problems.27 Also, it has been estimated that about 70 % of children who are obese maintain their higher weight as adults, thus prevention or treatment of pediatric obesity will positively impact rates of adult obesity.

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Parents should not be offended if the child's pediatrician or other healthcare provider expresses concern over the child's weight status; early intervention is often the most effective measure against lifelong obesity. Pediatricians use growth charts published by the Centers for Disease Control and Prevention (CDC) to track a child's growth over time and identify children at risk for overweight or obesity. The charts aid clinicians in assessing a child's stature-for-age, weight-for-age, and BMI-for-age (see Appendix E). The charts are also available for families at the CDC website listed in the **Web Links.** The CDC classifies as obese children over the age of 2 who are at or above the 95th percentile for their gender-specific BMI-for-age; that is, their BMI is higher than that of 95% of U.S. children of the same age and gender. Children at or above the 85th percentile but below the 95th percentile on BMI-for-age charts are defined as overweight. Recently, the CDC added two new categories to describe severe obesity among children and adolescents:

- Class 2 obesity is a BMI greater than or equal to 120% of the 95th percentile or a BMI greater than or equal to 35; approximately 6% of U.S. children meet the criteria for class 2 obesity.

- Class 3 obesity is a BMI greater than or equal to 140% of the 95th percentile or a BMI greater than or equal to 40; approximately 2% of U.S. children meet the criteria for class 3 obesity.

Unfortunately, rates of class 2 and 3 obesity have increased over the past several years, particularly among girls.28

Using growth charts, pediatricians and parents can easily observe the pattern that develops from year to year. Children who begin to track toward higher and higher BMI-for-age percentiles should be encouraged and supported in healthful, balanced eating and increased physical activity.

**Encourage Healthful Eating Patterns**

The introduction and retention of healthful eating patterns within the family unit are among the most effective strategies in the fight against pediatric obesity.29 Rather than singling out overweight children and placing them on restrictive diets, experts encourage family-wide improvements in food choices and mealtime habits. Parents should strive to consistently provide nutritious food choices, limit access to sugary drinks, and sit down to a shared family meal as often as possible. Using the MyPlate model, parents and children can work together to "diagram" meals that include brightly colored vegetables, deep-brown whole grains, lean plant and animal protein sources, and dairy or dairy substitutes. A meal that includes prewashed bagged salad, frozen vegetables, instant brown rice, and deli-prepared broiled chicken is a quick and healthful option. Television and other electronic distractions should be off limits throughout mealtimes to encourage attentive eating and true enjoyment of the food.

Parents should retain control over the purchase and preparation of foods until older children and teens are responsible and knowledgeable enough to make healthful decisions. As the "gatekeepers" for household food supplies, parents' choices to buy or not to buy chips, sweets, fried foods, and sugary drinks influence their family members' health. Parents can keep a supply of nonperishable snacks--such as granola bars, dried fruits and nuts, and kid-friendly fruits, including apples, bananas, and oranges--to grab as everyone dashes out the door. Whenever possible, parents should minimize the number of meals eaten in restaurants, especially fast-food franchises. When families do eat out, large portion sizes can be shared; moreover, the family can order grilled, broiled, or baked foods instead of fried foods. Sugary drinks should be replaced with low-fat milk or water.

Finally, parents remain important role models, even through the often turbulent adolescent years. Parents themselves should follow a healthful eating pattern, engage in regular physical activity, and avoid substance abuse.

As discussed earlier, schools play a role in shaping eating behaviors. Parents can work with local school boards to eliminate or restrict the sale of soda, candy, chips, and pastries.

[Image: The rates of obesity among U.S. children remain unacceptably high.]

[Download a free, 112-page cookbook chock-full of healthy, kid-friendly recipes from the National Heart, Lung, and Blood Institute. Go to **www.nhlbi.nih.gov,** enter "keep the beat heart healthy recipes" into the search box, then click on the link.]

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[Image: Families should try to have shared meals whenever possible.]

Schools can set aside land or construct raised beds for vegetable gardens, and food service providers can use the produce in breakfasts and lunches. Consistent and repeated school-based messages on good nutrition can reinforce the efforts of parents and healthcare providers.

**Encourage Physical Activity**

Television, computer use, and electronic games often tempt children into a sedentary lifestyle, but increased energy expenditure through increased physical activity is essential for successful weight management. The Physical Activity Guidelines for Americans recommend bone- and muscle-strengthening activities for children at least 3 days each week,30 in addition to at least 1 hour of moderate to vigorous physical activity each day. For younger children, daily activity can be divided into two or three shorter sessions, allowing them to regroup, recoup, and refocus between activity sessions. Overweight children are more likely to engage in physical activities that are noncompetitive, fun, and structured in a way that allows them to proceed at their own pace. All children can be encouraged to have fun using their muscles in various ways that suit their interests **(TABLE 15.2).** Activity-based interactive DVD games are ideal for children who must remain indoors for extended periods.

As with healthful eating patterns, parents play an important role in establishing and maintaining an active lifestyle for the family. Shared family activities such as bicycle riding, volleyball or basketball games, hikes, and water sports encourage physical activity throughout the year. Parents can establish daily limits on the use of electronic games, television, recreational use of computers, and other sedentary activities in order to minimize sitting time. These approaches can help reduce children's and adolescents' obesity risk.

**[recap**

Obesity is an important concern for children of all ages, their families, and their communities. About 17% of U.S. children and adolescents ages 2 to 19 years--nearly 13 million children--are currently classified as obese. Complications of obesity include more severe asthma, sleep apnea, impaired mobility, metabolic syndrome, reduced academic performance, low self-esteem, depression, and many other problems. Parents should model healthful eating and activity behaviors. Schools play an important role in providing nutritious breakfasts and lunches and varied opportunities for daily physical activity. Children should engage in bone- and muscle-strengthening activities for at least 3 days each week, in addition to at least 1 hour of moderate to vigorous physical activity each day.]

[Tips on family fitness can be found at **www.verywell.com.** From the home page, enter "family fitness" into the search box and choose a link.]

[Image: Active, healthy-weight children are less likely to become overweight adults.]

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**TABLE 15.2 Examples of Physical Activities for Children and Adolescents\***

|  |  |  |
| --- | --- | --- |
| **Type of Physical Activity** | **Age Group: Children** | **Age Group: Adolescents** |
| Moderate-intensity aerobic | - Active recreation, such as hiking, skateboarding, rollerblading- Bicycle riding- Brisk walking | - Active recreation, such as canoeing, hiking, skateboarding, rollerblading- Brisk walking- Bicycle riding (stationary or road bike)- Housework and yard work, such as sweeping or pushing a lawn mower- Games that require catching and throwing, such as baseball and softball |
| Vigorous-intensity aerobic | - Active games involving running and chasing, such as tag- Bicycle riding- Jumping rope- Martial arts, such as karate- Running- Sports such as soccer, ice or field hockey, basketball, swimming, tennis- Cross-country skiing | - Active games involving running and chasing, such as flag football- Bicycle riding- Jumping rope- Martial arts, such as karate- Running- Sports such as soccer, ice or field hockey, basketball, swimming, tennis- Vigorous dancing- Cross-country skiing |
| Muscle-strengthening | - Games such as tug-of-war- Modified push-ups (with knees on the floor)- Resistance exercises using body weight or resistance bands- Rope or tree climbing- Sit-ups (curl-ups or crunches)- Swinging on playground equipment/bars | - Games such as tug-of-war- Push-ups and pull-ups- Resistance exercises with exercise bands, weight machines, handheld weights- Climbing wall- Sit-ups (curl-ups or crunches) |
| Bone-strengthening | - Games such as hopscotch- Hopping, skipping, jumping- Jumping rope- Running- Sports such as gymnastics, basketball, volleyball, tennis | - Hopping, skipping, jumping- Jumping rope- Running- Sports such as gymnastics, basketball, volleyball, tennis |

*\*Note:* Some activities, such as bicycling, can be moderate or vigorous intensity, depending on level of effort.

*Source:* Data from *2008 Physical Activity Guidelines for Americans,* U.S. Department of Health and Human Services.

**LO 5** Describe the growth of the older adult population in the United States and the physiologic changes that accompany normal aging.

## **What** **characterizes aging?**

Throughout this book, our exploration of nutrition and physical activity has focused mainly on young and middle-age adults. In the following section, we discuss aging, including the ways in which diet and lifestyle affect the aging process.

**Americans Are Getting Older**

The U.S. population is getting older each year. Consider the following statistics:

- In 2014, average life expectancy at birth was projected at 78.8 years.31

- The elderly (those 65 years and above) number over 45 million and account for about 14% of the American population.32

- People 85 years of age and older currently represent the fastest-growing U.S. population subgroup, projected to increase from 6 million in 2015 to nearly 20 million by the year 2050.32 These so-called very elderly or oldest old account for the majority of healthcare expenditures and nursing home admissions in the United States.

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- The number of *centenarians,* persons over the age of 100 years, and *super centenarians,* over 110 years, continues to grow as well. Between 2000 and 2014, the number of centenarians grew by over 40%, and there are now more than 72,000 centenarians in the United States.

These statistics have important nutrition-related implications for you, even if you're a young adult. That's because a nutritious diet and regular physical activity throughout life can delay the onset of chronic diseases, and help you to maintain a better quality of life as you age.

**Characteristic Physiologic Changes Accompany Aging**

Older adulthood is a time in which body systems begin to slow and degenerate. If the following discussion of this degeneration seems disturbing or depressing, remember that the changes described are at least partly within an individual's control. For instance, some of the decrease in muscle mass, bone mass, and muscle strength is due to low physical activity levels. In addition, there are intriguing lines of research actively searching for a modern-day "fountain of youth," some of which are discussed in the **In Depth** essay following this chapter.

**Age-Related Changes in Sensory Perception**

For most individuals, eating is a social and pleasurable process; the sights, sounds, odors, and textures associated with food stimulate and enhance one's appetite. However, odor, taste, touch, and vision all decline with age and negatively affect the food intake and nutritional status of older adults.

It has been estimated that over half of older adults experience a significant impairment in their sense of smell. The nerve receptors for taste and smell are complementary; thus, enjoyment of food relies heavily on the sense of smell. Older adults who cannot adequately appreciate the appealing aromas of food may be unable to fully enjoy the foods offered in a meal. Although often a simple consequence of aging, loss of odor perception can also be caused by a zinc deficiency or a medication. If this is the case, a zinc supplement or change of medication may be a simple solution.

Because the sense of smell contributes significantly to the sense of taste, *dysgeusia,* or an impaired sense of taste, is also common. Most often diminished are the abilities to detect salt and bitter tastes. The perception of sweetness and sourness also declines, but to a lesser extent.

Loss of visual acuity has unexpected consequences for the nutritional health of older adults. Many have difficulty reading food labels, including nutrient information and "pull dates" for perishable foods. Driving skills decline, limiting the ability of some older Americans to get to a market offering healthful, affordable foods. Older adults with vision loss may not be able to see the temperature knobs on stoves or the controls on microwave ovens and may therefore choose cold meals, such as sandwiches, rather than meals that require heating. Also, the visual appeal of a colorful, attractively arranged plate of food is lost to visually impaired elderly people, further reducing their desire to eat healthful meals.

**Age-Related Changes in Gastrointestinal Function**

Significant changes in the mouth, stomach, intestinal tract, and related organs occur with aging. Some of these changes can increase the risk for nutrient deficiency and excessive weight loss.

With increasing age, salivary production declines. A dry mouth reduces taste perception, increases tooth decay, and makes chewing and swallowing more difficult. Thus, a diet rich in moist foods, including fruits and vegetables; sauces or gravies on meats; and high-fluid desserts, such as puddings, is advised. Difficulty swallowing, clinically known as *dysphagia,* can also result from a stroke or a condition such as Parkinsonism. Smooth, thick foods, such as cream soups, applesauce, milkshakes, fruit nectars, yogurt, and puddings, are usually well tolerated.

[Image: Centenarians represent the future of U.S. elderly.]

[How many more years can you expect to live? Find out by using the Social Security Administration's calculator at **www.ssa.gov.** From the home page, type "life expectancy calculator" in the search box and get started.]

[Find over a dozen links to resources on healthful nutrition for older adults at **https://www.nutrition.gov/life-stages/seniors**.]

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Older adults are also at risk for a reduced secretion of gastric hydrochloric acid, which limits the absorption of minerals such as calcium, iron, and zinc and food sources of folic acid and vitamin B12. A decline in intrinsic factor also reduces the absorption of vitamin B12 (see Chapter 8). Thus, vitamin B12 supplements and/or B12 injections are advised.

**Age-Related Changes in Body Composition**

With aging, body fat increases and muscle mass declines, leading to impaired physical functioning in the elderly. It has been estimated that women and men lose 20% to 25% of their lean body mass, respectively, as they age from 35 to 70 years. The decreased production of certain hormones, including testosterone and growth hormone, and chronic diseases contribute to this loss of muscle, as do poor diet and an increasingly sedentary lifestyle. Adequate protein intake and regular physical activity, including strength or resistance training, can help older adults maintain their muscle mass and strength.33,34

Body fat increases from young adulthood through middle age, peaking at approximately 55 to 65 years of age, then declining in persons over the age of 70. With aging, body fat shifts from subcutaneous stores, just below the skin, to internal, or visceral, fat stores. Older men and women tend to deposit more fat in their abdominal region compared to younger adults. Among women, this shift in body fat stores is most dramatic after the onset of menopause and coincides with an increased risk for heart disease, diabetes, and metabolic syndrome.

Bone mineral density declines with age and may eventually drop to the critical fracture zone. Among older women, the onset of menopause leads to a sudden and dramatic loss of bone due to the lack of estrogen. Although it is less dramatic, elderly men also experience this loss of bone, due in part to decreasing levels of testosterone. In addition to the well-known benefits of calcium and vitamin D, intakes of vitamins A, C, and K, phosphorus, magnesium, fluoride, and protein are recognized as influencing bone density. As noted in the **Nutrition Debate** on physical activity in the elderly (page 559), bone health can be promoted through regular weight-bearing activity in adults well into their 90s and beyond.

**[recap**

The U.S. population is getting older. Adults age 65 and older account for about 14% of the U.S. population. The physiologic changes that can occur with aging include sensory declines; an impaired ability to chew, swallow, and absorb and metabolize various nutrients; a loss of muscle mass and lean tissue; increased fat mass; and decreased bone density. These age-related changes influence the nutritional needs of older adults and their ability to consume a healthful diet.]

**LO 6** Explain how aging influences the nutrient needs and health concerns of older adults.

## **What are the nutritional needs and concerns of older adults?**

The energy and nutrient needs of older adults reflect their reduced physical activity and the physiologic changes of aging. At the same time, several nutrition-related health concerns arise.

**Some Nutrient Recommendations Increase or Decrease with Aging**

The requirements for many nutrients are the same for older adults as for young and middle-aged adults. A few nutrient requirements increase, and a few are actually lower. **TABLE 15.3** identifies the nutrient recommendations that change as well as the physiologic reasons behind these changes.

[Image: Age-related changes in sensory as well as gastrointestinal function can lead to inappropriate weight loss in older adults.]

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**TABLE 15.3 Nutrient Recommendations That Change with Increased Age**

|  |  |
| --- | --- |
| **Changes in Nutrient Recommendations** | **Rationale for Changes** |
| **Vitamin D** | Decreased bone density |
| Increased need for vitamin D from 600 IU/day for adults age 18-70 years to 800 IU/day for adults over age 70 years | Decreased ability to synthesize vitamin D in the skin |
| **Calcium** | Decreased bone density |
| Increased need for calcium from 1,000 mg/day for adults 19-50 years to 1,200 mg/day for women 51 years of age and older, and men 71 years and older | Decreased absorption of dietary calcium |
| **Fiber** | Decreased energy intake |
| Decreased need for fiber from 38 g/day for young men to 30 g/day for men 51 years and older; decreases for women from 25 g/day for young women to 21 g/day for women 51 years and older |  |
| **B-Vitamins** | Lower levels of gastric juice |
| Increased need for vitamin B6 and need for vitamin B12 as a supplement or from fortified foods | Decreased absorption of food B12 from gastrointestinal tractIncreased need to reduce homocysteine levels and to optimize immune function |

**Energy and Macronutrient Recommendations for Older Adults**

The energy needs of older adults are lower than those of younger adults. This decrease is due to a loss of muscle mass and lean tissue, a reduction in thyroid hormones, and an increasingly sedentary lifestyle. It is estimated that total daily energy expenditure decreases approximately 10 kcal each year for men and 7 kcal each year for women ages 19 and older.2 This adds up over time; for example, a woman who needs 2,000 kcal at age 20 needs just 1,650 at age 70. Some of this decrease in energy expenditure is an inevitable response to aging, but some of the decrease can be delayed or minimized by staying physically active.

To avoid weight gain, older adults need to consume a diet high in nutrient-dense foods. The USDA MyPlate model can be adapted to reflect the needs of older adults and help guide their food choices **(FIGURE 15.6).** See the **In Depth** essay following this chapter to learn more about the theories of Caloric restriction and intermittent fasting, which propose that low-energy diets may significantly prolong life.

To reduce their risk for cardiovascular and other chronic diseases, it is recommended that older adults maintain a total fat intake within 20% to 35% of total daily energy intake, with less than 10% of total energy intake coming from saturated fat.

The RDA for carbohydrate is the same for adults of all ages: 130 g/day.2 Fiber-rich carbohydrates should be emphasized over refined carbohydrates: it is recommended that older individuals consume a diet that contains no more than 25% of total energy intake as sugars.2 The fiber recommendations are slightly lower for older adults than for younger adults because older adults eat less energy. After age 50, 30 g of fiber per day for men and 21 g for women is assumed sufficient to reduce the risks for constipation and diverticular disease, maintain healthful blood levels of glucose and lipids, and provide good sources of nutrient-dense, low-energy foods.

The DRI for protein is the same for adults of all ages: 0.80 g protein/kg body weight per day.2 Some researchers have argued for a protein allowance of 1.0 to 1.2 g per kg body weight for older adults in order to optimize their protein status; however, the issue remains unresolved.35,36 Protein is important to help minimize the loss of muscle and lean tissue, optimize healing after injury or disease, maintain immunity, and help prevent excessive bone loss. Many protein-rich foods are also important sources of the vitamins and minerals that are typically low in the diets of older adults; thus, protein is an important nutrient for this age group.

[Image: Older adults have lower total energy requirements as a result of several factors, including a less physically active lifestyle.]

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[**FIGURE 15.6** This adaptation of the USDA MyPlate illustrates healthful food and fluid choices for older adults.]

**Micronutrient Recommendations for Older Adults**

The vitamins and minerals of particular concern for older adults are identified in Table 15.3.

**Calcium** Preventing or minimizing the consequences of osteoporosis is a top priority for older adults. The RDA for calcium is higher for all adults over the age of 70 years and for women aged 51 to 70 years compared to younger adults.4 The calcium requirement increases at an earlier age for women compared to men due to the earlier onset of bone loss, typically at the onset of menopause.

**Vitamin D** Older adults living in long-term care facilities are at increased risk for vitamin D deficiency because they may not be exposed to amounts of sunlight adequate for vitamin D synthesis in the skin. Even among older adults leading active lives, the use of sunscreen may block the sunlight needed for vitamin D synthesis. It is critical, therefore, that older adults consume foods that are high in calcium and vitamin D and, when needed, use supplements in appropriate amounts and under the guidance of a healthcare provider. Adequate vitamin D not only enhances bone health but optimizes immunity and supports normal muscle and pancreatic function. A deficiency of vitamin D may increase the older adult's risk of falls, cognitive impairment, and overall mortality.37

**Iron** Iron needs decrease with aging. This decrease is primarily due to reduced muscle and lean tissue in both men and women and the cessation of menstruation in women.

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The decreased need for iron in older men is not significant enough to change the recommendations for iron intake in this group; thus, the RDA for iron is the same for older and younger men, 8 mg/day. However, the RDA for iron for older women is 8 mg/day, which is 10 mg/day lower than the RDA for younger women.5 Heme iron from meat, fish, and poultry represents the most available source of dietary iron; however, some older adults reduce their intake of these foods because of cost or difficulties in chewing and swallowing. Fortified grains and cereals, as well as legumes, greens, and dried fruits, can provide additional iron in the diet.

**Zinc** Although zinc recommendations are the same for all adults, it is a critical nutrient for optimizing immune function and wound healing in older adults. Zinc intake can be inadequate in older adults for the same reasons that heme iron intake may be deficient: red meats, poultry, and fish are relatively expensive, and older adults may have a difficult time chewing meats because of loss of teeth and/or the use of dentures.

**Vitamins C and E** Although it is thought that older adults have increased oxidative stress, the recommendations for the antioxidant vitamins C and E are the same as for younger adults.38 Researchers continue, however, to investigate the potential benefits of dietary or supplemental vitamin C and the roles it may play in lowering the risk of hypertension, impaired physical performance, and other age-related disorders. Vitamin E also continues to be evaluated for its potential to reduce the risk of cataracts and age-related macular degeneration, two types of vision impairment discussed shortly, as well as other forms of oxidative stress.39 Overall, however, the ability of dietary or supplemental vitamin C or E to lower risk of age-related disorders remains uncertain.

**B-vitamins** Older adults need to pay close attention to their intake of the

B-vitamins--specifically, vitamin B12, vitamin B6, and folate.10 Inadequate intakes

of these nutrients increase the levels of the amino acid homocysteine in the blood.

This state has been linked to an increased risk for cardiovascular disease, age-related

dementia (including Alzheimer's disease), and loss of cognitive function in the

elderly.10

The RDA for both folate and vitamin B12 is the same for younger and older adults, but up to 30% of older adults cannot absorb enough vitamin B12 from foods because of reduced production of gastric juice. It is recommended that older adults consume supplements or foods that are fortified with vitamin B12 because the vitamin B12 in these products is absorbed more readily. Vitamin B12 is also available via injection. Vitamin B6 recommendations are slightly higher for adults age 51 and older because these higher levels appear necessary to reduce homocysteine levels, decrease risk of depression, and optimize cognitive function in this population.

**Vitamin A** Vitamin A requirements are the same for adults of all ages; however, older adults should be careful not to consume more than the RDA because the absorption of vitamin A is actually greater in older adults. Thus, this group is at greater risk for vitamin A toxicity, which can cause liver damage and neurologic problems. In addition, high intakes of vitamin A by older adults have been linked to increased risk for hip fractures.5 Although older adults should avoid high dietary vitamin A and high-potency vitamin A supplements, consuming fruits and vegetables high in beta-carotene or other carotenoids is safe and does not lead to vitamin A toxicity.

**Supplementation** A variety of factors may limit an older adult's ability to eat healthfully. These include limited financial resources, reduced appetite, social isolation, an inability to prepare foods, and illnesses and physiologic changes that limit the absorption and metabolism of many nutrients. Thus, some older adults may benefit from taking a multivitamin and mineral supplement that contains no more than the RDA for all the nutrients contained in the supplement. Additional supplementation may be necessary for nutrients such as calcium, vitamin D, and vitamin B12.

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However, supplementation with individual nutrients should be done only under the supervision of the individual's primary healthcare provider because the risk of nutrient toxicity is high in this population.

**Fluid Recommendations for Older Adults**

The AI for fluid is the same for older and younger adults.6 Men should consume 3.7 liters of total water per day, which includes 3.0 liters (about 13 cups) as beverages, including drinking water. Women should consume 2.7 liters of total water per day, which includes 2.2 liters (about 9 cups) as beverages. Kidney function changes with age, and the thirst mechanism of older people can be impaired. These changes can result in chronic dehydration and hypernatremia (elevated blood sodium levels) in this population. Some older adults intentionally limit their beverage intake because they have urinary incontinence or don't want to be awakened for nighttime urination. This practice can endanger their health, so it is important for them to seek treatment for the incontinence and continue to drink plenty of fluids.

**Older Adults Have Many Unique Nutrition-Related Concerns**

In addition to overweight and underweight, older adults commonly face dental problems, eye disorders, and potential interactions between nutrients and medications. Also, some older adults face financial difficulties that affect their nutritional choices. Each of these concerns is discussed briefly in the following sections.

**Obesity and Underweight**

In the United States, nearly 41 % of adults between the ages of 65 and 74 years are obese; however, the incidence drops to just below 28% for those 75 years and older.40 The elderly population as a whole has a high risk for cardiovascular disease, type 2 diabetes, and cancer, all of which are more prevalent in older adults who are obese. Obesity also increases the severity and consequences of osteoarthritis, limits mobility, and is associated with functional declines in daily activities.

Underweight is also risky for older adults; mortality rates are actually higher in the underweight elderly (BMI below 18.5) than in the overweight elderly (BMI 25.0 to 29.9). Significantly underweight older adults have fewer protein reserves to call upon during periods of catabolic stress, such as post-surgery or trauma, and are more susceptible to infection. Inappropriate weight loss suggests inadequate energy intake, which also implies inadequate nutrient intake. Chronic deficiencies of protein, vitamins, and minerals leave older adults at risk for poor wound healing and a depressed immune response.

Gerontologists have identified "nine Ds" that account for most cases of geriatric weight loss **(FIGURE 15.7)** (page 556). Several of these factors promote weight loss by reducing energy intake, others by increasing energy expenditure or loss of nutrients. A condition known as *geriatric failure-to-thrive*--also called "the dwindles"--illustrates the complexity of inappropriate age-related weight loss and related health issues.

**Dental Health Issues**

Diet plays an important role in the maintenance of dental health in the elderly. Deficiencies of the B-vitamins can lead to irritation, inflammation, and cracking of the lips and tongue, whereas vitamin C deficiency increases the risk for periodontal (gum) disease. A lack of adequate calcium, vitamin D, and protein contributes to bone loss in the oral cavity, which increases risk for tooth loss. Saliva helps neutralize the decay-promoting acids produced by oral bacteria; however, with aging, saliva production decreases.

Despite great advances in dental health, older adults remain at high risk of losing some or all of their teeth, suffering from gum disease, or having poorly fitting dentures, which cause considerable mouth pain and make chewing difficult. Adults with poorly fitted dentures or chewing problems tend to avoid meats and firm fruits and vegetables, leading to nutrient deficiencies. Older adults can compensate for a loss of chewing ability by selecting soft, protein-rich foods, such as eggs, peanut butter, cheese, yogurt, ground meat, fish, and well-cooked legumes.

[Image: Older adults need the same amount of fluids as other adults.]

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[**FIGURE 15.7** The nine Ds of geriatric weight loss. These are among the most significant factors contributing to inappropriate weight loss in the elderly.]

**[FIGURE 15.8** These photos simulate two forms of vision loss common in older adults. **(a)** Macular degeneration results in a loss of central vision. **(b)** Cataracts impair vision across the visual field.]

Red meats and poultry can be stewed or cooked in liquid for a long period. Oatmeal and other whole-grain cooked cereals can provide needed fiber, as do mashed berries and bananas, ripened melons, and canned vegetables. Shredded and minced raw vegetables can be added to dishes. With planning, older adults with oral health problems can maintain a varied, healthful diet.

**Age-Related Eye Diseases**

Two age-related eye disorders are responsible for vision impairment and blindness in older adults. **Macular degeneration** is damage to the macula, the portion of the retina of the eye that enables us to see the center of the visual field and to see details **(FIGURE 15.8a).** Affecting more than 1.75 million U.S. adults, it is the leading cause of blindness in the elderly. A **cataract** is a cloudiness in the lens of the eye (Figure 15.8b). This condition affects 20% of adults in their 60s and almost 70% of those in their 80s. Although these are different conditions, sunlight exposure and smoking are lifestyle practices that increase the risk for both.

Recent research suggests, but does not prove, that dietary choices may slow the progress of these two degenerative eye diseases, saving millions of dollars and preventing or delaying the functional losses associated with impaired vision. Several studies have shown the beneficial effects of antioxidants, including vitamins C and E, on cataract formation, whereas others have reported no significant benefit.41 Two phytochemicals, lutein and zeaxanthin, have also been identified as protective by some, but not all, studies.42 These four antioxidants, as well as zinc and omega-3 fatty acids, may also provide protection against macular degeneration.41 Although the research is not yet conclusive, older adults can benefit by consuming foods rich in these nutrients, primarily colorful fruits and vegetables, nuts, and whole grains. Vision-enhancing nutrient supplements, the formulations of which are based on the results of two large research studies (AREDS 1 and 2), may help delay the progression of macular degeneration and cataracts.43

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**Interactions Between Medications and Nutrition**

Although persons 65 years of age and older account for only 13% of the U.S. population, they are prescribed about 35% of all medications, and they experience almost 40% of all adverse drug effects.44 Between 2006 and 2011, the incidence of major drug-drug interactions among older adults doubled from 8% to 15%.45 At least in part, these statistics reflect the risks of **polypharmacy,** or the use of five or more prescription drugs at any given time. Nearly 40 % of Americans age 65 and older take five or more prescription medications, meeting the definition of polypharmacy.45 A small but significant number of older adults use 10 or more medications, a practice known as *excessive polypharmacy.* The more medications older adults take, the greater their risk for cognitive decline, falls, drug-drug interactions, medication errors, and rehospi-talization.46 Medications can interact not only with each other, but also with herbs and other dietary supplements.

Medications can also reduce or increase appetite, thereby promoting weight loss or weight gain. Moreover, they can affect nutrient digestion, absorption, activation, or excretion. A number of medications reduce the absorption of certain vitamins and minerals, including calcium, iron, and fat-soluble vitamins. Other medications reduce the activation of vitamin D, vitamin B6, folate, and other vitamins. Certain anticoagulants interfere with vitamin K metabolism, which means that healthcare providers must carefully balance drug dosage in order to minimize risk of vitamin K deficiency. Finally, some medications, such as diuretics, increase urinary excretion of potassium or other nutrients.

From the opposite perspective, food and supplement choices can negatively impact medication activity and effectiveness. Individual foods such as grapefruit juice, spinach, and aged cheese are known to react negatively with a number of drugs. A compound in grapefruit juice, for example, inhibits the breakdown of as many as 85 different drugs, leading to as much as a tenfold increase in blood drug levels and potential overdose. High calcium foods and calcium supplements decrease the absorption of many antibiotics, greatly reducing their therapeutic value. Foods high in vitamin K, such as dark green leafy vegetables, greatly reduce the effectiveness of certain anticoagulants, leading to the potential for abnormal clot formation. **TABLE 15.4** summarizes some of the more common drug-nutrient interactions.

**TABLE** **15.4 Examples of Common Drug-Nutrient Interactions**

|  |  |
| --- | --- |
| **Category of Drug** | **Interactions** |
| Antacids | May decrease the absorption of iron, calcium, folate, vitamin B12 |
| Antibiotics | May reduce the absorption of calcium, fat-soluble vitamins; reduces the production of vitamin K by gut bacteria |
| Anticonvulsants | Interfere with activation of vitamin D |
| Anticoagulants ("blood thinners") | Reduce the activity of vitamin K |
| Antidepressants | May cause weight gain as a result of increased appetite |
| Antiretroviral agents (used in treatment of HIV/AIDS) | Reduce absorption of most nutrients |
| Aspirin | Lowers blood folate levels; increases iron loss due to gastrointestinal bleeding |
| Diuretics | May increase urinary excretion of potassium, sodium, calcium, magnesium; may cause retention of potassium, other electrolytes |
| Laxatives | Increase fecal excretion of dietary fat, fat-soluble vitamins, calcium, and other minerals |

[Image: Medications taken by older adults can interact in a harmful way with one another and with nutrients and foods.]

[Sidebar: macular degeneration A vision disorder characterized by deterioration of the macula, the central portion of the retina, and marked by loss or distortion of the center of the visual field.]

[Sidebar: **cataract** A damaged portion of the eye's lens, which causes cloudiness that impairs vision.]

[Sidebar: **polypharmacy** The use of five or more prescription drugs at any one time.]

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**Financial Problems**

Over 8 % of elderly men and women in the United States, or 4 million adults over the age of 60 years, experience some form of food insecurity. At greatest risk are African American, Hispanic, and other minorities; those living in the South; and those living alone. In response to this problem, the federal government has developed a network of food and nutrition services for older Americans. These services are typically coordinated with state and local governments as well as nonprofit or community organizations. They include the following:

**-** **Supplemental Nutrition Assistance Program (SNAP)**: Previously known as the Food Stamp program, this USDA program provides food assistance for low-income households. It is designed to meet the basic nutritional needs of eligible people of all ages. Participants are provided with a monthly allotment, typically in the form of a prepaid debit card or food coupons. Unfortunately, only 67% of older Americans who are eligible for SNAP participate, a rate below that of younger groups.47

**-** **Congregate Nutrition Services Program:** This program is administered by the Administration on Aging, a unit within the Department of Health and Human Services (HHS).48 Each year, it provides more than 200 million meals to disabled, low-income, minority, and rural elderly, as well as those with limited English language skills, and those at risk for institutionalization.49 Nearly 60% of the participants report that one meal represents half or more of their total daily food intake.50

**-** **Nutrition Services Incentive Program:** This USDA-administered program provides a limited number of "commodity foods" to nearly 600,000 low-income adults 60 years and older. Foods are distributed to state-level agencies, then to community organizations. They include cereals, peanut butter, dry beans, rice or pasta, and canned juice, fruits, vegetables, meat, poultry, and tuna. The foods distributed are rich in nutrients typically lacking in the diets of low-income elderly.

**-** **Senior Farmers' Market Nutrition Program:** This program, sponsored by the USDA, provides funds to states and Indian tribal governments to distribute coupons to 865,000 low-income seniors, so that they can buy eligible foods such as fruits and vegetables at farmers' markets and roadside stands. Seniors enjoy the nutritional benefits of fresh local produce and the opportunity to increase the variety of their meals.51

**[recap**

Because of their loss of lean tissue and lower physical activity levels, older adults need less total energy than younger adults. Their macronutrient intake levels are the same as for younger adults, but some researchers believe that older adults need more protein. The micronutrients of concern are calcium, vitamin D, iron, zinc, vitamin B6, vitamin B12, and folate. Supplementation may be necessary. Older adults are at risk for chronic dehydration. Men need to drink about 13 cups of water and other beverages per day, and women need about 9 cups. Both obesity and underweight increase the risk for disease and disability in older adults. Dental and vision problems can limit the intake of meats, fruits, and vegetables, leading to nutrient deficiencies. Medications can interact with each other in harmful ways, and certain medications and foods or nutrients can have adverse interactions. More than 8% of older adults in the United States experience food insecurity. Several government and community programs are available for older adults in need of food assistance.]

[Image: For many homebound, disabled, and low-income older adults, community programs are lifelines that provide nourishing meals as well as vital social contact.]

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**nutrition debate Physical Activity in Older Adulthood: What Amounts, Types, and Intensities Are Appropriate?**

A minority of older adults exercise. Fewer than 44% of the "young elderly" (65-74 years) and only 27% of the "older elderly" (75 years and above) report participating in any regular leisure-time physical activity.52 Even fewer--about 14% of young elderly and 8% of older elderly--meet federal (CDC) guidelines for aerobic and muscle-strengthening activities.53 These statistics are unfortunate, because we know that physically active elders live longer and have a reduced risk for cardiovascular disease, type 2 diabetes, obesity, depression, and cognitive decline. The complications of arthritis and osteoporosis can also be reduced with appropriate exercise, as can the risk for falls and bone fractures.54 The need for healthcare visits is also reduced with regular exercise.

How much physical activity do older adults need in order to achieve these health benefits--and does moderate activity count, or should seniors "go for the gold"? Here are the most recent CDC guidelines:55

*-* *Aerobic activity:* Seniors should engage in a minimum of 150 minutes of moderate-intensity aerobic activity (brisk walking, bicycling, swimming) or 75 minutes of vigorous aerobic activity (running or jogging) every week.

*-* *Muscle strengthening:* Seniors should engage in resistance or strength training on 2 or more days a week. The activities should work all the major muscle groups. Free weights, weight machines, resistance bands, push-ups, and heavy physical work are all strengthening.

*-* *Flexibility and balance:* Seniors should do a few minutes of flexibility exercises, such as stretches, tai chi, Pilates, or yoga, most days of the week. Daily balance exercises are also important to reduce the risk for falls. In addition to tai chi, toe raises, side leg raises, and rear leg swings are examples of effective balance activities.

Older adults who cannot meet these standards should engage in whatever level of physical activity is tolerable, as any increase in activity among sedentary elderly can improve their health and mobility.54

Are older adults more susceptible to injury or harm from vigorous exercise? At greatest risk are people who perform activities at an intensity or a duration they are not used to. Think of the "weekend warrior": a person who is very sedentary most days of the week but goes "all out" on a Saturday afternoon. This person is at high risk for a heart attack or sudden cardiac death during or shortly after vigorous activity. A second vulnerable group includes older adults with diagnosed or undiagnosed heart disease and those with diabetic foot ulcers. Seniors may also be more vulnerable to dehydration, heat stress, fractures, falls, knee pain, and muscle soreness or stiffness with intense exercise.54

To minimize the risk for exercise-related cardiac events and other complications of vigorous exercise, older adults should follow these guidelines:

- Work with a qualified healthcare provider to determine the types, intensities, and duration of physical activities appropriate for them.

- Become familiar with the signs of cardiac impairment: shortness of breath, chest pain, neck pain, dizziness or palpitations, and unusual fatigue.

- Recognize the need to modify activity patterns under conditions of stress, such as very cold temperatures, high heat or humidity, or during recovery from an illness.

- Exercise in rooms with appropriate temperature, ventilation, and lighting; wear appropriate clothing and comfortable shoes; and have water readily available.

- Engage in supervised warm-up and cool-down activities.

For most older adults, the risks of vigorous exercise are outweighed by the benefits--better health, more independence, less disability, and a longer, happier life!

**CRITICAL THINKING QUESTIONS**

1. What might encourage an older adult to start a regular program of physical activity after a lifetime of mostly sedentary behavior?

2. If you were the manager of a fitness center popular with young adults, what modifications to the facility might you propose to make it more attractive to older adults? Do you think one fitness center can effectively serve both young and older adults? Why or why not?

3. How might communities increase exercise opportunities for the elderly?

[Image: Engaging in regular physical activity is one of the best strategies for maintaining quality of life before and throughout the senior years.]]

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**[TEST YOURSELF** *ANSWERS*

**1** **F** Toddlers may need 10 or more exposures to a specific food before accepting it.

**2** **F** Adolescents experience an average 20% to 25% increase in height during puberty.

**3** **T** Although a reduction in muscle mass and lean tissue is inevitable with aging, regular physical activity can help preserve muscle mass.]

**review questions**

**LO 1 1.** Which of the following breakfasts would be most appropriate to serve a 20-month-old child?

a. 1/2 cup of iron-fortified cooked oat cereal, 2 tbsp. of mashed pineapple, and 1 cup of whole milk

b. 2 tbsp. of nonfat yogurt, 2 tbsp. of applesauce, one slice of melba toast spread with strawberry preserves, and 1 cup of calcium-fortified orange juice

c. 1/2 cup of iron-fortified cooked oat cereal, 1/4 cup of cubed pineapple, and 1 cup of low-fat milk

d. two small link sausages cut in 1-inch pieces, 2 tbsp. of scrambled egg, one slice of whole-wheat toast, four cherry tomatoes, 2 tbsp. of applesauce, and 1 cup of whole milk

**LO 1 2.** Which of the following is most likely to be deficient in the diet of a vegetarian toddler?

a. carbohydrate and fat

b. vitamin C

c. iron and zinc

d. fiber

**LO 2** 3. Which of the following statements about the nutrient needs of preschool and school-age children is true?

a. Children's estimated energy requirement (EER) is 1,200 kcal per day.

b. Children require a diet providing between 25% to 35% of total energy as fat.

c. Children's RDA for protein is 0.8 g per kg body weight.

d. It is recommended that all children take a pediatric multivitamin/multimineral supplement.

**LO 3 4.** An adolescent continues to grow in height until

a. production of testosterone and estrogen ceases.

b. the epiphyseal plates close.

c. peak bone density is reached.

d. approximately age 13 in girls and age 16 in boys.

**LO 3 5.** The RDA for calcium is 1,300 mg for which of the following groups?

a. both boys and girls, ages 4 to 18

b. girls only, ages 9 to 18

c. both boys and girls, ages 9 to 18

d. girls only, ages 14 to 18

**LO 4** 6. Which of the following statements about pediatric obesity is true?

a. Fewer than 10% of U.S. children and adolescents are obese.

b. To control energy intake, parents should encourage obese children to skip breakfast.

c. Among adolescents, cigarette smoking increases the risk for obesity.

d. None of the above is true.

**LO 5** **7.** Which of the following events occurs with normal aging?

a. Absorption of vitamin B12 from foods in the gastrointestinal tract is reduced.

b. A reduced sense of smell contributes to dysgeusia, which together make food less appealing.

c. Muscle mass decreases.

d. All of the above occur with normal aging.

**LO 6 8.** Among older adults

a. cataracts are the most common cause of blindness.

b. those living alone have a lower rate of food insecurity than those living with others.

c. the need for vitamin A is two times greater than for younger adults.

d. the prevalence of obesity declines after age 75.

**LO 2 9. True or false?** The food choice patterns of children are heavily influenced by the food choices of their parents.

**LO 6 10.** **True or false?** Mortality rates are higher in the underweight elderly than in the overweight elderly.

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**LO 5 11.** While helping her 72-year-old grandmother put away groceries, Krishna notices three new supplement bottles. One is a single-nutrient vitamin A supplement, which provides 3,333 µg/dose. The second is a "Healthy Skin Formula" providing 1,500 µg vitamin A/dose. The third is a multivitamin-mineral supplement that provides 2,200 µ*g* vitamin A/dose. When Krishna asks her grandmother about these new products, her grandmother explains that she read online that vitamin A makes your skin look younger, so she was taking the three supplements every day to make her wrinkles go away faster. If Kristina's grandmother takes one dose of each of the three supplements per day, what percentage of the RDA does she consume? Of the UL? Do you see any potential problems with this level of vitamin A intake?

*Answers to Review Questions and Math Review are located at the back of this text and in the MasteringNutrition Study Area.*

**web links**

**www.cdc.gov**

The Centers for Disease Control and Prevention

*In the Search bar, type "parent information children." From the index page, select any topic of interest, from growth charts to school health.*

**www.nutrition.gov/life-stages**

Nutrition.gov

*This USDA site lets you select from Toddlers, Children, and Teen sections; each provides age-specific information, age-appropriate activities, nutrition web links, and consumer and nutrition news.*

**www.vrg.org**

The Vegetarian Resource Group

*Learn more about vegetarianism for all ages. Included on the site are sections for teens and kids as well as recipes and eating guides.*

**www.nutrition.wsu.edu**

Eat Better, Eat Together

*This website offers educational materials for strengthening family meal time. Suggestions for community events, media interviews, and educational materials are available. Enter "eat better" into the search bar to get underway.*

**www.aoa.gov**

Administration on Aging

*Find statistics on aging, as well as information and resources on healthy aging.*

**www.fns.usda.gov**

USDA Food & Nutrition Service

*Read about government programs to provide food to people of all ages, including school meal programs, SNAP, and the Nutrition Services Incentive Program.*

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# **in** **depth 15.5** **Searching for the Fountain of Youth**

***After studying this In Depth, you should be able to:***

**1** Discuss the proposed mechanisms by which Calorie restriction may increase life span, as well as challenges and alternatives, pp. 563-564.

**2** Refute the claim that single-nutrient, herbal, and other dietary supplements increase longevity, p. 565.

**3** Evaluate the potential of your current health-related behaviors to increase or reduce the likelihood of your living a long and healthy life, p. 566.

**Throughout human history, legends have told of a "fountain of youth" that reverses decades of aging in anyone who drinks its waters.** One

16th century myth claimed that the Spanish explorer Ponce de Le6n sought for these restorative waters throughout Florida, and a 15-acre archaeological park in Saint Augustine, Florida, still commemorates this mythical journey. Of course, no one believes such tales any longer, but modern equivalents persist: anti-aging diets, supplements, cosmetics, and spa treatments. If you were to read that you could live to celebrate your 100th birthday in good health by eating about a quarter less than the average energy intake for your gender and height, would you do it? Would you try anti-aging micronutrients, phytochemicals, herbs, or hormones? Or would you assume that the claims for these therapies were just fairy tales, too?

In this **In Depth** essay, we'll discuss the science behind anti-aging diets and supplements. We'll also identify lifestyle changes you can make right now to live longer in good health. What other actions can you take right now to live longer in good health? Let's find out.

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[Image: We may no longer believe in an actual "fountain of youth," but our search for health and longevity continues today.]

## **Does calorie restriction increase life span?**

**LO 1** Discuss the proposed mechanisms by which Calorie restriction may increase life span, as well as challenges and alternatives.

A practice known as *Calorie restriction* (CR) has been getting a great deal of press lately. CR involves consuming 20% to 30% fewer Calories than would be typical for your weight, body composition, and level of activity, while still getting enough nutrients to keep your body functioning in good health.

Research has shown that CR can significantly extend the life span of rats, mice, fish, flies, and yeast cells as well as non-human primates such as monkeys.1 But only in the past few years have researchers begun to design and conduct studies of CR in humans. The results of these preliminary studies suggest that CR can also improve metabolic measures of health in humans and thus may be able to extend the human life span.2-7

**Calorie Restriction May Reduce Production of Free Radicals**

How might CR prolong life span? Although not fully understood, the reduction in metabolic rate that occurs with restricted caloric intake results in a much lower production of free radicals, which in turn reduces oxidative damage throughout the body, possibly lowering chronic disease risk and prolonging life. Several, but not all, human studies show that CR also improves insulin sensitivity and decreases blood glucose, LDL cholesterol, and blood pressure, reducing the risk for cardiovascular disease, stroke, and diabetes. There is also evidence that CR can alter gene expression in ways that reduce the effects of aging and lower the risk of cancer and other diseases. Other metabolic effects of CR reported in several, but not all, human studies include:1-5,7

- Decreased fat mass and lean body mass

- Increased serum high-density lipoprotein (HDL) cholesterol

- Decreased core body temperature

- Decreased energy expenditure beyond that expected for the weight loss that occurred, which suggests a generalized slowing of metabolic rate

- Reduced levels of DNA damage

- Lower levels of chronic inflammation

- Protective changes in various hormone levels

It is important to emphasize that, in laboratory studies, species found to live longer with CR are fed highly nutritious diets. Situations such as starvation, anorexia nervosa, and extreme fad dieting, in which both energy and nutrient intakes are severely restricted, do not result in prolonged life but are associated with an increased risk for premature death. It's also essential to understand that the benefits of CR are thought to correlate to the age at which the program begins. The later in life the CR protocol is started, the lower the expected benefit.

[Image: On a Calorie-restricted diet, all food must be highly nutritious, and both nutrients and energy must be calculated precisely.]

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**Calorie Restriction Presents Significant Challenges**

Although the benefits listed previously appear promising, the research data supporting these benefits in humans are only preliminary. Research that can precisely study CR in humans over decades might never be conducted because of logistical and ethical concerns, including an increased risk for malnutrition. Currently, the most extensive study examined the impact of CR over only a two-year period, and participants achieved only a 12% reduction in usual Caloric intake, not the target 20% to 30% reduction typically associated with CR.7

In the absence of prolonged high-quality human studies, several CR groups, including the "CRONies" (Caloric Restriction with Optimal Nutrition), have provided researchers with some data. Most of the CRONies are males in their late 30s to mid 50s. One report indicated that most CRONies had followed the CR diet for about 10 years and reduced their caloric intake by about 30%. Overall, members report improved blood lipids and the other health benefits listed earlier. Still, researchers lack specific data on how well free-living adults actually follow the rigid and extensive demands of CR protocols. In addition, researchers now question if the caloric restriction alone led to the metabolic improvements or if the largely vegetarian, Mediterranean-like diet of the CRONies, along with their active lifestyle, contributed to the metabolic improvements.3,5

It has been estimated that humans would need to restrict their typical energy intake by at least 20% for 40 years or more in order to gain a potential 4 to 5 additional years of healthy living.8 If you normally eat about 2,000 kcal/day, a 20% reduction would result in an energy intake of about 1,600 kcal per day. Although at first this might not seem difficult, bear in mind that you would need to maintain this lower Calorie/high nutrient-density pattern every day for 40 years.

Also consider that CR is associated with several unpleasant side effects. The top three complaints of those who follow CR are constant hunger, frequently feeling cold, and a loss of libido (sex drive).1 In addition, CR impairs wound healing and may reduce immune response. There is concern that, if initiated in early adulthood, CR might reduce bone density or lead to inappropriate loss of muscle mass. And because the production of female reproductive hormones is linked to a certain level of body fat, CR could result in amenorrhea and/or impair a woman's fertility. Interestingly, as noted earlier, most of the members of the CRONies are males. Finally, it is well known that being significantly underweight is associated with increased mortality, especially among older adults.

**Alternatives to Calorie Restriction Show Similar Benefits**

As researchers continue to question the effectiveness and practicality of CR, alternative approaches have been developed and studied. *Intermittent fasting (IF),* also known as *every-other-day-feeding (EODF), alternate-day fasting (ADF),* or *time-restricted feeding,* does *not* reduce average energy intake but simply alters the pattern of food intake.9-12 These approaches been shown, in animals, to prolong life span and improve a range of metabolic measures of health. Although not as well studied as CR, ADF, for example, has produced beneficial changes in metabolic profile including blood lipid levels.11

Additionally, some researchers have proposed that the lower and largely plant protein intake of CR drives some of the metabolic improvements. Even without caloric restriction, vegan diets are known to lower blood pressure, LDL cholesterol, triglycerides, and fasting glucose levels. Most people would find it much easier to simply reduce their total protein intake and/or convert to a largely vegan diet than to maintain a lifelong 20% to 30% reduction in their energy intake. Finally, the combination of a healthful diet with adequate physical activity can decrease inflammation and oxidative stress without the need for the more extreme CR program.

[Image: Maintaining either a Calorie-restricted or vegan diet requires significant meal planning, but both appear to have similar health benefits.]

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## **Can supplements slow aging?**

**LO 2** Refute the claim that single-nutrient, herbal, and other dietary supplements increase longevity.

Recently, some researchers have speculated that consuming the optimum level of nutrients could extend a person's healthy life span. Could micronutrient supplements take the place of whole foods in providing this "optimum level of nutrients"? And could other ingredients, besides vitamins and minerals, also slow aging?

The global anti-aging market accounts for nearly $125 billion in sales, with some individuals spending as much as $20,000 a year on various products and services.13 Among the most popular are "anti-aging" supplements, many of which provide specific combinations of vitamins and minerals marketed with claims that the product has powerful antioxidant effects, or will boost memory, reduce fine lines and wrinkles, or maintain joint health. Are these micronutrient supplements worth the investment? Unfortunately, not even one trial of such supplements has shown them to be effective.14 In fact, some studies actually have reported a *higher* risk of death with high doses of vitamin A, vitamin E, or beta-carotene supplements.15 Nevertheless, a quick Internet search will open up a world of promises of better health and longer life if you use the advertised supplements!

In addition to micronutrients, supplements that claim to enhance longevity often contain:

- Food extracts, such as resveratrol from red wines and other foods

[Image: Anyone can benefit from the antioxidant nutrients in fresh fruits and vegetables.]

- Herbs, including Siberian ginseng, ginkgo biloba, and various combinations of botanicals from Asia

- Animal extracts, such as royal jelly and dried glandulars

- Hormone-based preparations, such as DHEA (dehydroepiandrosterone), HGH (human growth hormone), and melatonin

- Metabolites, such as alpha-lipoic acid

Manufacturers promote these products with claims such as "revered in the Far East for centuries" and "nature's own therapeutic powers." However, as with micronutrient supplements, no well-designed research studies support the claims of life-extending effectiveness for any of these products in humans. More disturbingly, like antioxidant supplements, many of these non-nutrient supplements have serious side effects. For example, ginkgo biloba can cause gastrointestinal upset, nausea, diarrhea, headache, dizziness, abnormal bleeding, or an allergic reaction and is known to interact with several medications.16 HGH can contribute to high cholesterol levels, increase the risk of diabetes and hypertension, and cause joint pain, muscle weakness, and other symptoms.17 Despite concerns such as these, sales of anti-aging supplements continue to grow.

## **nutri-case GUSTAVO**

"I don't believe in taking pills. If you eat good food, you get everything you need and it's the way nature intended it. My daughter kept nagging my wife and me to start taking B vitamins and some kind of Chinese herb with a name I can't pronounce. She said we need this stuff because when people get to be our age they have problems with their nerves and circulation. I didn't fall for it, but my wife did, and then her doctor told her she needs calcium pills and vitamin D, too. The kitchen counter is starting to look like a medicine cabinet! Our ancestors never took pills their whole lives! So how come we need them? I think the whole thing is a hoax to get you to empty your wallet."

Would you support Gustavo's decision to avoid taking supplements? Given what you have learned in previous Nutri-Cases about Gustavo's wife, would you support or oppose her taking ginkgo biloba, B-vitamins, calcium, or vitamin D? Explain your choices.

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## **Are your actions today promoting a longer, healthier life?**

**LO 3** Evaluate the potential of your current health-related behaviors to increase or reduce the likelihood of your living a long and healthy life.

If none of these options interest you, is there anything else you can do to increase your chances of living a long and healthful life? The Centers for Disease Control and Prevention (CDC) reminds us that chronic disease is responsible for seven out of every ten deaths of Americans.18 Moreover, just five behaviors within your control are key to the prevention of chronic disease:

- Getting adequate amounts of physical activity on a regular basis

- Maintaining a healthful body weight and composition

- Never smoking

- Consuming no or only moderate amounts of alcohol

- Obtaining sufficient sleep on a daily basis

So, if you want to live a longer, healthier life, the CDC advises that you adopt the health habits identified in the nearby **Quick Tips** box.

**Quick Tips**

**[Promoting Your Longevity**

Engage in at least 30 minutes of moderate or vigorous physical activity most days of the week.

Consume a diet based on the *2015-2020 Dietary Guidelines for Americans,* the Mediterranean diet, or a vegan/vegetarian diet.

Use only the nutrient supplements that have been recommended to you by your healthcare provider and within the recommended amounts.

Achieve and maintain a healthful weight and body composition.

If you smoke or use any other form of tobacco, stop. If you don't smoke, don't start.

If you drink alcohol, do so only in moderation, meaning no more than two drinks per day for men and one drink per day for women.

Maintain a healthy sleep schedule, aiming for at least 7 hours of uninterrupted sleep every 24 hours.]

**web links**

**www.nia.nih.gov**

The National Institute on Aging

*The National Institute on Aging provides information about how older adults can benefit from physical activity and a healthful diet.*

**www.nihseniorhealth.gov**

National Institutes of Health, Senior Health

*This website, written in large print, offers up-to-date information on popular health topics for older Americans.*

**www.aarp.org**

The American Association of Retired Persons

*Visit this gateway site for a wide range of articles on nutrition, physical activity, and other health-related topics for older adults.*

**https://nccih.nihgov/health/aging**

National Institutes of Health, National Center for Complementary and Integrative Health

*This website provides information on supplements for older adults, health scams targeting older adults, and complementary health interventions for chronic diseases common among older adults.*

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**A** 2015-2020 Dietary Guidelines, Dietary Reference Intakes, and Dietary Guidelines Recommendations A-3

**B** Calculations and Conversions B-1

**C** Foods Containing Caffeine C-1

**D** U.S. Exchange Lists for Meal Planning D-1

**E** Stature-for-Age Charts E-1

**F** The USDA Food Guide Evolution F-1

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# **Appendix A**

**2015-2020 Dietary Guidelines, Dietary Reference Intakes, and Dietary Guidelines Recommendations**

**Daily Nutritional Goals for Age-Sex Groups Based on Dietary Reference Intakes &** *Dietary Guidelines* Recommendations

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Source of****Goal**a | **Child 1-3** | **Female 4-8** | **Male 4-8** | **Female 9-13** | **Male 9-13** | **Female 14-18** | **Male 14-18** | **Female 19-30** | **Male 19-30** | **Female 31-50** | **Male 31-50** | **Female****51 +** | **Male****51 +** |
| Calorie Level(s) Assessed |  | 1,000 | 1,200 | 1,400, 1,600 | 1,600 | 1,800 | 1,800 | 2,200, 2,800, 3,200 | 2,000 | 2,400, 2,600, 3,000 | 1,800 | 2,200 | 1,600 | 2,000 |
| MacronutrientsProtein, g | RDA | 13 | 19 | 19 | 34 | 34 | 46 | 52 | 46 | 56 | 46 | 56 | 46 | 56 |
| Protein, % kcal | AMDR | 5-20 | 10-30 | 10-30 | 10-30 | 10-30 | 10-30 | 10-30 | 10-35 | 10-35 | 10-35 | 10-35 | 10-35 | 10-35 |
| Carbohydrate, g | RDA | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| Carbohydrate, % kcal | AMDR | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 | 45-65 |
| Dietary Fiber, g | 14 g/1,000 kcal | 14 | 16.8 | 19.6 | 22.4 | 25.2 | 25.2 | 30.8 | 28 | 33.6 | 25.2 | 30.8 | 22.4 | 28 |
| Added Sugars, % kcal | DGA | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% |
| Total Fat, % kcal | AMDR | 30-40 | 25-35 | 25-35 | 25-35 | 25-35 | 25-35 | 25-35 | 20-35 | 20-35 | 20-35 | 20-35 | 20-35 | 20-35 |
| Saturated Fat, % kcal | DGA | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% | <10% |
| Linoleic Acid, g | Al | 7 | 10 | 10 | 10 | 12 | 11 | 16 | 12 | 17 | 12 | 17 | 11 | 14 |
| Linolenic Acid, g | Al | 0.7 | 0.9 | 0.9 | 1 | 1.2 | 1.1 | 1.6 | 1.1 | 1.6 | 1.1 | 1.6 | 1.1 | 1.6 |
| MineralsCalcium, mg | RDA | 700 | 1,000 | 1,000 | 1,300 | 1,300 | 1,300 | 1,300 | 1,000 | 1,000 | 1,000 | 1,000 | 1,200 | 1,000b |
| Iron, mg | RDA | 7 | 10 | 10 | 8 | 8 | 15 | 11 | 18 | 8 | 18 | 8 | 8 | 8 |
| Magnesium, mg | RDA | 80 | 130 | 130 | 240 | 240 | 360 | 410 | 310 | 400 | 320 | 420 | 320 | 420 |
| Phosphorus, mg | RDA | 460 | 500 | 500 | 1,250 | 1,250 | 1,250 | 1,250 | 700 | 700 | 700 | 700 | 700 | 700 |
| Potassium, mg | Al | 3,000 | 3,800 | 3,800 | 4,500 | 4,500 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 | 4,700 |
| Sodium, mg | UL | 1,500 | 1,900 | 1,900 | 2,200 | 2,200 | 2,300 | 2,300 | 2,300 | 2,300 | 2,300 | 2,300 | 2,300 | 2,300 |
| Zinc, mg | RDA | 3 | 5 | 5 | 8 | 8 | 9 | 11 | 8 | 11 | 8 | 11 | 8 | 11 |
| Copper, mcg | RDA | 340 | 440 | 440 | 700 | 700 | 890 | 890 | 900 | 900 | 900 | 900 | 900 | 900 |
| Manganese, mg | Al | 1.2 | 1.5 | 1.5 | 1.6 | 1.9 | 1.6 | 2.2 | 1.8 | 2.3 | 1.8 | 2.3 | 1.8 | 2.3 |
| Selenium, mcg | RDA | 20 | 30 | 30 | 40 | 40 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| VitaminsVitamin A, mg RAE | RDA | 300 | 400 | 400 | 600 | 600 | 700 | 900 | 700 | 900 | 700 | 900 | 700 | 900 |
| Vitamin E, mg AT | RDA | 6 | 7 | 7 | 11 | 11 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Vitamin D, IU | RDA | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600c | 600c |
| Vitamin C, mg | RDA | 15 | 25 | 25 | 45 | 45 | 65 | 75 | 75 | 90 | 75 | 90 | 75 | 90 |
| Thiamin, mg | RDA | 0.5 | 0.6 | 0.6 | 0.9 | 0.9 | 1 | 1.2 | 1.1 | 1.2 | 1.1 | 1.2 | 1.1 | 1.2 |
| Riboflavin, mg | RDA | 0.5 | 0.6 | 0.6 | 0.9 | 0.9 | 1 | 1.3 | 1.1 | 1.3 | 1.1 | 1.3 | 1.1 | 1.3 |
| Niacin, mg | RDA | 6 | 8 | 8 | 12 | 12 | 14 | 16 | 14 | 16 | 14 | 16 | 14 | 16 |
| Vitamin B6, mg | RDA | 0.5 | 0.6 | 0.6 | 1 | 1 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.5 | 1.7 |
| Vitamin B12, meg | RDA | 0.9 | 1.2 | 1.2 | 1.8 | 1.8 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| Choline, mg | Al | 200 | 250 | 250 | 375 | 375 | 400 | 550 | 425 | 550 | 425 | 550 | 425 | 550 |
| Vitamin K, mcg | Al | 30 | 55 | 55 | 60 | 60 | 75 | 75 | 90 | 120 | 90 | 120 | 90 | 120 |
| Folate, mcg DFE | RDA | 150 | 200 | 200 | 300 | 300 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |

a RDA = Recommended Dietary Allowance, Al = Adequate Intake, UL = Tolerable Upper Intake Level, AMDR = Acceptable Macronutrient Distribution Range, DGA =

*2015-2020 Dietary Guidelines* recommended limit; 14 g fiber per 1,000 kcal = basis for Al for fiber.

b Calcium RDA for males ages 71 + years is 1,200 mg.

c Vitamin D RDA for males and females ages 71 + years is 800 IU.

*Sources:* Institute of Medicine. Dietary Reference Intakes: The essential guide to nutrient requirements. Washington (DC): The National Academies Press; 2006. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington (DC): The National Academies Press; 2010.

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# **Appendix B** **Calculations and Conversions**

**Calculation and Conversion Aids**

**Commonly Used Metric Units**

millimeter (mm): one-thousandth of a meter (0.001)

centimeter (cm): one-hundredth of a meter (0.01)

kilometer (km): one-thousand times a meter (1000)

kilogram (kg): one-thousand times a gram (1000)

milligram (mg): one-thousandth of a gram (0.001)

microgram (µg): one-millionth of a gram (0.000001)

milliliter (ml): one-thousandth of a liter (0.001)

**International Units**

Some vitamin supplements may report vitamin content as International Units (IU).

To convert IU to:

- Micrograms of vitamin D (cholecalciferol), divide the IU value by 40 or multiply by 0.025.

- Milligrams of vitamin E (alpha-tocopherol), divide the IU value by 1.5 if vitamin E is from natural sources. Divide the IU value by 2.22 if vitamin E is from synthetic sources.

- Vitamin A: 1 IU = 0.3 µg retinol or 3.6 µg beta-carotene.

**Retinol Activity Equivalents**

Retinol Activity Equivalents (RAE) are a standardized unit of measure for vitamin A. RAE account for the various differences in bioavailability from sources of vitamin A. Many supplements will report vitamin A content in IU, as just shown, or Retinol Equivalents (RE).

1 RAE = 1 µg retinol

12 µg beta-carotene

24 µg other vitamin A carotenoids

To calculate RAE from the RE value of vitamin carotenoids in foods, divide RE by 2.

For vitamin A supplements and foods fortified with vitamin A, 1 RE = 1 RAE.

**Folate**

Folate is measured as Dietary Folate Equivalents (DFE). DFE account for the different factors affecting bioavailability of folate sources.

1 DFE = 1 µg food folate

0.6 µg folate from fortified foods

0.5 µg folate supplement taken on an empty stomach

0.6 µg folate as a supplement consumed with a meal

To convert micrograms of synthetic folate, such as that found in supplements or fortified foods, to DFE:

µg synthetic x folate 1.7 = µg DFE

For naturally occurring food folate, such as spinach, each microgram of folate equals 1 microgram DFE:

µg folate = µg DFE

**Conversion Factors**

Use the following table to convert U.S. measurements to metric equivalents:

|  |  |  |
| --- | --- | --- |
| **Original Unit** | **Multiply by** | **To Get** |
| ounces avdp | 28.3495 | grams |
| ounces | 0.0625 | pounds |
| pounds | 0.4536 | kilograms |
| pounds | 16 | ounces |
| grams | 0.0353 | ounces |
| grams | 0.002205 | pounds |
| kilograms | 2.2046 | pounds |
| liters | 1.8162 | pints (dry) |
| liters | 2.1134 | pints (liquid) |
| liters | 0.9081 | quarts (dry) |
| liters | 1.0567 | quarts (liquid) |
| liters | 0.2642 | gallons (U.S.) |
| pints (dry) | 0.5506 | liters |
| pints (liquid) | 0.4732 | liters |
| quarts (dry) | 1.1012 | liters |
| quarts (liquid) | 0.9463 | liters |
| gallons (U.S.) | 3.7853 | liters |
| millimeters | 0.0394 | inches |
| centimeters | 0.3937 | inches |
| centimeters | 0.03281 | feet |
| inches | 25.4000 | millimeters |
| inches | 2.5400 | centimeters |
| inches | 0.0254 | meters |
| feet | 0.3048 | meters |
| meters | 3.2808 | feet |
| meters | 1.0936 | yards |
| cubic feet | 0.0283 | cubic meters |
| cubic meters | 35.3145 | cubic feet |
| cubic meters | 1.3079 | cubic yards |
| cubic yards | 0.7646 | cubic meters |

**Length: U.S. and Metric Equivalents**

1/4 inch = 0.6 centimeter

1 inch = 2.5 centimeters

1 foot = 0.3048 meter

30.48 centimeters

1 yard = 0.91144 meter

1 millimeter = 0.03937 inch

1 centimeter = 0.3937 inch

1 decimeter = 3.937 inches

1 meter = 39.37 inches

1.094 yards

1 micrometer = 0.00003937 inch

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**Weights and Measures**

**Food Measurement Equivalencies from U.S. to Metric**

**Capacity**

1/5 teaspoon = 1 milliliter

1/4 teaspoon = 1.25 milliliters

1/2 teaspoon = 2.5 milliliters

1 teaspoon = 5 milliliters

1 tablespoon = 15 milliliters

1 fluid ounce = 28.4 milliliters

1/4 cup = 60 milliliters

1/3 cup = 80 milliliters

1/2 cup = 120 milliliters

1 cup = 225 milliliters

1 pint (2 cups) = 473 milliliters

1 quart (4 cups) = 0.95 liter

1 liter (1.06 quarts) = 1,000 milliliters

1 gallon (4 quarts) = 3.84 liters

**Weight**

0.035 ounce = 1 gram

1 ounce = 28 grams

1/4 pound (4 ounces) = 114 grams

1 pound (16 ounces) = 454 grams

2.2 pounds (35 ounces) = 1 kilogram

**U.S. Food Measurement Equivalents**

3 teaspoons = 1 tablespoon

1/2 tablespoon = 1-1/2 teaspoons

2 tablespoons = 1/8 cup

4 tablespoons = 1/4 cup

5 tablespoons + 1 teaspoon = 1/3 cup

8 tablespoons = 1/2 cup

10 tablespoons + 2 teaspoons = 2/3 cup

12 tablespoons = 3/4 cup

16 tablespoons = 1 cup

2 cups = 1 pint

4 cups = 1 quart

2 pints = 1 quart

4 quarts = 1 gallon

**Volumes and Capacities**

1 cup = 8 fluid ounces

1/2 liquid pint

1 milliliter = 0.061 cubic inch

1 liter = 1.057 liquid quarts

0.908 dry quart

61.024 cubic inches

1 U.S. gallon = 231 cubic inches

3.785 liters

0.833 British gallon

128 U.S. fluid ounces

1 British Imperial gallon = 277.42 cubic inches

1.201 U.S. gallons

4.546 liters

160 British fluid ounces

1 U.S. ounce, liquid or fluid = 1.805 cubic inches

29.574 milliliters

1.041 British fluid ounces

1 pint, dry = 33.600 cubic inches

0.551 liter

1 pint, liquid = 28.875 cubic inches

0.473 liter

1 U.S. quart, dry = 67.201 cubic inches

1.101 liters

1 U.S. quart, liquid = 57.75 cubic inches

0.946 liter

1 British quart = 69.354 cubic inches

1.032 U.S. quarts, dry

1.201 U.S. quarts, liquid

**Energy Units**

1 kilocalorie (kcal) = 4.2 kilojoules

1 millijoule (MJ) = 240 kilocalories

1 kilojoule (kJ) =0.24 kcal

1 gram carbohydrate = 4 kcal

1 gram fat = 9 kcal

1 gram protein = 4 kcal

**Temperature Standards**

|  |  |  |
| --- | --- | --- |
|  | **°Fahrenheit** | **°Celsius** |
| Body temperature | 98.6° | 37° |
| Comfortable room temperature | 65-75° | 18-24° |
| Boiling point of water | 212° | 100° |
| Freezing point of water | 32° | 0° |

**Temperature Scales**

**To Convert Fahrenheit to Celsius:**

[(°F - 32) 5]/9

1. Subtract 32 from °F.

2. Multiply (°F - 32) by 5, then divide by 9.

**To Convert Celsius to Fahrenheit:**

[(°C × 9)/5] + 32

1. Multiply °C by 9, then divide by 5.

2. Add 32 to (°C × 9/5).

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# **Appendix C** **Foods Containing Caffeine**

Data from: USDA Nutrient Database for Standard Reference, Release 23.

**Beverages**

|  |  |  |
| --- | --- | --- |
| **Food Name** | **Serving** | **Caffeine/Serving (mg)** |
| Beverage mix, chocolate flavor, dry mix, prepared w/milk | 1 cup (8 fl. oz) | 7.98 |
| Beverage mix, chocolate malt powder, fortified, prepared w/milk | 1 cup (8 fl. oz) | 5.3 |
| Beverage mix, chocolate malted milk powder, no added nutrients,prepared w/milk | 1 cup (8 fl. oz) | 7.95 |
| Beverage, chocolate syrup w/o added nutrients, prepared w/milk | 1 cup (8 fl. oz) | 5.64 |
| Beverage, chocolate syrup, fortified, mixed w/milk | 1 cup milk and 1 tbsp syrup | 2.63 |
| Cocoa mix w/aspartame and calcium and phosphorus, no sodium or | 6 fl. oz water and 0.53-oz packet | 5 |
| vitamin A, low kcal, dry, prepared |  |  |
| Cocoa mix w/aspartame, dry, low kcal, prepared w/water | 1 packet dry mix with 6 fl. oz water | 1.92 |
| Cocoa mix, dry mix | 1 serving (3 heaping tsp. or 1 envelope) | 5.04 |
| Cocoa mix, dry, w/o added nutrients, prepared w/water | 1-oz packet with 6 fl. oz water | 4.12 |
| Cocoa mix, fortified, dry, prepared w/water | 6 fl. oz H2O and 1 packet | 6.27 |
| Cocoa, dry powder, high-fat or breakfast, plain | 1 piece | 6.895 |
| Cocoa, hot, homemade w/whole milk | 1 cup | 5 |
| Coffee liqueur, 53 proof | 1 fl. oz | 9.048 |
| Coffee liqueur, 63 proof | 1 fl. oz | 9.05 |
| Coffee w/cream liqueur, 34 proof | 1 fl. oz | 2.488 |
| Coffee mix w/sugar (cappuccino), dry, prepared w/water | 6 fl. oz H2O and 2 rounded tsp. mix | 74.88 |
| Coffee mix w/sugar (French), dry, prepared w/water | 6 fl. oz H2O and 2 rounded tsp. mix | 51.03 |
| Coffee mix w/sugar (mocha), dry, prepared w/water | 6 fl. oz and 2 round tsp. mix | 33.84 |
| Coffee, brewed | 1 cup (8 fl. oz) | 94.8 |
| Coffee, brewed, prepared with tap water, decaffeinated | 1 cup (8 fl. oz) | 2.37 |
| Coffee, instant, prepared | 1 cup (8 fl. oz) | 61.98 |
| Coffee, instant, regular, powder, half the caffeine | 1 cup (8 fl. oz) | 30.99 |
| Coffee, instant, decaffeinated | 1 cup (8 fl. oz) | 1.79 |
| Coffee and cocoa (mocha) powder, with whitener and low-Calorie sweetener | 1 cup | 405.48 |
| Coffee, brewed, espresso, restaurant-prepared | 1 cup (8 fl. oz) | 502.44 |
| Coffee, brewed, espresso, restaurant-prepared, decaffeinated | 1 cup (8 fl. oz) | 2.37 |
| Energy drink, with caffeine, niacin, pantothenic acid, vitamin B6 | 1 fl. oz | 9.517 |
| Milk beverage mix, dairy drink w/aspartame, low kcal, dry, prep | 6 fl. oz | 4.08 |
| Milk, low-fat, 1% fat, chocolate | 1 cup | 5 |
| Milk, whole, chocolate | 1 cup | 5 |
| Soft drink, cola w/caffeine | 1 fl. oz | 2 |
| Soft drink, cola, w/higher caffeine | 1 fl. oz | 8.33 |
| Soft drink, cola or pepper type, low kcal w/saccharin and caffeine | 1 fl. oz | 3.256 |
| Soft drink, cola, low kcal w/saccharin and aspartame, w/caffeine | 1 fl. oz | 4.144 |
| Soft drink, lemon-lime soda, w/caffeine | 1 fl. oz | 4.605 |
| Soft drink, low kcal, not cola or pepper, with aspartame and caffeine | 1 fl. oz | 4.44 |
| Soft drink, pepper type, w/caffeine | 1 fl. oz | 3.07 |
| Tea mix, instant w/lemon flavor, w/saccharin, dry, prepared | 1 cup (8 fl. oz) | 16.59 |
| Tea mix, instant w/lemon, unsweetened, dry, prepared | 1 cup (8 fl. oz) | 26.18 |
| Tea mix, instant w/sugar and lemon, dry, no added vitamin C, prepared | 1 cup (8 fl. oz) | 28.49 |
| Tea mix, instant, unsweetened, dry, prepared | 1 cup (8 fl. oz) | 30.81 |
| Tea, brewed | 1 cup (8 fl. oz) | 47.36 |
| Tea, brewed, prepared with tap water, decaffeinated | 1 cup (8 fl. oz) | 2.37 |
| Tea, instant, unsweetened, powder, decaffeinated | 1 tsp. | 1.183 |
| Tea, instant, w/o sugar, lemon-flavored, w/added vitamin C, dry prepared | 1 cup (8 fl. oz) | 26.05 |
| Tea, instant, with sugar, lemon-flavored, decaffeinated, no added vitamin | 1 cup | 9.1 |

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**Cake, Cookies, and Desserts**

|  |  |  |
| --- | --- | --- |
| **Food Name** | **Serving** | **Caffeine/serving (mg)** |
| Brownie, square, large (2-3/4" **×** 7/8") | 1 piece | 1.12 |
| Cake, chocolate pudding, dry mix | 1 oz | 1.701 |
| Cake, chocolate, dry mix, regular | 1 oz | 3.118 |
| Cake, German chocolate pudding, dry mix | 1 oz | 1.985 |
| Cake, marble pudding, dry mix | 1 oz | 1.985 |
| Candies, chocolate-covered, caramel with nuts | 1 cup | 35.34 |
| Candies, chocolate-covered, dietetic or low-Calorie | 1 cup | 16.74 |
| Candy, milk chocolate w/almonds | 1 bar (1.45 oz) | 9.02 |
| Candy, milk chocolate w/rice cereal | 1 bar (1.4 oz) | 9.2 |
| Candy, raisins, milk-chocolate-coated | 1 cup | 45 |
| Chocolate chips, semisweet, mini | 1 cup chips (6-oz package) | 107.12 |
| Chocolate, baking, unsweetened, square | 1 piece | 22.72 |
| Chocolate, baking, Mexican, square | 1 piece | 2.8 |
| Chocolate, sweet | 1 oz | 18.711 |
| Cookie Cake, Snackwell Fat Free Devil's Food, Nabisco | 1 serving | 1.28 |
| Cookie, Snackwell Caramel Delights, Nabisco | 1 serving | 1.44 |
| Cookie, chocolate chip, enriched, commercially prepared | 1 oz | 3.118 |
| Cookie, chocolate chip, homemade w/margarine | 1 oz | 4.536 |
| Cookie, chocolate chip, lower-fat, commercially prepared | 3 pieces | 2.1 |
| Cookie, chocolate chip, refrigerated dough | 1 portion, dough spooned from roll | 2.61 |
| Cookie, chocolate chip, soft, commercially prepared | 1 oz | 1.985 |
| Cookie, chocolate wafers | 1 cup, crumbs | 7.84 |
| Cookie, graham crackers, chocolate-coated | 1 oz | 13.041 |
| Cookie, sandwich, chocolate, cream-filled | 3 pieces | 3.9 |
| Cookie, sandwich, chocolate, cream-filled, special dietary | 1 oz | 0.85 |
| Cupcake, chocolate w/frosting, low-fat | 1 oz | 0.86 |
| Donut, cake, chocolate w/sugar or glaze | 1 oz | 0.284 |
| Donut, cake, plain w/chocolate icing, large (3-1/2") | 1 each | 1.14 |
| Fast food, ice cream sundae, hot fudge | 1 sundae | 1.58 |
| Fast food, milk beverage, chocolate shake | 1 cup (8 fl. oz) | 1.66 |
| Frosting, chocolate, creamy, ready-to-eat | 2 tbsp creamy | 0.82 |
| Frozen yogurt, chocolate | 1 cup | 5.58 |
| Fudge, chocolate w/nuts, homemade | 1 oz | 1.984 |
| Granola bar, soft, milk-chocolate-coated, peanut butter | 1 oz | 0.85 |
| Granola bar, with coconut, chocolate-coated | 1 cup | 5.58 |
| Ice cream, chocolate | 1 individual (3.5 fl. oz) | 1.74 |
| Ice cream, chocolate, light | 1 oz | 0.85 |
| Ice cream, chocolate, rich | 1 cup | 5.92 |
| M&M's Peanut Chocolate | 1 cup | 18.7 |
| M&M's Plain Chocolate | 1 cup | 22.88 |
| Milk chocolate | 1 cup chips | 33.6 |
| Milk-chocolate-coated coffee beans | 1 NLEA serving | 48 |
| Milk dessert, frozen, fat-free milk, chocolate | 1 oz | 0.85 |
| Milk shake, thick, chocolate | 1 fl. oz | 0.568 |
| Pastry, eclair/cream puff, homemade, custard-filled w/chocolate | 1 oz | 0.567 |
| Pie crust, chocolate-wafer-cookie-type, chilled | 1 crust, single 9" | 11.15 |
| Pie, chocolate mousse, no bake mix | 1 oz | 0.284 |
| Pudding, chocolate, instant dry mix prepared w/reduced-fat (2%) milk | 1 oz | 0.283 |
| Pudding, chocolate, regular dry mix prepared w/reduced-fat (2%) milk | 1 oz | 0.567 |
| Pudding, chocolate, ready-to-eat, fat-free | 4 oz can | 2.27 |
| Syrups, chocolate, genuine chocolate flavor, light, Hershey | 2 tbsp. | 1.05 |
| Topping, chocolate-flavored hazelnut spread | 1 oz | 1.984 |
| Yogurt, chocolate, nonfat milk | 1 oz | 0.567 |
| Yogurt, frozen, chocolate, soft serve | 0.5 cup (4 fl. oz) | 2.16 |

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# **Appendix D** **U.S. Exchange Lists for Meal Planning**

Adapted from: Choose Your Foods: Exchange Lists For Diabetes. © 2008 by the American Diabetes Association and the Academy of Nutrition and Dietetics. Used by permission of the Academy of Nutrition and Dietetics.

**Starch List**

1 starch choice = 15 g carbohydrate, 0-3 g protein, 0-1 g fat, and 80 cal

Icon Key

= More than 3 g of dietary fiber per serving.

! = Extra fat, or prepared with added fat. (Count as 1 starch + 1 fat.)

= 480 mg or more of sodium per serving.

**Food Serving Size**

**Bread**

Bagel, 4 oz ¼ (1 oz)

! Biscuit, 2½"across 1

Bread

reduced-calorie 2 slices (10½ oz)

white, whole-grain, pumpernickel, rye, unfrosted raisin 1 slice (1 oz)

Chapatti, small, 6" across 1

! Cornbread, 1¾" cube. 1(1½ oz)

English muffin ½

Hot dog bun or hamburger bun ½ (1 oz)

Naan, 8" by *2". ¼*

Pancake, 4" across, ¼*"* thick 1

Pita, 6" across. ½

Roll, plain small 1 (1 oz)

! Stuffing, bread ⅓ cup

! Taco shell, 5" across 2

Tortilla

Corn, 6" across 1

Flour, 6" across 1

Flour, 10" across 1/3 tortilla

! Waffle, 4"-square or 4" across 1

**Cereals and Grains**

Barley, cooked ⅓ cup

Bran, dry

oat ¼c

wheat ½c

Bulgur (cooked) ½c

Cereals ½c

bran ½c

cooked (oats, oatmeal) *½*c

puffed 1½c

shredded wheat, plain ½c

sugar-coated ½c

unsweetened, ready-to-eat ¾c

Couscous ⅓c

Granola

low-fat ¼c

regular ¼c

Grits, cooked ½c

Kasha *½*c

Millet, cooked ⅓c

Muesli ¼c

Pasta, cooked ⅓c

Polenta, cooked ⅓c

Quinoa, cooked ⅓c

Rice, white or brown, cooked ⅓c

Tabbouleh (tabouli), prepared ⅓*c*

Wheat germ, dry 3 tbs

Wild rice, cooked ½c

**Starchy Vegetables**

Cassava ⅓c

Corn ½c

on cob, large ½ cob (5 oz)

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**[Food Serving Size**

Hominy, canned ¾c

Mixed vegetables with corn, peas, or pasta 1c

Parsnips ½c

Peas, green ½c

Plantain, ripe ⅓c

Potato

baked with skin ¼ large **(**3 oz)

boiled, all kinds ½c or ½

medium **(**3 oz)

! mashed, with milk and fat ½c

French fried (oven-baked) 1 cup (2 oz)

Pumpkin, canned, no sugar added 1c

Spaghetti/pasta sauce ½c

Squash, winter (acorn, butternut) 1c

Succotash ½c

Yam, sweet potato, plain ½c

**Crackers and Snacks**

Animal crackers 8

Crackers

! round-butter type 6

saltine-type 6

! sandwich-style, cheese or peanut butter filling 3

! whole-wheat regular 2-5 (¾ oz)

! whole-wheat lower fat or crispbreads 2-5 (¾ oz)

Graham crackers, 2½" square 3

Matzoh ¾ oz

Melba toast, about 2" by 4" piece 4 pieces

Oyster crackers 20

Popcorn 3c

! with butter 3c

no fat added 3c

© lower fat 3c

Pretzels ¾oz

Rice cakes, 4" across 2

Snack chips

fat-free or baked (tortilla, potato),

baked pita chips 15-20 *(¾* oz)

regular (tortilla, potato) 9-13 (¾ oz)

**Beans, Peas, and Lentils**

*(Count as 1 starch + 1 lean meat)*

Baked beans ⅓c

Beans, cooked (black, garbanzo, kidney, lima, navy, pinto, white) ½c

Lentils, cooked (brown, green, yellow) ½c

Peas, cooked (black-eyed, split) ½ c

Refried beans, canned ½c]

**[Fruit List**

1 fruit choice = 15 g carbohydrate, 0 g protein, 0 g fat, and 60 cal Weight includes skin, core, seeds, and rind.

**Icon** Key

= More than 3 g of dietary fiber per serving.

! = Extra fat, or prepared with added fat.

= 480 mg or more of sodium per serving.

**Food Serving Size**

Apples

unpeeled, small 1 (4 oz)

dried 4 rings

Applesauce, unsweetened ½c

Apricots canned ½c

dried 8 halves

I fresh 4 whole (5½ oz)

Banana, extra small 1 (4 oz)

Blackberries ¾c

I Blueberries ¾c

Cantaloupe, small ⅓ melon or 1 c cubed (11 oz)

Cherries

sweet, canned ½c

sweet, fresh 12 (3 oz)

Dates 3

Dried fruits (blueberries, cherries, cranberries, mixed fruit, raisins) 2 tbs

Figs

dried 1½

fresh 1½ large or 2 medium (3½ oz)

Fruit cocktail ½c

Grapefruit

large ½ (11 oz)

sections, canned ¾c

Grapes, small 17 (3 oz)

Honeydew melon 1 slice or 1 e cubed (10 oz)

Kiwi 1 (3½ oz)

Mandarin oranges, canned ¾ c

Mango, small ½ fruit (5½ oz) or ½c

Nectarine, small 1 (5 oz)]

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**[Food Serving Size**

Orange, small 1 (6½ oz)

Papaya ½ fruit or 1 c cubed (8 oz)

Peaches

canned ½c

fresh, medium 1 (6 oz)

Pears

canned ½c

fresh, large ½(4 oz)

Pineapple

canned ½c

fresh ¾*c*

Plums

canned ½c

dried (prunes) 3

small 2 (5 oz)

Raspberries 1c

Strawberries 1¼c whole berries

Tangerines, small 2 (8 oz)

Watermelon 1 slice or 1¼c cubes (13½ oz)

**Fruit Juice**

Apple juice/cider ½c

Fruit juice blends, 100%

juice ⅓c

Grape juice ⅓c

Grapefruit juice ½c

Orange juice ½c

Pineapple juice ½c

Prune juice ⅓c]

**[Milk and Yogurts**

1 milk choice = 12 g carbohydrate and 8 g protein

|  |  |  |
| --- | --- | --- |
| **Food**  | **Serving Size** | **Count As** |
| **Fat-Free or Low-Fat (1%)** |
| *(0-3 g fat per serving, 100 calories per serving)* |
| Milk, buttermilk, acidophilus milk, Lactaid | 1c | 1 fat-free milk |
| Evaporated milk | ½c | 1 fat-free milk |
| Yogurt, plain or flavored with an artificial sweetener | ⅔c (6 oz)  | 1 fat-free milk |
| **Reduced-Fat (2%)** |  |  |
| *(5 g fat per serving, 120 calories per serving)* |  |  |
| Milk, acidophilus milk, kefir, Lactaid | 1c | 1 reduced-fat milk |
| Yogurt, plain | ⅔c (6 oz) | 1 reduced-fat milk |
| **Whole** |  |  |
| *(8 g fat per serving, 160 calories per serving)* |  |  |
| Milk, buttermilk, goat's milk | 1c | 1 whole milk |
| Evaporated milk | ½c | 1 whole milk |
| Yogurt, plain | 8 oz | 1 whole milk |
| **Dairy-Like Foods** |  |  |
| Chocolate milk |  |  |
| fat-free | 1c | 1 fat-free milk + 1 carbohydrate |
| whole | 1c | 1 whole milk + 1 carbohydrate |
| Eggnog, whole milk | ½c | 1 carbohydrate + 2 fats |
| Rice drink |  |  |
| flavored, low-fat | 1c | 2 carbohydrates |
| plain, fat-free | 1c | 1 carbohydrate |
| Smoothies, flavored, regular | 10 oz | 1 fat-free milk + 2½ carbohydrates |
| Soy milk |  |  |
| light | 1c | 1 carbohydrate + ½ fat |
| regular, plain | 1c | 1 carbohydrate + 1 fat |
| Yogurt |  |  |
| and juice blends | 1c | 1 fat-free milk + 1 carbohydrate |
| low carbohydrate (less than 6 g carbohydrate per choice) | ⅔c (6 oz) | ½ fat-free milk |
| with fruit, low-fat | ⅔c (6 oz) | 1 fat-free milk + 1 carbohydrate |

D-3

**Sweets, Desserts, and Other Carbohydrates List**

1 other carbohydrate choice = 15 g carbohydrate and variable protein, fat, and calories.

**Icon Key**

I = 480 mg or more of sodium per serving.

|  |  |  |
| --- | --- | --- |
| **Food**  | **Serving Size** | **Count As** |
| **Beverages, Soda, and Energy/Sports Drinks** |
| Cranberry juice cocktail | ½c | 1 carbohydrate |
| Energy drink | 1 can (8.3 oz) | 2 carbohydrates |
| Fruit drink or lemonade | 1 c (8 oz) | 2 carbohydrates |
| Hot chocolate |  |  |
| regular | 1 envelope added to 8 oz water | 1 carbohydrate + 1 fat |
| sugar-free or light | 1 envelope added to 8 oz water | 1 carbohydrate |
| Soft drink (soda), regular | 1 can (12 oz) | 2½ carbohydrates |
| Sports drink  | 1 cup (8 oz) | 1 carbohydrate |
| **Brownies, Cake, Cookies, Gelatin, Pie, and Pudding** |  |  |
| Brownie, small, unfrosted | 1¼" square, ⅞". high (about 1 oz) | 1 carbohydrate + 1 fat |
| Cake |  |  |
| angel food, unfrosted | 1½ of cake (about 2 oz) | 2 carbohydrates |
| frosted | 2" square (about 2 oz) | 2 carbohydrates + 1 fat |
| unfrosted | 2" square (about 2 oz) | 1 carbohydrate + 1 fat |
| Cookies |  |  |
| chocolate chip | 2 cookies (2¼" across) | 1 carbohydrate + 2 fats |
| gingersnap | 3 cookies | 1 carbohydrate |
| sandwich, with creme filling | 2 small (about ⅔ oz) | 1 carbohydrate + 1 fat |
| sugar-free | 3 small or **1** large (¾ oz-1 oz) | 1 carbohydrate + 1-2 fats |
| vanilla wafer | 5 cookies | 1 carbohydrate + 1 fat |
| Cupcake, frosted | 1 small (about 1¾ oz) | 2 carbohydrates + 1-1½ fats |
| Fruit cobbler  | ½c (3½ oz) | 3 carbohydrates + 1 fat |
| Gelatin, regular | ½c | 1 carbohydrate |
| Pie |  |  |
| commercially prepared fruit, 2 crusts | ⅙ of 8" pie | 3 carbohydrates + 2 fats |
| pumpkin or custard | ⅙ of 8" pie | 1½ carbohydrates + 1½ fats |
| Pudding |  |  |
| regular (made with reduced-fat milk) | ½c | 2 carbohydrates |
| sugar-free, or sugar-free and fat-free (made with fat-free milk) | ½c | 1 carbohydrate |
| **Candy, Spreads, Sweets, Sweeteners, Syrups, and Toppings** |
| Candy bar, chocolate/peanut | 2 "fun size" bars (1 oz) | 1½ carbohydrates + 1½ fats |
| Candy, hard | 3 pieces | 1 carbohydrate |
| Chocolate "kisses" | 5 pieces | 1 carbohydrate + 1 fat |
| Coffee creamer |  |  |
| dry, flavored | 4 tsp | ½ carbohydrate + ½ fat |
| liquid, flavored | 2 tbs | 1 carbohydrate |
| Fruit snacks, chewy (pureed fruit concentrate) | 1 roll (¾ oz) | 1 carbohydrate |
| Fruit spreads, 100% fruit | 1½ tbs | 1 carbohydrate |
| Honey | 1 tbs | 1 carbohydrate |

D-4

|  |  |  |
| --- | --- | --- |
| **Food**  | **Serving Size** | **Count As** |
| Jam or jelly, regular | 1 tbs | 1 carbohydrate |
| Sugar | 1 tbs | 1 carbohydrate |
| Syrup |  |  |
| chocolate | 2 tbs | 2 carbohydrates |
| light (pancake type) | 2 tbs | 1 carbohydrate |
| regular (pancake type) | 1 tbs | 1 carbohydrate |
| **Condiments and Sauces** |  |  |
| Barbeque sauce | 3 tbs | 1 carbohydrate |
| Cranberry sauce, jellied | ¼c | 1½ carbohydrates |
| Gravy, canned or bottled | ½c | ½ carbohydrate + ½ fat |
| Salad dressing, fat-free, low-fat, cream-based | 3 tbs | 1 carbohydrate |
| Sweet and sour sauce | 3 tbs | 1 carbohydrate |
| **Doughnuts, Muffins, Pastries, and Sweet Breads** |  |  |
| Banana nut bread | 1" slice (1 oz) | 2 carbohydrates + 1 fat |
| Doughnut |  |  |
| cake, plain | 1 medium, (1½ oz) | 1½ carbohydrates + 2 fats |
| yeast type, glazed | 3¾" across (2 oz) | 2 carbohydrates + 2 fats |
| Muffin (4 oz) | ¼ muffin (1 oz) | 1 carbohydrate + ½ fat |
| Sweet roll or Danish | 1 (2½ oz) | 2½ carbohydrates + 2 fats |
| **Frozen Bars, Frozen Dessert, Frozen Yogurt, and Ice Cream** |  |  |
| Frozen pops | 1 | ½ carbohydrate |
| Fruit juice bars, frozen, 100% juice | 1 bar (3 oz) | 1 carbohydrate |
| Ice cream |  |  |
| fat-free | ½c | 1½ carbohydrates |
| light | ½c | 1 carbohydrate + 1 fat |
| no sugar added | ½c | 1 carbohydrate + 1 fat |
| regular | ½c | 1 carbohydrate + 2 fats |
| Sherbet, sorbet | ½c | 2 carbohydrates |
| Yogurt, frozen |  |  |
| fat-free | ⅓c | 1 carbohydrate |
| regular | ½c | 1 carbohydrate + 0-1 fat |
| **Granola Bars, Meal Replacement Bars/Shakes, and Trail Mix** |  |  |
| Granola or snack bar, regular or low-fat | 1 bar (1 oz) | 1½ carbohydrates |
| Meal replacement bar | 1 bar (1⅓ oz) | 1½ carbohydrates + 0-1 fat |
| Meal replacement bar | 1 bar (2 oz) | 2 carbohydrates + 1 fat |
| Meal replacement shake, reduced-calorie | 1 can (10-11 oz) | 1½ carbohydrates + 0-1 fat |
| Trail mix |  |  |
| candy/nut-based | 1 oz | 1 carbohydrates + 2 fats |
| dried-fruit-based | 1 oz | 1 carbohydrate + 1 fat |

D-5

[**Nonstarchy Vegetable List**

1 vegetable choice = 5 g carbohydrate, 2 g protein, 0 g fat, 25 cal

**Icon Key**

= More than 3 g of dietary fiber per serving.

I = 480 mg or more of sodium per serving.

Amaranth or Chinese spinach

Artichoke

Artichoke hearts

Asparagus

Baby corn

Bamboo shoots

Beans (green, wax, Italian)

Bean sprouts

Beets

Borscht

Broccoli

Brussels sprouts

Cabbage (green, bok choy, Chinese)

Carrots

Cauliflower

Celery

Chayote

Coleslaw, packaged, no dressing

Cucumber

Eggplant

Gourds (bitter, bottle, luffa, bitter melon)

Green onions or scallions

Greens (collard, kale, mustard, turnip)

Hearts of palm

Jicama

Kohlrabi

Leeks

Mixed vegetables (without corn, peas, or pasta)

Mung bean sprouts

Mushrooms, all kinds, fresh

Okra

Onions

Oriental radish or daikon

Pea pods

Peppers (all varieties)

Radishes

Rutabaga

Sauerkraut

Soybean sprouts

Spinach

Squash (summer, crookneck, zucchini)

Sugar pea snaps

Swiss chard

Tomato

Tomatoes, canned

Tomato sauce

Tomato/vegetable juice

Turnips

Water chestnuts

Yard-long beans]

**Meat and Meat Substitutes List**

**Icon Key**

! = Extra fat, or prepared with added fat. (Add an additional fat choice to this food.)

= 480 mg or more of sodium per serving (based on the sodium content of a typical 3 oz serving of meat, unless 1 or 2 is the normal serving size).

|  |  |
| --- | --- |
| **Food** | **Amount** |
| **Lean Meats and Meat Substitutes** |  |
| *(1 lean meat choice = 7g protein, 0-3 g fat, 45 calories)* |  |
| *Beef:* Select or Choice grades trimmed of fat: ground round, roast (chuck, rib, rump), round, sirloin, steak (cubed, flank, porterhouse, T-bone), tenderloin | 1 oz |
| Beef jerky | 1 oz |
| Cheeses with 3 g of fat or less per oz | 1 oz |
| Cottage cheese | ¼ cup |
| Egg substitutes, plain | ¼ cup |
| Egg whites | 2 |
| *Fish, fresh or frozen, plain: catfish,* cod, flounder, haddock, halibut, orange roughy, salmon, tilapia, trout, tuna | 1 oz |
| *Fish, smoked:* herring or salmon (lox) | 1 oz |
| *Game:* buffalo, ostrich, rabbit, venison | 1 oz |
| Hot dog with 3 g of fat or less per oz (8 dogs per 14 oz package) *(Note: May**be high in carbohydrate.)* | 1 |
| *Lamb:* chop, leg, or roast | 1 oz |
| *Organ meats:* heart, kidney, liver *(Note: May be high in cholesterol)* | 1 oz |

D-6

|  |  |
| --- | --- |
| **Food** | **Amount** |
| Oysters, fresh or frozen | 6 medium |
| Pork, lean |  |
| Canadian bacon | 1 oz |
| rib or loin chop/roast, ham,tenderloin | 1 oz |
| *Poultry without skin:* Cornish hen, chicken, domestic duck or goose (well drained of fat), turkey | 1 oz |
| *Processed sandwich meats with 3 g of fat or less per oz:* chipped beef, deli thin-sliced meats, turkey ham, turkey kielbasa, turkey pastrami | 1 oz |
| Salmon, canned | 1 oz |
| Sardines, canned | 2 medium |
| Sausage with 3 g or less fat per oz | 1 oz |
| *Shellfish:* clams, crab, imitation shellfish, lobster, scallops, shrimp | 1 oz |
| Tuna, canned in water or oil, drained | 1 oz |
| *Veal:* Lean chop, roast | 1 oz |
| **Medium-Fat Meat and Meat Substitutes** |  |
| *(1 medium-fat meat choice = 7g protein, 4-7g fat, and 75 calories)* |  |
| *Beef:* corned beef, ground beef,meatloaf, Prime grades trimmed offat (prime rib), short ribs, tongue | 1 oz |
| *Cheeses with 4-7 g of fat per oz:* feta, mozzarella, pasteurized processed cheese spread, reduced-fat cheeses, string | 1 oz |
| Egg *(Note: High in cholesterol, limit to 3 per week.)* | 1 |
| Fish, any fried product | 1 oz |
| *Lamb:* ground, rib roast | 1 oz |
| *Pork:* cutlet, shoulder roast | 1 oz |
| *Poultry:* chicken with skin; dove,pheasant, wild duck, or goose; fried chicken; ground turkey | 1 oz |
| Ricotta cheese | 2 oz or ¼*c* |
| Sausage with 4-7 g fat per oz | 1 oz |
| *Veal:* Cutlet (no breading) | 1 oz |
| **High-Fat Meat and Meat Substitutes**a |  |
| *(1 high-fat meat choice = 7g protein, 8 + g fat, 100 calories)* |  |
| Bacon |  |
| pork | 2 slices (16 slices per lb or 1 oz each, before cooking) |
| turkey | 3 slices (½ oz each before cooking) |
| *Cheese, regular:* American, bleu, brie, cheddar, hard goat, Monterey Jack, queso, Swiss | 1 oz |
| ! *Hot dog:* beef, pork, or combination(10 per lb-sized package) | 1 |
| *Hot dog:* turkey or chicken (10 per lb-sized package) | 1 |
| *Pork:* ground, sausage, spareribs | 1 oz |
| *Processed sandwich meats with 8g of fat or more per oz:* bologna, pastrami, hard salami | 1 oz |
| I *Sausage with 8 g of fat or more per oz:* bratwurst, chorizo, Italian, knockwurst, Polish, smoked, summer | 1 oz |

aThese foods are high in saturated fat, cholesterol, and calories and may raise blood cholesterol levels if eaten on a regular basis. Try to eat 3 or fewer servings from this group per week.

**Plant-Based Proteins**

Because carbohydrate and fat content varies among plant-based proteins, you should read the food label.

**Icon Key**

= More than 3 g of dietary fiber per serving; 7 g protein; calories vary.

= 480 mg or more of sodium per serving (based on the sodium content of a typical 3-oz serving of meat, unless 1 or 2 oz is the normal serving size).

|  |  |  |
| --- | --- | --- |
| **Food** | **Amount** | **Count As** |
| "Bacon" strips, soy-based | 3 strips | 1 medium-fat meat |
| Baked beans | ⅓c | 1 starch + 1 lean meat |
| *Beans, cooked:* black, garbanzo, kidney, lima,navy, pinto, white | ½c | 1 starch + 1 lean meat |
| "Beef" or "sausage" crumbles, soy-based | 2 oz | ½ carbohydrate + 1 lean meat |
| "Chicken" nuggets, soy-based | 2 nuggets (1½ oz) | ½ carbohydrate + 1 medium-fat meat |

D-7

|  |  |  |
| --- | --- | --- |
| **Food** | **Amount** | **Count As** |
| Edamame | ½c | ½ carbohydrate + 1 lean meat |
| Falafel (spiced chickpea and wheat patties) | 3 patties (about 2 inchesacross) | 1 carbohydrate + 1 high-fat meat |
| Hot dog, soy-based | 1(1½ oz) | ½ carbohydrate + 1 lean meat |
| Hummus | ⅓c | 1 carbohydrate + 1 high-fat meat |
| Lentils, brown, green, or yellow | ½c | 1 carbohydrate + 1 lean meat |
| Meatless burger, soy-based | 3 oz | ½ carbohydrate + 2 lean meats |
| Meatless burger, vegetable- and starch-based  | 1 patty (about 2½ oz) | 1 carbohydrate + 2 lean meats |
| *Nut spreads:* almond butter, cashew butter, peanut butter, soy nut butter | 1 tbs | 1 high-fat meat |
| *Peas, cooked:* black-eyed and split peas | ½c | 1 starch + 1 lean meat |
| Refried beans, canned | ½c | 1 starch + 1 lean meat |
| "Sausage" patties, soy-based | 1(1½ oz) | 1 medium-fat meat |
| Soy nuts, unsalted | ¾ oz | ½ carbohydrate + 1 medium-fat meat |
| Tempeh | ¼ cup | 1 medium-fat meat |
| Tofu | 4 oz (½ cup) | 1 medium-fat meat |
| Tofu, light | 4 oz (½ cup) | 1 lean meat |

**Fat List**

1 fat choice = 5 g fat, 45 cal

**Icon Key**

= 480 mg or more of sodium per serving.

|  |  |
| --- | --- |
| **Food** | **Serving Size** |
| Avocado, medium | 2 tbs (1 oz) |
| *Nut butters (trans fat-free):* almond butter, cashew butter, peanut butter (smooth or crunchy) | 1½ tsp |
| Nuts |  |
| almonds | 6 nuts |
| Brazil | 2 nuts |
| cashews | 6 nuts |
| filberts (hazelnuts) | 5 nuts |
| macadamia | 3 nuts |
| mixed (50% peanuts) | 6 nuts |
| peanuts | 10 nuts |
| pecans  | 4 halves |
| pistachios | 16 nuts |
| *Oil:* canola, olive, peanut | 1 tsp |
| Olives |  |
| black (ripe) | 8 large |
| green, stuffed | 10 large |
| **Polyunsaturated Fats** |  |
| Margarine: lower-fat spread (30% to 50% vegetable oil, trans fat-free) | 1 tbs |
| Margarine: stick, tub (trans fat-free), or squeeze (trans fat-free) | 1 tsp |
| Mayonnaise |  |
| reduced-fat | 1 tbs |
| regular | 1 tsp |
| Mayonnaise-style salad dressing |  |
| reduced-fat | 1 tbs |
| regular | 2 tsp |
| Nuts |  |
| Pignolia (pine nuts) | 1 tbs |
| walnuts, English | 4 halves |
| Oil: corn, cottonseed, flaxseed, grape seed, safflower, soybean, sunflower | 1 tsp |
| Oil: made from soybean and canola oil--Enova | 1 tsp |
| Plant stanol esters |  |
| light | 1 tbs |
| regular | 2 tsp |
| Salad dressing |  |
| reduced-fat (Note: May be high in carbohydrate.) | 2 tbs |
| regular | 1 tbs |
| Seeds  | 1 tbs |
| flaxseed, whole | 1 tbs |
| pumpkin, sunflower | 1 tbs |
| sesame seeds | 1 tbs |
| Tahini or sesame paste | 2 tsp |

D-8

|  |  |
| --- | --- |
| **Food** | **Serving Size** |
| **Saturated Fats** |  |
| Bacon, cooked, regular or turkey | 1 slice |
| Butter |  |
| reduced-fat | 1 tbs |
| stick | 1 tsp |
| whipped | 2 tsp |
| Butter blends made with oil |  |
| reduced-fat or light | 1 tbs |
| regular | 1½ tsp |
| Chitterlings, boiled | 2 tbs (½ oz) |
| Coconut, sweetened, shredded | 2 tbs |
| Coconut milk |  |
| light | ¼c |
| regular | 1½ tbs |
| Cream |  |
| half and half | 2 tbs |
| heavy  | 1 tbs |
| light | 1½ tbs |
| whipped | 2 tbs |
| whipped, pressurized | ¼c |
| Cream cheese |  |
| reduced-fat | 1½ tbs (¾ oz) |
| regular | 1 tbs (½ oz) |
| Lard | 1 tsp |
| *Oil:* coconut, palm, palm kernel | 1 tsp |
| Salt pork | ¼ oz |
| Shortening, solid | 1 tsp |
| Sour cream |  |
| reduced-fat or light | 3 tbs |
| regular | 2 tbs |

**[Free Foods List**

A free *food* is any food or drink that has less than 20 calories and 5 g or less of carbohydrate per serving. Foods with a serving size listed should be limited to three servings per day. Foods listed without a serving size can be eaten as often as you like. **Icon Key**

I = 480 mg or more of sodium per serving.

|  |  |
| --- | --- |
| **Food** | **Serving Size** |
| Low Carbohydrate Foods |  |
| Cabbage, raw | ½c |
| Candy, hard (regular or sugar-free) | 1 piece |
| Carrots, cauliflower, or green beans, cooked | ¼c |
| Cranberries, sweetened with sugar substitute | 1½c |
| Cucumber, sliced | 1½c |
| Gelatin |  |
| dessert, sugar-free |  |
| unflavored |  |
| Gum |  |
| Jam or jelly, light or no sugar added  | 2 tsp |
| Rhubarb, sweetened with sugar substitute | 1½c |
| Salad greens |  |
| Sugar substitutes (artificial sweeteners) |  |
| Syrup, sugar-free | 2 tbs |
| **Modified Fat Foods with Carbohydrate** |
| Cream cheese, fat-free | 1 tbs (½ oz) |
| Creamers |  |
| nondairy, liquid | 1 tbs |
| nondairy, powdered | 2 tsp |
| Margarine spread |  |
| fat-free | 1 tbs |
| reduced-fat | 1 tsp |
| Mayonnaise |  |
| fat-free | 1 tbs |
| reduced-fat | 1 tsp |
| **Mayonnaise-style salad dressing** |  |
| fat-free | 1 tbs |
| reduced-fat | 1 tsp |
| Salad dressing |  |
| fat-free or low-fat | 1 tbs |
| fat-free, Italian | 2 tbs |
| Sour cream, fat-free, reduced-fat | 1 tbs |
| Whipped topping |  |
| light or fat-free | 2 tbs |
| regular | 1 tbs |
| **Condiments** |  |
| Barbecue sauce | 2 tsp |
| Catsup (ketchup) | 1 tbs |
| Honey mustard | 1 tbs |
| Horseradish |  |
| Lemon juice |  |
| Miso | 1½ tsp |
| Mustard |  |

]

D-9

D-10

|  |  |
| --- | --- |
| **Food** | **Serving Size** |
| Parmesan cheese, freshly grated | 1 tbs |
| Pickle relish | 1 tbs |
| Pickles |  |
| dill | 1½ medium |
| sweet, bread and butter | 2 slices |
| sweet, gherkin | ¾ oz |
| Salsa | ¼c |
| Soy sauce, regular or light  | 1 tbs |
| Sweet and sour sauce  | 2 tsp |
| Sweet chili sauce  | 2 tsp |
| Taco sauce  | 1 tbs |
| Vinegar |  |
| Yogurt, any type  | 2 tbs |

**[Drinks/Mixes**

Any food on this list--without serving size listed--can be consumed in any moderate amount.

**Icon Key**

= 480 mg or more of sodium per serving.

I Bouillon, broth, consomme

Bouillon or broth, low sodium

Carbonated or mineral water Club soda

Cocoa powder, unsweetened (1 tbs)

Coffee, unsweetened or with sugar substitute

Diet soft drinks, sugar-free

Drink mixes, sugar-free

Tea, unsweetened or with sugar substitute

Tonic water, diet

Water

Water, flavored, carbohydrate free]

**[Seasonings**

Any food on this list can be consumed in any moderate amount.

Flavoring extracts (for example, vanilla, almond, peppermint)

Garlic

Herbs, fresh or dried

Nonstick cooking spray

Pimento

Spices

Hot pepper sauce

Wine, used in cooking

Worcestershire sauce]

**Combination Foods List**

**Icon Key**

= More than 3 g of dietary fiber per serving.

! = 600 mg or more of sodium per serving (for combination food main dishes/meals).

|  |  |  |
| --- | --- | --- |
| **Food** | **Serving Size** | **Count As Entrees** |
| Casserole type (tuna noodle, lasagna, spaghetti with meatballs, chili with beans, macaroni and cheese)  | 1c (8 oz) | 2 carbohydrates + 2 medium-fat meats |
| Stews (beef/other meats and vegetables) | 1c (8 oz) | 1 carbohydrate + 1 medium-fat meat + 0-3 fats |
| Tuna salad or chicken salad |  | ½c (3½ oz) ½ carbohydrate + 2 lean meats + 1 fat |

D-11

|  |  |  |
| --- | --- | --- |
| **Food** | **Serving Size** | **Count As** |
| Burrito (beef and bean)  | 1 (5 oz)  | 3 carbohydrates + 1 lean |
| Dinner-type meal | generally 14-17 oz | 3 carbohydrates + 3 medium-fat meats + 3 fats |
| Entree or meal with less than 340 calories | about 8-11 oz | 2-3 carbohydrates + 1-2 lean meats |
| Pizza |  |  |
| cheese/vegetarian thin crust | ¼ of 12" (4½ to 5 oz) | 2 carbohydrates + 2 medium-fat meats |
| meat topping, thin crust | ¼ of 12" (5 oz) | 2 carbohydrates + 2 medium-fat meats, + 1½ fats |
| Pocket sandwich | 1 (4½ oz) | 3 carbohydrates + 1 lean meat + 1-2fats |
| Pot pie | 1 (7 oz) | 2½ carbohydrates + 1 medium-fat meat + 3 fats |
| **Salads (Deli-Style)** |  |  |
| Coleslaw | ½*c* | 1 carbohydrate + 1½ fats |
| Macaroni/pasta salad | ½*c* | 2 carbohydrates + 3 fats |
| Potato salad | ½*c* | 1½ carbohydrates + 1-2 fats |
| **Soups** |  |  |
| Bean, lentil, or split pea | 1 cup | 1 carbohydrate + 1 lean meat |
| Chowder (made with milk) | 1 c (8 oz) | 1 carbohydrate + 1 lean meat + 1½ fats |
| Cream (made with water) | 1 c (8 oz) | 1 carbohydrate + 1 fat |
| Instant | 6 oz prepared | 1 carbohydrate |
| with beans or lentils | 8 oz prepared | 2½ carbohydrates + 1 lean meat |
| Miso soup | 1c  | ½ carbohydrate + 1 fat |
| Oriental noodle | 1c | 2 carbohydrates + 2 fats |
| Rice (congee) | 1c | 1 carbohydrate |
| Tomato (made with water) | 1c (8 oz) | 1 carbohydrate |
| Vegetable beef, chicken noodle, or other broth-type | 1c (8 oz) | 1 carbohydrate |

[**Fast Foods List**a

**Icon Key**

= More than 3 g of dietary fiber per serving.

! = Extra fat, or prepared with added fat.

= 600 mg or more sodium per serving (for fast food main dishes/meals).

|  |  |  |
| --- | --- | --- |
| **Food** | **Serving Size** | **Exchanges per Serving** |
| **Breakfast Sandwiches** |  |  |
| Egg, cheese, meat, English muffin | 1 sandwich | 2 carbohydrates + 2 medium-fat meats |
| Sausage biscuit sandwich | 1 sandwich | 2 carbohydrates + 2 high-fat meats*+* 3½ fats |
| **Main Dishes/Entrees** |  |  |
| Burrito (beef and beans) | 1 (about 8 oz) | 3 carbohydrates + 3 medium-fat meats + 3 fats |

aThe choices in the Fast Foods list are not specific fast food meals or items, but are estimates based on popular foods. You can get specific nutrition information for almost every fast food or restaurant chain. Ask the restaurant or check its website for nutrition information about your favorite fast foods.

|  |  |  |
| --- | --- | --- |
| **Food** | **Serving Size** | **Exchanges per Serving** |
| Chicken breast, breaded and fried | 1 (about 5 oz) | 1 carbohydrate + 4 medium-fat meats |
| Chicken drumstick, breaded and fried | 1 (about 2 oz) | 2 medium-fat meats |
| Chicken nuggets | 6 (about 3½ oz) | 1 carbohydrate + 2 medium-fat meats + 1 fat |
| Chicken thigh, breaded and fried | 1 (about 4 oz) | ½ carbohydrate + 3 medium-fat meats + 1½ fats |
| Chicken wings, hot | 6 (5 oz) | 5 medium-fat meats + 1½ fats |
| **Oriental** |  |  |
| Beef/chicken/shrimp with vegetables in sauce | 1c (about 5 oz) | 1 carbohydrate + 1 lean meat + 1 fat |
| Egg roll, meat | 1 (about 3 oz) | 1 carbohydrate + 1 lean meat + 1 fat |
| Fried rice, meatless | ½c | 1½ carbohydrates + 1½ fats |
| Meat and sweet sauce (orange chicken) | 1c | 3 carbohydrates + 3 medium-fat meats+ 2 fats |
| Noodles and vegetables in sauce (chow mein, lo mein) | 1c | 2 carbohydrates + 1 fat |
| **Pizza** |  |  |
| Cheese, pepperoni, regular crust | ⅛ of 14" (about 4 oz) | 2½ carbohydrates + 1 medium-fat meat+ 1½ fats |
| Cheese/vegetarian, thin crust | ¼ of 12" (about 6 oz) | 2½ carbohydrates + 2 medium-fat meats+ 1½ fats |
| **Sandwiches** |  |  |
| Chicken sandwich, grilled | 1 | 3 carbohydrates + 4 lean meats |
| Chicken sandwich, crispy | 1 | 3½ carbohydrates + 3 medium-fat meats+ 1 fat |
| Fish sandwich with tartar sauce | 1 | 2½ carbohydrates + 2 medium-fat meats+ 2 fats |
| Hamburger |  |  |
| large with cheese | 1 | 2½ carbohydrates + 4 medium-fat meats+ 1 fat |
| regular | 1 | 2 carbohydrates + 1 medium-fat meat + 1 fat |
| Hot dog with bun | 1 | 1 carbohydrate + 1 high-fat meat + 1 fat |
| Submarine sandwich |  |  |
| less than 6 grams fat | 6" sub | 3 carbohydrates + 2 lean meats |
| regular | 6" sub | 3½ carbohydrates + 2 medium-fat meats+ 1 fat |
| Taco, hard or soft shell (meat and cheese)  | 1 small | 1 carbohydrate + 1 medium-fat meat + 1½ fats |
| **Salads** |  |  |
| Salad, main dish (grilled chicken type,no dressing or croutons) | Salad | 1 carbohydrate + 4 lean meats |
| Salad, side, no dressing or cheese | Small | (about **5** oz) 1 vegetable |

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|  |  |  |
| --- | --- | --- |
| **Food** | **Serving Size** | **Exchanges per Serving** |
| **Sides/Appetizers** |  |  |
| French fries, restaurant style | Small | 3 carbohydrates + 3 fats |
| Medium |  | 4 carbohydrates + 4 fats |
| Large |  | 5 carbohydrates + 6 fats |
| Nachos with cheese | Small (about 4½ oz) | ½ carbohydrates + 4 fats |
| Onion rings | 1 serving (about 3 oz) | 2½ carbohydrates + 3 fats |
| **Desserts** |  |  |
| Milkshake, any flavor | 12 oz | 6 carbohydrates + 2 fats |
| Soft-serve ice cream cone | 1 small | 2½ carbohydrates + 1 fat |

**Alcohol List**

In general, 1 alcohol choice (½ oz absolute alcohol) has about 100 calories.

|  |  |  |
| --- | --- | --- |
| **Alcoholic Beverage** | **Serving Size** | **Count As** |
| Beer |  |  |
| light (4.2%) | 12 fl. oz | 1 alcohol equivalent + ½ carbohydrate |
| regular (4.9%) | 12 fl. oz | 1 alcohol equivalent + 1 carbohydrate |
| *Distilled spirits:* vodka, rum, gin, whiskey, 80 or 86 proof | ½ fl. oz | 1 alcohol equivalent |
| Liqueur, coffee (53 proof) | 1 fl. oz | 1 alcohol equivalent + 1 carbohydrate |
| Sake | 1 fl. oz | ½ alcohol equivalent |
| Wine |  |  |
| dessert (sherry) | 3½ fl. oz | 1 alcohol equivalent + 1 carbohydrate |
| dry, red or white (10%) | 5 fl. oz  | 1 alcohol equivalent |

D-14

# **Appendix E** **Stature-for-Age Charts**

[Graph: **CDC Growth Charts: United States**

Stature-for-age percentiles: Boys, 2 to 20 years

*Source:* "CDC Growth Charts, United States" Developed by the National

Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, from the Centers For Disease Control and Prevention website, 2000.]

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[Graph: **CDC Growth Charts: United States**

Stature-for-age percentiles: Girls, 2 to 20 years

*Source:* CDC Growth Charts, United States" Developed by the National

Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, from the Centers For Disease Control and Prevention website 2000]

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# **Appendix F** **The USDA Food Guide Evolution**

**Early History of Food Guides**

Did you know that in the United States food guides in one form or another have been around for over 125 years?

That's right. Back in 1885 a college chemistry professor named Wilber Olin Atwater helped bring the fledgling science of nutrition to a broader audience by introducing dietary standards that became the basis for the first U.S. food guide. Those early standards focused on defining the daily needs of an "average man" for proteins and Calories. They soon expanded into food composition tables with three sweeping categories: protein, fat, and carbohydrate; mineral matter; and "fuel values." As early as 1902, Atwater advocated for three foundational nutritional principles that we still support today: variety, proportionality, and moderation in food choices and eating.

These ideas were adapted a few years later by a nutritionist named Caroline Hunt, who developed a food "buying" guide divided into five categories: meats and proteins; cereals and starches; vegetables and fruits; fatty foods; and sugar.

From the 1930s to the early 1970s, these guidelines kept changing--from twelve food groups to seven to four, and from there to a "Hassle-Free" guide that briefly increased the number of groups back up to five. Although critics identified many drawbacks of these approaches, they were necessary attempts to provide Americans with reliable guidelines based on the best scientific data and practices available at the time.

**Contemporary Food Guides: From Pyramid to Plate**

By the early 1980s, public health experts began to recognize that, to be effective, a national food guide had to reflect key philosophical values. These core values included the following:

- it must encompass a broad focus on *overall health;*

- it should emphasize the use of *current research;*

- it should be an approach that includes the *total diet,* rather than parts or pieces;

- it should be *useful;*

- it should be *realistic;* a it should be *flexible;*

- it should be *practical;*

- and it must be *evolutionary,* able to adapt as new information comes to light.

These values guided the development of the USDA Food Guide Pyramid, released in 1992, which also was the first guide to include a graphic representation of the Dietary Guidelines for Americans--in the shape of a pyramid. The 1992 Guide included the following components:

[Image: The 1992 Food Guide Pyramid. This representation of the USDA guidelines took several years to develop and attempted to convey in a single image all the key aspects of a nutritional guide.

Data from: The 1992 Food Guide Pyramid.]

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**-** Nutritional Goals it Food Groups

- Serving Sizes

- Nutrient Profiles

- Numbers of Servings

The 1992 Guide did not have an enthusiastic reception. Instead, critics quickly began pointing out flaws in the design, recommendations, and ease of use. Many nutritionists trying to use the Guide to teach different population groups basic nutrition messages found that it was out of touch with people's day-to-day lives. Back to the drawing board!

The USDA addressed these complaints by revising--and then radically reinventing--the 1992 Guide. Let's take a look at this evolution of the USDA Food Guide over the past two decades by examining the following graphics.

**MyPyramid**

[Image: The USDA revised the Guide in 2005 to address concerns regarding the recommendations and ease of use for a general audience. The result was the MyPyramid Food Guidance System, which retained the "pyramid" graphic, but in a simpler presentation that included an emphasis on daily physical activity, and introduced an interactive MyPyramid website where consumers could enter personal data and print out a personalized guide.

Data from: USDA ChooseMyPlate. www.choosemyplate.org]

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[Image: In May 2011 the USDA again changed the food guide--this time dramatically. Dropping the pyramid concept, as well as the previous attempts to teach detailed lessons about foods and physical activity, the new MyPlate guide uses simple icons to directly convey a few key pointers for maintaining a healthy diet. The accompanying website, www.choosemyplate.gov, includes more detailed information as well as interactive tools and multimedia for professionals and consumers.

Data from: www.nal.usda.gov and www choosemyplate.gov.]

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# **answers**

**Answers to Review Questions**

## **Chapter 1**

**Review Questions**

1. **c.** identifying and preventing diseases caused by dietary deficiencies.

2. **a.** Pellagra **is** caused by a nutrient deficiency.

3. **d.** micronutrients.

4. **b.** the RDA for vitamin C.

5. **d.** "A high-protein diet increases the risk for porous bones" is an example of a hypothesis.

6. **b.** an observational study.

7. c. conflict of interest.

8. **b.** National Institutes of Health.

9. true

10. false

**Math Review**

11. 24.5% of Kayla's diet comes from fat; this percentage is within the AMDR for fat.

## **Chapter 2**

**Review Questions**

1. **c.** is based on foods that provide a high level of nutrients and fiber for a relatively low number of Calories.

2. **b.** A conditioned taste aversion to pork sausages could develop in a person who learns how they are made.

3. **d.** the % Daily Value of select nutrients in one serving of the food.

4. **a.** limiting intake of added sugars, saturated fats, and sodium.

5. **d.** fruits and vegetables

6. **b.** a serving that is 1 ounce or equivalent to an ounce for either grains or protein foods.

7. **d.** None of the above is true.

8. true

9. false

10. false

**Math Review**

11. The total Calorie content of Hannah's lunch is 699 Calories. The sodium content is 1,656 mg, which is 72% of the recommended total daily sodium limit. A simple change Hannah could make to reduce the total Calories and sodium in her lunch would be to replace the packet of Ranch dressing on her salad with a drizzle of olive oil and vinegar.

## **Chapter 3**

**Review Questions**

1. **c.** atoms, molecules, cells, tissues, organs, systems

2. **b.** two flexible layers of phospholipid molecules.

3. **c.** hypothalamus.

4. **c.** the middle segment of the small intestine.

5. **c.** small intestine.

6. **a.** collectively known as the enteric nervous system.

7. **a.** gastric juice in the esophagus.

8. true

9. false

10. true

**Math Review**

11. The difference between pH 9 and pH 2 is 7. The alkalinity of baking soda as compared to gastric juice can be expressed as 7 = log10 (10,000,000). In other words, baking soda is 10 million times more alkaline than gastric juice.

## **Chapter 4**

**Review Questions**

1. **a.** monosaccharides.

2. **d.** Consuming a diet high in fiber-rich carbohydrates may reduce the level of cholesterol in the blood.

3. **b.** is converted to glycogen and stored in the liver and muscles.

4. **b.** the potential of foods to raise blood glucose and insulin levels.

5. c. up to 65% of our daily energy intake as carbohydrate.

6. **d.** sweetened soft drinks.

7. c. whole-oat cereal

8. **a.** phenylketonuria.

9. false

10. true

**Math Review**

11. The AMDR for carbohydrate for adults is 45-65% of total daily energy. If Simon wants to make sure he is meeting the minimum (45%), the answers are:

a) 3,500 kcal per day × 0.45 = 1,575 kcal per day of carbohydrate, preferably from fiber-rich sources; and

b) 1,575 kcal per day ÷ 4 kcal per gram of carbohydrate = 393.75 grams. Thus, Simon should consume at least 394 grams of carbohydrate per day.

## **Chapter 5**

**Review Questions**

1. **d.** produced by the body.

2. **b.** monounsaturated.

3. **c.** both saturated and unsaturated fats.

4. **d.** found in leafy green vegetables, flaxseeds, soy milk, walnuts, and almonds.

5. **b.** are a major source of fuel for the body at rest.

6. **a.** lipoprotein lipase

7. **c.** less than 10% of total energy.

8**. c.** vegetables, fish, and nuts.

9. true

10. false

**Math Review**

11. Answers will vary.

12. Maria should consume between 400 and 700 kcal/day as total fat. She should consume no more than 200 kcal/day as saturated fat. This would leave about 200 to 500 kcal/day for healthful unsaturated fats. She should keep her intake of *trans* fatty acids to an absolute minimum--ideally, none at all.

## **Chapter 6**

**Review Questions**

1. **c.** hydrogen, carbon, oxygen, and nitrogen.

2. **d.** None of the above is true.

AN-2

3. **d.** mutual supplementation.

4. **a.** exert pressure that draws fluid out of tissue spaces, preventing edema.

5. **c.** protease.

6. **c.** The RDA for protein is higher for children and adolescents than for adults.

7. **b.** Protein levels in the blood must be adequate to transport fat.

8. a. Rice, pinto beans, acorn squash, soy butter, and almond milk

9. false

10. false

**Math Review**

11. (a) The AMDR for protein is 10% to 35% of total daily energy intake. Thus, the lower level of AMDR for Barry is equal to 3,000 kcal × 0.10 = 300 kcal protein. This is equivalent to 75 g of protein (300 kcal 4 kcal/g protein). The upper level of AMDR for Barry is equivalent to 262.5 g of protein (1,050 kcal ÷ 4 kcal/g protein). Barry is meeting the AMDR for protein. (b) Assuming Barry is not an athlete, his RDA for protein is 0.8 g of protein per kg body weight per day × 75 kg = 60 g per day. Barry is exceeding the RDA for protein.

## **Chapter 7**

**Review Questions**

1. **a.** extracellular fluid.

2. **c.** It provides protection for the brain and spinal cord.

3. **b.** It is freely permeable to water but not to electrolytes.

4. **d.** all of the above.

5. **a.** tap water

6. **c.** The kidney's excretion and reabsorption of sodium contribute to blood pressure regulation.

7. **b.** It can be found in fresh fruits and vegetables.

8. **b.** sweating and breathing heavily while active in a hot environment

9. true

10. false

**Math Review**

11. He should consume 9 cups of fluid.

## **Chapter 8**

**Review Questions**

1. **c.** a molecule that combines with and activates an enzyme.

2. **d.** vitamin B6.

3. **d.** vitamin B12.

4. a. iodine.

5. **b.** an atom loses an electron.

6. **b.** Both vitamins donate electrons to free radicals.

7. a. Beta-carotene is a provitamin precursor of vitamin A.

8. **d.** is regenerated by a form of vitamin A.

9. false

10. true

**Math Review**

11. (a) Each tablet contains 400 IU of the synthetic form of vitamin E. In supplements containing the synthetic form of vitamin E, 1 IU is equal to 0.45 mg α-TE. To convert IU to mg α-TE = 400 IU × 0.45 = 180 mg α-TE, which is equal to 180 mg of active vitamin E.

**(b)** The RDA for vitamin A is 15 mg alpha-tocopherol per day. To calculate the percentage of the RDA for vitamin E coming from the supplements = (180 mg α-TE 15 mg α-TE) X 100 = 1200%

**(c)** The tolerable upper intake level is 1,000 mg alpha-tocopherol per day, and thus the amount coming from the supplement is relatively small at 180 mg. Although in the past up to 18 times the RDA has been shown to be safe (18 x 15 mg = 270 mg of alpha-tocopherol per day), recent evidence suggests that even 400 IU per day could increase the risk for premature mortality. Thus it would be safest for Joey's mother to obtain adequate vitamin E from her diet. If she is taking aspirin each day as prescribed, it is imperative that she stop taking vitamin E supplements, as aspirin is an anticoagulant and taking vitamin E supplements could enhance its action and result in uncontrollable bleeding and hemorrhaging.

## **Chapter 9**

**Review Questions**

1. **b.** About two-thirds of the body's iron is found in hemoglobin, the oxygen-carrying compound in red blood cells.

2. **a.** iron-deficiency anemia.

3. **b.** vitamin K.

4. **d.** is essential for the synthesis of collagen.

5. **c.** It has a faster turnover rate than cortical bone.

6. **d.** structure of bone, nerve impulse transmission, muscle contraction, and blood clotting.

7. **a.** They regulate the absorption of calcium and phosphorus from the small intestine.

8. **c.** a fair-skinned retired teacher living in a nursing home in Ohio.

9. true

10. false

**Math Review**

11. This statement is false. Although 20 mg/day × 100 days = 2,000 mg, or 2 g, zinc absorption rates range from just 10% to 35% of dietary intake.

## **Chapter 10**

**Review Questions**

1. **d.** None of the above.

2. **a.** body mass index.

3. **b.** take in more energy than they expend.

4. **a.** energy expended via basal metabolism, the thermic effect of food, and physical activity equals energy intake.

5. **b.** ghrelin

6. **c.** a low-income single parent who provides child care to other families in their urban apartment block

7. a**.** a realistic, achievable goal.

8. **c.** a peanut-butter sandwich on whole-grain bread with an apple

9. false

10. true

**Math Review**

11. To calculate Misty's BMI: Convert Misty's height to meters and her weight to kg. Her height is 5 feet 8 inches or 68 inches, which is equal to 1.727 meters (68 inches × .0254 cm/inch). Her weight is 148 pounds, which is equal to 67.27 kilograms (148 lbs × 0.4545 kg/lb). Thus, her BMI is equal to 22.6 kg/m2 (67.27 kg/2.982529 meters). Misty's BMI falls into the normal weight category.

There are many questions and bits of advice you could share with Misty. You could inquire as to why she feels she is overweight and suggest she explore the various definitions of a healthful body weight listed in this chapter.

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You could point out that as she exercises regularly, she is promoting overall health, and she might get her body composition measured to reassure her that her weight is in the healthful range. You could also suggest that she schedule an appointment with a registered dietitian to discuss her dietary intake and views on her personal body image.

To estimate Misty's kcal needs, first calculate her BMR = 0.9 kcal per kg body weight per hour = 0.9 kcal/body weight/hour × 67.27 kg × 24 hours/day = 1,453 kcal/day. Next, estimate the energy cost of Misty's activity. Being moderately active, Misty expends kcal ranging from 50% to 70% of her BMR, or 726 kcal (0.50 × 1,453 kcal) and 1,017 kcal (0.70 × 1,453 kcal). Finally, add together Misty's BMR and energy needed to perform daily activities: 1,453 kcal/day + 726 kcal/day = 2,179 kcal/day to 1,453 kcal/day + 1,017 kcal/day = 2,470 kcal/day.

## **Chapter 11**

**Review Questions**

1. **c.** Reduces anxiety and mental stress

2. **c.** 50% to 70% of your estimated maximal heart rate.

3. **a.** 1 to 3 seconds.

4. **b.** Fat

5. **b.** Carbohydrate loading results in increased storage of glycogen in muscles and the liver.

6. **b.** somewhat higher than for sedentary adults, about 1.0 to 1.2 g protein per kg body weight.

7. **d.** drink a beverage containing carbohydrate and electrolytes both before and during the event in amounts that balance hydration with energy, carbohydrate, and electrolyte needs.

8. **d.** caffeine

9. true

10. false

**Math Review**

11. **(a)** Liz's suggested intake for protein is identified as 1.5 grams per kg body weight. Her body weight is equal to 105 lbs ÷ 2.2 = 47.7 kg. Her protein intake (in grams) is equal to 1.5 grams protein/kg body weight × 47.7 kg = 71.6 grams.

**(b)** Liz's preferred fat intake is 20% of her total daily energy intake, thus 1,800 kcal × 0.20 = 360 kcal. Because the energy value of fat is 9 kcal per gram, her total intake of fat in grams = 360 kcal ÷ 9 kcal/gram = 40 grams of fat.

**(c)** To calculate Liz's carbohydrate intake, you must first determine the amount of kcal of her total energy intake that remains once her protein and fat intake are accounted for.

- Liz's protein intake is 71.6 grams; as the energy value of protein is 4 kcal per gram, her kcal intake from protein = 71.6 grams × 4 kcal/gram = 286.4 kcal.

- Liz's fat intake has already been calculated as 360 kcal.

- As Liz's total energy intake is 1,800 kcal per day, the amount of kcal she'll consume from carbohydrate = 1,800 kcal - 286.4 kcal - 360 kcal = 1,153.6 kcal of carbohydrate.

- The energy value of carbohydrates is 4 kcal per gram, and thus Liz's intake of carbohydrate in grams is equal to 1,153.6 kcal H- 4 kcal/gram = 288.4 grams.

**(d)** To determine if Liz's carbohydrate intake falls within the AMDR = (1,153.6 kcal of carbohydrate ÷ 1,800 kcal) × 100 = 64%. Thus her carbohydrate intake does fall within the AMDR.