

CHAPTER TWO

THE BASIS OF A HEALTHY DIET



CHAPTER OUTLINE

A Food Philosophy That Works

Variety Means Eating Many Different Foods • Balance Means Not Overconsuming Any Single Type of Food • Moderation Refers Mostly to Portion Size • Nutrient Density Focuses on Nutrient Content • Energy Density Especially Influences Energy Intake

Expert Opinion: The Importance of Energy Density in the Diet

States of Nutritional Health

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How Can Your Nutritional State Be Measured?

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Take Action

CASE SCENARIO:

Andy is like many other college students. He grew up on a quick bowl of cereal and milk for breakfast and a hamburger, french fries, and cola for lunch, either in the school cafeteria or at a local fast-food restaurant. At dinner, he generally avoided eating any salad or vegetables, and by 9 o'clock he was deep into bags of chips and cookies. Andy has taken these habits to college. He prefers coffee for breakfast and possibly a chocolate bar. Lunch is still mainly a hamburger, french fries, and cola, but pizza and tacos now alternate more frequently than when he was in high school. One thing Andy really likes about the restaurants surrounding campus is that, for just about half a dollar more, he can *supersize* his meal. This helps him stretch his food dollar; searching out value meals for lunch and dinner now has become part of a typical day.

Can you provide some dietary advice for Andy? Start with his positive habits and then provide some constructive criticism based on what you now know.





How many times have you heard wild claims about how healthful certain foods are for you? As consumers focus more and more on diet and disease, food manufacturers are asserting that their products have all sorts of health benefits. Supermarket shelves have begun to look like an 1800s medicine show. “Take fish oil capsules to avoid a heart attack.” “Eat more olive oil and oat bran to lower blood cholesterol.” Hearing these claims, you would think that food manufacturers have solutions to all our health problems.⁸

Advertising aside, nutrient intakes out of balance with our needs—such as excess energy, saturated fat, cholesterol, *trans* fat, salt, alcohol, and sugar—are linked to many leading causes of death in North America, including obesity, hypertension, cardiovascular disease, cancer, liver disease, and type 2 diabetes. Physical inactivity is also too common. In Chapter 2, you will explore the components of a healthy diet—a diet that will minimize your risks of developing nutrition-related diseases. The goal is to provide you with a firm understanding of basic diet-planning concepts before you study the nutrients in detail.⁴

REFRESH YOUR MEMORY AS YOU BEGIN YOUR STUDY OF DIET PLANNING IN CHAPTER 2, YOU MAY WANT TO REVIEW:

- The terms in the margin in Chapter 1 and Table 1-2.
- The impact of the Dietary Supplement Health and Education Act (DSHEA) on certain label claims in Chapter 1.
- The impact of genetic background on the risk of developing certain chronic diseases in Chapter 1.

CHAPTER OBJECTIVES CHAPTER 2 IS DESIGNED TO ALLOW YOU TO:

1. Develop a healthy eating plan based on the concepts of variety, balance, moderation, nutrient density, and energy density.
2. Outline the ABCDEs of nutrition assessment: anthropometric, biochemical, clinical, dietary, and economic.
3. Describe what the Recommended Dietary Allowances (RDAs) represent and how these relate to the other standards included in the new Dietary Reference Intakes.
4. Learn the food groupings used in the MyPyramid food guide.
5. Review the 2005 Dietary Guidelines for Americans and the diseases these guidelines are designed to prevent or minimize.
6. Describe what a nutrition label currently consists of and which health claims and label descriptors are allowed on a food package.

■ A Food Philosophy That Works

You may be surprised to learn that minimizing your risk of developing common nutrition-related diseases can be accomplished by doing what you’ve heard many times before: *consume a variety of foods balanced by a moderate intake of each food*. A variety of foods is best because no one food meets all your nutrient needs. Meat provides protein and iron but little calcium and no vitamin C. Eggs also provide protein but little calcium because the calcium is mostly in the shell. Cow’s milk contains calcium, but very little iron. And none of these foods contain fiber. Thus you need a variety of foods in your diet because the required nutrients are scattered among many foods.²

Health professionals have recommended the same basic diet and health plan for the past 40 years: control how much you eat, focus on the major food groups, and stay physically active. Whole-grain breads and cereals, fruits, and vegetables have always been among the foods emphasized for our diet for these past 40 years.¹⁰

It is disappointing, however, that according to a recent survey conducted by the American Dietetic Association, two of five people in the United States believe that following a healthful diet means completely giving up foods they enjoy. To the contrary, a healthful diet requires only some simple planning and doesn’t have to mean deprivation and misery. Besides, eliminating favorite foods typically doesn’t work for “dieters” in the long run. The best plan consists of learning the basics of a healthful diet—a

Some people would like to live mostly on french fries. What is the nutrient content of french fries? Check the food composition table in Appendix N for the vitamin C content of french fries. How many servings would you need to eat to meet vitamin C needs (75 to 95 mg/day)?

(Answer: 4 to 5 servings)

variety and balance of foods from all food groups and moderate consumption of all foods.¹⁰ Let's now fine-tune this advice by focusing on variety, balance, moderation, nutrient density, and energy density.

Variety Means Eating Many Different Foods

Variety in your diet means choosing a number of different foods within any given food group, rather than eating the “same old thing” day after day. Variety makes meals more interesting and helps ensure that a diet contains sufficient nutrients. For example, carrots—a rich source of a pigment that forms vitamin A in our bodies—may be your favorite vegetable; however, if you choose carrots every day as your only vegetable source, you may miss out on the vitamin folate. Other vegetables, such as broccoli and asparagus, are rich sources of this nutrient. This concept is true of all classes of foods: fruits, vegetables, grains, and so on. Different foods within each class vary somewhat in the nutrients they contain, but they generally provide similar types of nutrients.

A benefit of variety in the diet, especially within the fruit and vegetable groups, is the inclusion of a rich supply of what scientists call **phytochemicals**. These plant components are not considered essential nutrients in the diet. Still, many of these substances provide significant health benefits.¹ Considerable research attention is focused on various phytochemicals in reducing the risk for certain diseases (e.g., cancer). You can't just buy a bottle of phytochemicals—they are generally available only within whole foods. Current multivitamin and mineral supplements contain few or none of these beneficial plant chemicals.

Numerous population studies show reduced cancer risk among people who regularly consume fruits and vegetables. This is true for cancer of the gastrointestinal (GI) tract, breast, lung, and bladder. Researchers surmise that some phytochemicals present in the fruits and vegetables block the cancer process.¹³ The cancer process and the specific roles of some phytochemicals in this regard are described in the Nutrition Focus in Chapter 12. For now, realize that cancer develops over many years via a multistep process. If a phytochemical blocks any one of the steps in this process, it reduces the chances that cancer will ultimately appear in the body. Some phytochemicals have also been linked to a reduced risk of cardiovascular disease. Could it be that because humans evolved on a wide variety of plant-based foods, the body developed with a need for these phytochemicals, along with the various nutrients present, to maintain optimal health?

It will likely take many years for scientists to unravel the important effects of the myriad of phytochemicals in foods, and it is unlikely that all will ever be available or effective in supplement form. For this reason, leading nutrition and medical experts suggest that a diet rich in fruits, vegetables, and whole-grain breads and cereals is the most reliable way to obtain the potential benefits of phytochemicals.⁶ Table 2-1 lists some phytochemicals under study, with their common food sources. Table 2-2 provides a number of suggestions for including more phytochemicals in your diet, as does the website www.5aday.com and 5aday.nci.nih.gov.

Balance Means Not Overconsuming Any Single Type of Food

One way to balance your diet as you consume a variety of foods is to select foods from the six major food groups every day:¹⁵

- Grains
- Vegetables
- Fruits
- Milk
- Meat & Beans
- Oils

A dinner consisting of a bean burrito, lettuce and tomato salad with oil and vinegar dressing, a glass of milk, and an apple covers all groups.

Variety—choose different types of foods within each food group.

Balance—choose foods from all six food groups.

Moderation—control portion size so that balance and variety are possible in your diet.

phytochemical A chemical found in plants. Some phytochemicals may contribute to a reduced risk of cancer or cardiovascular disease in people who consume them regularly.

Some research suggests that increasing variety in a diet can lead to overeating. Thus, as you include a wide variety of foods in your diet, pay attention to total energy intake as well.



Focus on nutrient-rich foods as you strive to meet your nutrient needs. The more colorful your plate, the greater the content of nutrients and phytochemicals.



Fruits, vegetables, beans, and whole-grain breads and cereals are typically rich in phytochemicals.

Table 2-1 | Some Phytochemical Compounds under Study⁶

Phytochemical	Food Sources
Allyl sulfides/organosulfurs	Garlic, onions, leeks
Saponins	Garlic, onions, licorice, legumes
Carotenoids (e.g., lycopene)	Orange, red, yellow fruits and vegetables (egg yolks are a source as well)
Monoterpenes	Oranges, lemons, grapefruit
Capsaicin	Chili peppers
Lignans	Flaxseed, berries, whole grains
Indoles	Cruciferous vegetables (broccoli, cabbage, kale)
Isothiocyanates	Cruciferous vegetables, especially broccoli
Phytosterols	Soybeans, other legumes, cucumbers, other fruits and vegetables
Flavonoids	Citrus fruit, onions, apples, grapes, red wine, tea, chocolate, tomatoes
Isoflavones	Soybeans, other legumes
Catechins	Tea
Ellagic acid	Strawberries, raspberries, grapes, apples, bananas, nuts
Anthocyanosides	Red, blue, and purple plants (eggplant, blueberries)
Fructooligosaccharides	Onions, bananas, oranges (small amounts)
Resveratrol	Grapes, peanuts, red wine

Some related compounds under study are found in animal products, such as sphingolipids (meat and dairy products) and conjugated linoleic acid (meat and cheese). These compounds are not phytochemicals per se because they are not from plant sources, but they have been shown to have health benefits.

Foods rich in phytochemicals are now part of a family of foods referred to as **functional foods**.⁶ A functional food is a food that provides health benefits beyond those supplied by the traditional nutrients it contains. Since a tomato contains the phytochemical lycopene, it can be called a functional food. You may hear this term more from the food industry in the future.

Moderation Refers Mostly to Portion Size

Although moderating portion size is a good practice, eating moderately requires planning your entire day's diet so that you don't overconsume nutrient sources. For example, if you eat something relatively high in fat, salt, and energy, such as a bacon cheeseburger, you should eat foods that are less concentrated sources of the same nutrients, such as fruits and salad greens at other meals that same day. This aids in balancing your diet. If you prefer whole milk to low-fat or fat-free milk, reduce the fat elsewhere in your meals. Try low-fat salad dressings, or use jam rather than butter or margarine on toast. Overall, strive to simply moderate serving sizes of some foods rather than eliminate these foods altogether.

Many nutrition experts agree that there are no exclusively "good" or "bad" foods. Even so, many North Americans have diets that lack the foundations of a healthy food plan—variety, balance, and moderation.^{3,16} Consuming diets that are overloaded with foods high in fatty meats, fried foods, sugared soft drinks, and refined starches can result in substantial risk for nutrition-related chronic diseases.

Nutrient Density Focuses on Nutrient Content

Nutrient density has gained acceptance in recent years as an assessment of the nutritional quality of an individual food. To determine the nutrient density of a food, simply compare its vitamin or mineral content with the amount of energy it provides. A food is said to be nutrient dense if it provides a large amount of a nutrient for a relatively small amount of energy (compared with other food sources). The higher a food's nutrient density, the better it is as a nutrient source. Comparing the nutrient density of different foods is an easy way to estimate their relative nutritional quality. Generally, nutrient density is determined with respect to individual nutrients. For example, many fruits and vegetables have a high content of vitamin C compared with their modest energy content, that is, they are nutrient-dense foods for vitamin C. Moreover, as Figure 2-1 shows, fat-free milk is much more nutrient dense than is a sugared soft drink for many nutrients.

nutrient density The ratio derived by dividing a food's contribution to nutrient needs by its contribution to energy needs. When its contribution to nutrient needs exceeds its energy contribution, the food is considered to have a favorable nutrient density.

Table 2-2 | Tips for Boosting the Phytochemical Content of a Diet

- Include vegetables in main and side dishes. Add these to rice, omelets, potato salad, and pastas. Try broccoli or cauliflower florets, mushrooms, peas, carrots, corn, or peppers.
- Look for quick-fixing grain side dishes in the supermarket. Pilafs, couscous, rice mixes, and tabbouleh are just a few that you'll find.
- Choose fruit-filled cookies, such as fig bars, instead of sugar-rich cookies. Use fresh or canned fruit as a topping for puddings, hot or cold cereal, pancakes, and frozen desserts.
- Put raisins, grapes, apple chunks, pineapple, grated carrots, zucchini, or cucumber into coleslaw, chicken salad, or tuna salad.
- Be creative at the salad bar: Try fresh spinach, leaf lettuce, red cabbage, zucchini, yellow squash, cauliflower, peas, mushrooms, or red or yellow peppers.
- Pack fresh or dried fruit for snacks away from home instead of grabbing a candy bar or going hungry.
- Add slices of cucumber, zucchini, spinach, or carrot slivers to the lettuce and tomato on your sandwiches.
- Try one or two vegetarian meals per week: beans and rice or pasta; Chinese vegetable stir fry; or spaghetti and tomato sauce.
- When daily protein intake more than meets recommended amounts, reduce the meat, fish, or poultry in recipes by one-third to one-half and add more vegetables and legumes such as soy.
- Keep a bowl of fresh vegetables in the refrigerator for snacks.
- Choose fruit or vegetable juices instead of soft drinks, preferably 100% juice varieties.
- Substitute tea for coffee or soft drinks on a regular basis.
- Have a bowl of fruit on hand.
- Switch from crisphead lettuce to leaf lettuce, such as romaine.
- Use salsa as a dip for chips in place of creamy dips.
- Choose whole-grain breakfast cereals, breads, and crackers.
- Add flavor to your plate with ginger, rosemary, basil, thyme, garlic, onions, parsley, and chives in place of salt.

As noted previously, menu planning focuses mainly on the total diet—not on the selection of one critical food as key to an adequate diet. Nonetheless, nutrient-dense foods—such as fat-free and low-fat milk, lean meats, legumes (beans), oranges, carrots, broccoli, whole-wheat bread, and whole-grain breakfast cereals—do help balance less nutrient-dense foods—such as cookies and potato chips—which many people like to eat. The latter are often called empty-calorie foods because they tend to be high in sugar and/or fat but few other nutrients.

Eating nutrient-dense foods is especially important for people who tend not to eat a lot of food. This includes some older people and those following weight-loss diets.

Energy Density Especially Influences Energy Intake

Energy density is a concept that has captured the attention of nutrition scientists in recent years.⁹ Energy density of a food is determined by comparing the energy content with the weight of food. A food that is rich in energy but weighs relatively little is considered energy dense. Examples include nuts, cookies, fried foods in general, and fat-free processed snacks such as pretzels. Foods with low energy density include fruits, vegetables, and any food that incorporates lots of water during cooking, such as oatmeal (Table 2-3). Dr. Barbara Rolls discusses energy density in detail in the Expert Opinion, p. 43.



Choosing whole-grain cereals is an excellent way to increase the nutrient content of a diet. Ideally, the cereal should have at least 3 g of fiber per serving.

Critical | Thinking

Andy, described in this chapter's Case Scenario, would benefit from more variety in his diet. What are some practical tips he can use to increase his fruit and vegetable intake?

energy density A comparison of the energy content of a food with the weight of the food. An energy-dense food is high in energy content but weighs very little (e.g., many fried foods), whereas a food low in energy density, such as an orange, weighs a lot but is low in energy content.

Figure 2-1 | Comparison of the nutrient density of a sugary soft drink with that of fat-free (i.e., skim) milk. Choosing a glass of fat-free milk makes a significantly greater contribution to nutrient intake than does a sugary soft drink. An easy way to determine nutrient density from this chart is to compare the lengths of the bars indicating vitamin or mineral contribution with the bar that represents energy content. For the soft drink, no nutrient surpasses energy content. Fat-free milk, in contrast, has longer nutrient bars for protein, vitamin A, the vitamins thiamin and riboflavin, and the mineral calcium. Including many nutrient-dense foods in your diet is a good way to meet nutrient needs.

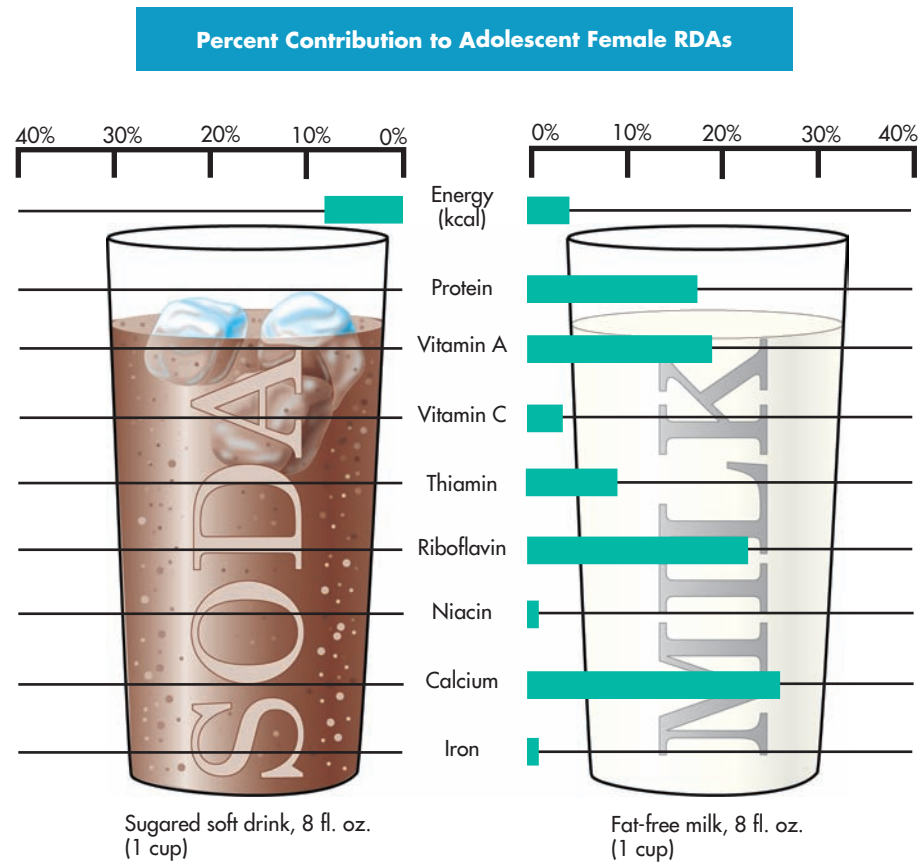


Table 2-3 | Energy Density of Common Foods (Listed in Relative Order)

Very Low Energy Density (less than 0.6 kcal/g)	Low Energy Density (0.6 to 1.5 kcal/g)	Medium Energy Density (1.5 to 4 kcal/g)	High Energy Density (greater than 4 kcal/g)
Lettuce	Whole milk	Eggs	Graham crackers
Tomatoes	Oatmeal	Ham	Fat-free sandwich cookies
Strawberries	Cottage cheese	Pumpkin pie	Chocolate
Broccoli	Beans	Whole-wheat bread	Chocolate chip cookies
Salsa	Bananas	Bagels	Tortilla chips
Grapefruit	Broiled fish	White bread	Bacon
Fat-free milk	Fat-free yogurt	Raisins	Potato chips
Carrots	Ready-to-eat breakfast cereals with 1% low-fat milk	Cream cheese	Peanuts
Vegetable soup	Plain baked potato	Cake with frosting	Peanut butter
	Cooked rice	Pretzels	Mayonnaise
	Spaghetti noodles	Rice cakes	Butter or margarine
			Vegetable oils

Data adapted from Rolls B, Barnett RA: *Volumetrics*. New York: HarperCollins, 2000.

Expert Opinion



The Importance of Energy Density in the Diet

Barbara J. Rolls, Ph.D.

With the surge in the incidence of overweight and obesity, effective dietary strategies for weight management are needed. On the surface the issue is clear-cut: simply reduce energy intake below energy expenditure. There is much debate and controversy, however, over the optimal way this goal should be achieved. Although it is unlikely that a single dietary strategy will ever fit everyone's preferences, health professionals have a responsibility to communicate to the public which strategies are considered both safe and effective.

Designing Diets That Reduce Hunger and Enhance Satiety

The biggest problem in weight management is adherence to the diet, no matter what its composition. Because of this problem, the focus has shifted away from the macronutrient composition of the diet (e.g., fat vs. carbohydrate) toward dietary factors that affect hunger and satiety (the feeling of fullness and satisfaction after eating). Since weight loss is achieved through energy restriction, adherence is more likely if hunger is controlled and dieters feel satisfied.

Short-term studies show that the energy density (kcal/g) of the diet affects both the amount consumed and how satisfied people feel. Foods low in energy density provide bigger portions for a given number of calories. Water is the dietary component that has the biggest impact on the energy density of foods. Water adds weight but no calories and therefore decreases the energy density. Increasing the water content of recipes (for example, by the addition of vegetables) is associated with reduced energy intake and enhanced satiety. Whereas water decreases energy density, fat increases it because fat has 9 kcal/g, or more than twice that of carbohydrates and protein (both have 4 kcal/g). People overeat high-fat foods not only because they taste good but also because fat packs so many calories into a relatively small amount of food.

A surprising finding in recent years, both in controlled lab studies and in studies of free-living individuals, has been the demonstration that people tend to eat a consistent weight or volume of food over a day or two. Furthermore, they are relatively insensitive to calories while they are eating. A number of lab-based studies show that when offered unlimited amounts of similar dishes with different energy densities, people consume a consistent weight of food. Thus, when the food offerings contain fewer calories per gram, people consume less energy but still report feeling just as full and satisfied. If people eat foods high in energy density, they have to restrict portions to avoid excessive energy intake.

In our current "obesogenic" food environment in which we are surrounded by tasty, inexpensive, energy-dense foods in huge portions, it is difficult to avoid overeating. Indeed, a number of studies find that eating out, particularly at fast-food restaurants, is associated with increased intake and ele-

vated body weight. My colleagues and I have shown in several studies that the effects of energy density and portion size combine to increase food intake, confirming that large portions of energy-dense foods are particularly problematic for weight management. On the other hand, large portions of foods low in energy density, such as soups and salads consumed at the start of a meal, are associated with enhanced satiety and a reduction in energy intake at the meal. Other dietary factors that have been shown to enhance satiety are increases in fiber and protein.

Why Focusing on Macronutrient Composition Is Not As Helpful

Both the scientific community and proponents of popular diets for weight loss have emphasized the importance of the proportions of the macronutrients in diets for weight loss. In the 1980s and 1990s the focus was on reducing the amount of fat in the diet. Remember the proliferation of fat-free or reduced-fat products? This emphasis on fat reduction was reflected in an evidence-based report published by the National Institutes of Health in 1998 that



Salads are low in energy density if we limit additional calories from salad dressing, and especially minimize bacon bits, cheese, and croutons.

(continued)



assessed the data from 48 randomized, controlled trials of weight-loss diets. The report found that on lower-fat diets (20 to 30% of calories) people lost weight, and this weight loss was associated with a reduction in energy intake. The emphasis on fat reduction in the 1998 report was related to the fact that most of the clinical trials meeting the criteria for inclusion focused on the fat content of the diet. Since then, the emphasis has shifted to restricting carbohydrates and increasing protein intake. A number of clinical trials have shown that low-carbohydrate, high-protein diets are associated with significant weight loss over 6 to 12 months. As with low-fat diets, energy intake on low-carbohydrate diets was reduced; this reduction was probably due to the restriction of food choices. The verdict is not yet in on how these alterations in the proportions of macronutrients affect health or whether adherence to such restrictive programs is possible in the long term.

It remains to be proven whether variations in the macronutrient composition of the diet can significantly affect the rate of weight loss when energy intake is held constant. There are small differences in the metabolic effects of the macronutrients, but well-controlled metabolic studies have found that these differences have only a small impact on weight loss.

Use Energy Density As a Guide to Food Choices

Using energy density as a guide to food choices not only enhances satiety but also leads consumers to foods that health professionals routinely encourage:

vegetables, fruits, whole grains, legumes, lean protein, and low-fat dairy products. Furthermore, despite the emphasis on weight loss, the key to weight management is actually prevention of weight gain; this goal will also require innovative strategies to reduce the energy density of the diet.

In summary, optimal diets for weight management should

- Provide adequate amounts of foods and nutrients from a variety of food groups
- Fit with consumer's preferences, be affordable, and be readily available
- Emphasize quality rather than quantity
- Help control hunger and promote satiety through reductions in the energy density of the diet

Dr. Barbara Rolls is Guthrie Chair of Nutrition in the Department of Nutritional Sciences at The Pennsylvania State University, University Park, Pennsylvania. She obtained a B.A. in biology from The University of Pennsylvania and a Ph.D. in physiology from The University of Cambridge, England. She is past president of both the Society for the Study of Human Ingestive Behavior and the North American Association for the Study of Obesity. She is on the editorial boards of leading journals and is the coauthor of four books, including Thirst and The Volumetrics Weight-Control Plan: Feel Full on Fewer Calories. Her research interests include the controls of food and fluid intake, especially as they relate to obesity, eating disorders, and aging.

One more dietary strategy to consider is increased meal frequency. Eating smaller, more frequent meals and snacks provides benefits to the body—such as lower blood glucose, cholesterol, and triglycerides—since body metabolism is not as overwhelmed as it is with large meals. In addition, fasting for much of a day may lead to overeating once eating resumes. As long as overall energy intake remains appropriate, spreading food throughout the day is a healthy practice. One idea is to pack a lunch and consume it throughout the day rather than all at once at noontime.

Overall, foods with lots of water and fiber provide a low-energy-density contribution to a meal and help a person feel full, whereas foods with high energy density must be eaten in greater amounts in order to contribute to fullness.⁹ This is one more reason to support a diet rich in fruits, vegetables, and whole-grain breads and cereals, a pattern that also is typical of many ethnic diets throughout the world. Still, favorite foods, even if they are high in energy density, can have a place in your dietary pattern, but you will have to plan for them.⁷ For example, chocolate is a very energy-dense food, but a small portion at the end of a meal can supply a satisfying finale. In addition, foods with high energy density can help people with poor appetites, such as some older people, to maintain or gain weight.

The following sections of Chapter 2 describe various states of nutritional health and provide tools and nutrient guidelines for planning healthy diets to support overall health.

Concept | Check

Basic diet-planning concepts include consuming a variety of foods, balancing a diet by consuming foods from each of the six food groups, and moderating portion size with each food choice so that the diet is not excessive in energy. Choosing nutrient-dense foods,

such as fat-free milk, fruits, vegetables, and whole-grain breads and cereals, helps create a diet with many nutrients but not excessive in energy content. Many of these foods are also rich sources of phytochemicals, supplying an even greater health benefit to the diet. Consuming foods of low energy density, such as fruits and vegetables, may also help in weight control in that these foods provide satiety after a meal because of their large weight but relatively little energy content.

I States of Nutritional Health

The body's nutritional health is determined by the sum of its **nutritional status** with respect to each needed nutrient. We recognize three general categories: desirable nutrition, **undernutrition**, and **overnutrition**. The common term **malnutrition** can refer to either overnutrition or undernutrition. Neither state is conducive to good health.

Desirable Nutrition

The nutritional status for a particular nutrient is optimal when body tissues have enough of the nutrient to support normal metabolic functions as well as surplus stores to be used in times of increased need.⁵ A desirable nutritional state can be achieved by obtaining essential nutrients from a variety of foods.

Undernutrition

Undernutrition occurs when nutrient intake does not meet nutrient needs. Any surpluses are then put to use and health begins to decline. Many nutrients are in high demand because of the constant cycle of cell loss and later regeneration in the body, such as in the gastrointestinal tract. For this reason, certain nutrient stores are exhausted rapidly, including many of the B vitamins. Therefore, a regular intake is needed.⁵ In addition, some women in North America do not consume sufficient iron to meet monthly losses and eventually deplete their iron stores. Reduced biochemical functions and ultimately clinical evidence of an iron deficiency can develop (Table 2-4).

nutritional status The nutritional health of a person as determined by anthropometric measurements (height, weight, circumferences, and so on), biochemical measurements of nutrients or their by-products in blood and urine, a clinical (physical) examination, a dietary analysis, and economic evaluation.

undernutrition Failing health that results from a long-standing dietary intake that does not meet nutritional needs.

overnutrition A state in which nutritional intake greatly exceeds the body's needs.

malnutrition Failing health that results from long-standing dietary practices that do not meet nutritional needs.

Table 2-4 | Categories of Nutritional Status with Respect to Iron*

General Condition	Condition with Respect to Iron
Overnutrition: nutrients consumed in excess of body needs (degree of toxicity varies for each nutrient)	Results in toxic damage to liver cells; may contribute to cardiovascular disease
Desirable nutrition: nutrients consumed to support body functions and stores of nutrients for times of increased need	Adequate liver stores of iron, adequate blood values for iron-related compounds
Undernutrition: nutrient intake does not meet nutrient needs; biochemical changes then take place	Many changes in body functions associated with a decline in iron status (e.g., iron-containing proteins and pigments in the blood drop below acceptable amounts [e.g., 12 ng/ml] and oxygen supply to body tissues is reduced); eventual pale complexion; fatigue upon exertion; "spooning" of the nails in a severe deficiency; poor body temperature regulation

*This general scheme can apply to all nutrients. Iron was chosen because you are likely to be familiar with this nutrient. Note that ng refers to nanograms, or 10⁻⁹ grams.

biochemical lesion An indication of reduced biochemical function (e.g., low concentrations of nutrient by-products or enzyme activities in the blood or urine) resulting from a nutritional deficiency.

subclinical Disease or disorder that is present but not severe enough to produce signs and symptoms that can be detected or diagnosed.

clinical lesion A sign seen on physical examination or a symptom perceived by the patient resulting from a nutritional deficiency.

A **sign** is a feature visible on examination, such as flaky skin. A **symptom** is a change in body function that is not necessarily apparent to an examiner. An example is stomach pain.

Reduced Biochemical Functions

Once nutrient stores are depleted, a continuing nutritional deficit drains body tissues further. The body can only compensate to a certain point.⁵ When tissue concentrations of an essential nutrient fall sufficiently low, a **biochemical lesion** results and the body's metabolic processes eventually slow down or even stop. Diminished enzyme function often is the cause of the slowdown in biochemical function. This type of nutrient deficiency is termed **subclinical** because there are no overt signs or symptoms. At the subclinical stage for poor iron status, concentrations of hemoglobin (a red blood cell protein) in the blood are lower than considered healthy; the synthesis of hemoglobin requires iron.

Clinical Signs and Symptoms

If a biochemical deficit becomes severe, clinical signs and symptoms eventually develop and become outwardly apparent.⁵ It is then possible to note **clinical lesions** in the body, perhaps in the skin, hair, nails, tongue, or eyes. In the case of an iron deficiency, the complexion may become very pale in Caucasians, and fatigue can quickly develop during even moderate activity.

Overnutrition

Prolonged consumption of more nutrients than the body needs can lead to overnutrition. In the short run, for instance a week or two, overnutrition may cause only a few symptoms, such as stomach distress from excess fiber or iron intake. But if an excess intake continues, some nutrients may increase to toxic amounts, which can lead to serious disease.⁵ For example, too much vitamin A can have negative effects, particularly in children, pregnant women, and older adults.

The most common type of overnutrition in industrialized nations—excess intake of energy-yielding nutrients—often leads to obesity. In the long run, obesity can then lead to other serious diseases, such as type 2 diabetes and certain forms of cancer. Use the website shapeup.org to learn more about the importance of avoiding this form of overnutrition.

For most vitamins and minerals, the gap between desirable intake and overnutrition is wide. Even if people take a typical balanced multivitamin and mineral supplement daily, they probably won't receive a harmful amount of any nutrient. However, the gap between optimal intake and overnutrition is very narrow for vitamin A, calcium, iron, copper, and other minerals. Thus, if you take nutrient supplements, keep a close eye on your total vitamin and mineral intake both from food and from supplements to avoid toxicity. Men in general and older women should be especially cautious of supplements containing iron (see Chapter 9 for further advice on use of nutrient supplements).

How Can Your Nutritional State Be Measured?

To find out how nutritionally fit *you* are, a nutritional assessment—either whole or in part—needs to be performed (Table 2-5). Generally, this is performed by a physician, often with the aid of a registered dietitian.

Analyzing Background Factors

Since family history plays an important role in determining nutritional and health status, it must be carefully recorded and critically analyzed as part of a nutritional assessment. Other related background parameters include: (1) a medical history, especially for any disease states or treatments that could impede nutrient absorptive processes or ultimate use; (2) a list of medications taken; (3) a social history; (4) information about the person's level of education since poorly educated people have a greater risk for poor health; and (5) economic status to determine the ability of the person to purchase, transport, and cook food.⁵

Table 2-5 | Conducting an Evaluation of Nutritional Health

Parameters	Example
Background	Medical history (e.g., current diseases, past surgeries, current weight, weight history, and current medications) Social history (marital status, cooking facilities) Family history Education attainment Economic status
Nutritional	Anthropometric assessment: height, weight, skinfold thickness, arm muscle circumference, and other parameters Biochemical (laboratory) assessment of blood and urine: enzyme activities, concentrations of nutrients or their by-products Clinical assessment (physical examination): general appearance of skin, eyes, and tongue; rapid hair loss; sense of touch; ability to walk Dietary assessment: usual intake or record of previous days' meals

Evaluating the ABCDEs

In addition to background factors, four nutritional parameters complete the picture of nutritional status. **Anthropometric assessment** measurements of height, weight (and weight changes), skinfolds, and body circumferences provide an outline of the current state of nutrition. Measures of body composition are easy to obtain and are generally reliable. However, an in-depth examination of nutritional health is impossible without the more expensive process of **biochemical assessments**. This involves the measurement of the concentrations of nutrients and nutrient by-products in the blood, urine, and feces and of specific blood enzyme activities.⁵

For example, in Chapter 10 you will learn that the status of the vitamin thiamin in the body is measured in part by determining the activity of an enzyme called transketolase used in the breakdown of glucose. It is possible to isolate that enzyme from cells, such as red blood cells, and determine if it can process its starting products quickly enough. To test for this, cells are broken open and thiamin is added to the preparation to see if this speeds the rate of the transketolase enzyme by more than 25%. If so, we say that the red blood cells lack sufficient thiamin for the enzyme to function at maximal capacity.

During a **clinical assessment**, the health professional searches for any physical evidence of diet-related diseases (e.g., high blood pressure). Possible problem areas are assessed when the health professional takes a close look at the person's diet (**dietary assessment**), including a record of at least the previous few days' intake. Finally, the **economic assessment** (from the background analysis), which impacts the person's ability to purchase and prepare foods needed to maintain health, provides further detail to the picture. Now the true nutritional state of a person emerges.⁵ Taken together, these five parameters form the ABCDEs of nutritional assessment: anthropometric, biochemical, clinical, dietary, and economic (Figure 2-2).

Recognizing the Limitations of Nutritional Assessment

A long time may elapse between the initial development of poor nutritional health and the first clinical evidence of a problem. Recall that a diet high in saturated (typically solid) fat often increases blood cholesterol, but without producing any clinical evidence for years. However, when the blood vessels become sufficiently blocked by cholesterol and other materials, chest pain during physical activity or a **heart attack** may occur. Much of the current nutrition research is designed to develop better methods for early detection of nutrition-related problems such as heart attack risk.

anthropometric assessment Pertaining to the measurement of body weight and the lengths, circumferences, and thicknesses of parts of the body.

biochemical assessment An assessment focusing on biochemical functions (e.g., concentrations of nutrient by-products or enzyme activities in the blood or urine) related to a nutrient's function.

clinical assessment An assessment that focuses on a person's physical evidence of diet-related diseases, for example, general appearance of skin, eyes, and tongue; evidence of rapid hair loss; sense of touch; and ability to cough and walk.

dietary assessment An assessment that focuses on the typical food choices of the person, relying mostly on the recounting of one's usual intake or a record of one's previous days' intake.

economic assessment An assessment that focuses on the ability of the person to purchase, transport, and cook food. The person's weekly budget for food purchases is also a key factor to consider.

heart attack Rapid fall in heart function caused by reduced blood flow through the heart's blood vessels. Often part of the heart dies in the process. It is technically called a *myocardial infarction*.



The first evidence that one's diet is out of balance with one's physiology could be a heart attack. About 25% of all heart attack victims do not survive the event.



Figure 2-2 | (a) **A**nthropometric, (b) **B**iochemical, (c) **C**linical, and (d) **D**ietary information helps determine a person's nutritional status. (e) **E**conomic status adds further information, rounding out the **ABCDEs** of nutritional assessment.

Another example of a serious health condition with delayed symptoms is low bone density resulting from a calcium deficiency—a particularly relevant issue for adolescent females. Many young women consume well below the needed amount of calcium but often suffer no ill effects in their younger years. However, the bone structures of these women with low calcium intakes do not reach full potential during the years of growth, which makes osteoporosis more likely later in life.

Furthermore, clinical symptoms of nutritional deficiencies—diarrhea, an irregular walk, and facial sores—are not very specific. These may have different causes. Because it can take a long time for signs and symptoms to develop and since these also can be quite vague, it is often difficult to establish a link between an individual's current diet and nutritional state.⁵

Concern about the State of Your Nutritional Health Is Important

Figure 1-5 in Chapter 1 portrayed the close relationship between nutrition and health. The good news is that people who focus on maintaining nutritional health are apt to enjoy a long, vigorous life. For example, a recent study found that women who observe

a healthy lifestyle experienced an 80% reduction in risk for heart attacks compared to women without such healthy practices.¹⁸ Here is a list of what these healthy women did:

- Consumed a healthy diet that
 - Was varied
 - Was rich in fiber
 - Included some fish
 - Was low in animal fat and *trans* fat
- Avoided becoming overweight
- Regularly drank a small amount of alcohol
- Exercised for at least 30 minutes daily
- Did not smoke

Concept | Check

A desirable nutritional state results when the body has enough nutrients to function fully and contains stores to use in times of increased needs. When nutrient intake fails to meet body needs, undernutrition develops. Symptoms of such an inadequate nutrient intake can take months or years to develop. Overloading the body with nutrients, leading to overnutrition, is another potential problem to avoid. Nutritional state can be assessed by using anthropometric, biochemical, clinical, dietary, and economic assessments (ABCDEs).

Setting Nutrient Needs— Dietary Reference Intakes (DRIs)

Using the tools of nutrition research discussed in Chapter 1 and those of nutrition assessment just discussed in this chapter, it is possible to determine the amount of each nutrient needed by the human body. People have pursued this question for centuries. Before World War II, when many men were rejected from military service because of the effects of poor nutrition on their health, the need for official dietary recommendations was recognized. In 1941, a group of 25 scientists formed the first Food and Nutrition Board. They established dietary standards for evaluating the nutritional intakes of large populations and for planning agricultural production, first published in 1943.²⁰

The framework of the latest recommendations from the Food and Nutrition Board are called **Dietary Reference Intakes (DRIs)** and have been released in stages throughout the last 10 years.²

Under the umbrella of the DRIs, five sets of standards have been established: Estimated Average Requirements (EARs), Recommended Dietary Allowances (RDAs), Adequate Intakes (AIs), Estimated Energy Requirements (EERs), and Tolerable Upper Intake Levels (Upper Levels, or ULs) (see the inside cover of this textbook).²⁰ All refer to intake averaged over a number of days, not a single day. Following is a more detailed discussion of each of these standards.

Estimated Average Requirements (EARs)

Estimated Average Requirements (EARs) are the nutrient intake that is estimated to meet the needs of 50% of the individuals in a certain age and gender group (Figure 2-3). To set an Estimated Average Requirement, the Food and Nutrition Board must be able to agree on a specific measurable functional marker to use for establishing nutrient adequacy. Such markers are typically the activity of an enzyme in the body or the ability of a cell to maintain physiological health.²⁰ (The specific markers used for various nutrients will be discussed in Chapters 9 through 12.) If no measurable functional marker is available, no Estimated Average Requirement can be set, such as for the mineral calcium. The Estimated Average Requirement also includes an adjustment for the amount of each nutrient that passes through the digestive tract unabsorbed. At the

A practical example using the ABCDEs for evaluating nutritional state can be illustrated in a person who chronically abuses alcohol. Upon evaluation, the physician notes:

- (a) Low weight-for-height, recent 10-lb weight loss, muscle wasting in the upper body
- (b) Low amounts of the vitamins thiamin and folate in the blood
- (c) Psychological confusion, facial sores, and uncoordinated movement
- (d) Dietary intake of little more than alcohol-fortified wine and hamburgers for the last week
- (e) Currently residing in a homeless shelter; \$35.00 in his wallet; unemployed

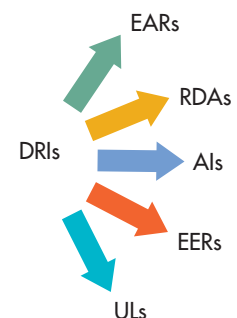
Evaluation: This person needs professional attention, including nutrient repletion.

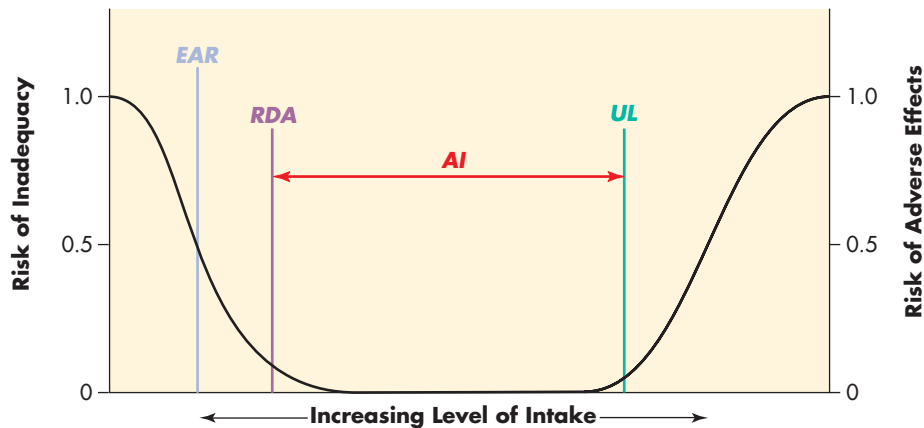
Critical | Thinking

Tom loves to eat hamburgers, fries, and lots of pizza with double amounts of cheese. He rarely eats any vegetables and fruits but, instead, snacks on cookies and ice cream. He insists that he has no problems with his health, is rarely ill, and doesn't see how his diet could cause him any health risks. How would you explain to Tom that despite his current good health, his diet could predispose him to future health problems?

Dietary Reference Intakes (DRIs) The term used to encompass the latest nutrient recommendations made by the Food and Nutrition Board of the National Academy of Sciences. These include RDAs.

Estimated Average Requirement (EARs) An amount of nutrient intake that is estimated to meet the needs of 50% of the individuals in a specific age and gender group.





Estimated Average Requirement (EAR): A nutrient intake value that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. When set for a nutrient, an intake below the Estimated Average Requirement is likely inadequate for an individual.

Recommended Dietary Allowance (RDA): The dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97% to 98%) healthy individuals in a particular life stage and gender group. When set for a nutrient, aim for this intake.

Adequate Intake (AI): A recommended intake value based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of healthy people that is assumed to be adequate — used when an RDA cannot be determined. When set for a nutrient, aim for this intake.

Tolerable Upper Intake Level (Upper Level or UL): The highest level of nutrient intake that is likely to pose no risk of adverse health effects for almost all individuals in the general population. As intake increases above the Upper Level, the risk of adverse effects increases.

Figure 2-3 | Dietary Reference Intakes (DRIs). This figure shows that 50% of North Americans would have an inadequate intake by consuming the *Estimated Average Requirement (EAR)*, whereas 50% would have their needs met. Only about 2 to 3% of this group of people would have an inadequate intake if each were to meet the *Recommended Dietary Allowance (RDA)*; 97 to 98% would have their needs met. At intakes between the RDA and the *Tolerable Upper Intake Level (Upper Level or UL)*, the risk of either an inadequate diet or adverse effects from the nutrient in question is close to 0. The Upper Level is then the highest level of nutrient intake that is likely to pose no risks of adverse health effects to almost all individuals in the general population. At intakes above the Upper Level, the margin of safety to protect against adverse effects is reduced. The *Adequate Intake (AI)*, set for some nutrients instead of an RDA, lies somewhere between the Estimated Average Requirement and the Upper Level. In determining the Adequate Intake for a nutrient, it is expected that the amount exceeds the RDA for that nutrient, if an RDA were known. Thus, the Adequate Intake should cover the needs of more than 97 to 98% of individuals. The actual degree to which the Adequate Intake exceeds the RDA is likely to differ among the various nutrients and population groups. The Food and Nutrition Board states that there is no established benefit for healthy individuals if they consume nutrient intakes above the RDA or Adequate Intake.

Estimated Average Requirement, the needs of the other 50% of the population would not be met for the nutrient. Thus, the Estimated Average Requirement can only be used to evaluate the adequacy of diets of a group of people, not individuals.²⁰ Specific Estimated Average Requirements are listed in Appendix M.

Recommended Dietary Allowances (RDAs)

Recommended Dietary Allowances (RDAs) represent intake of a nutrient that is sufficient to meet the needs of nearly all individuals (97 to 98%) in an age and gender group (see the inside cover). RDAs are based on a multiple of the Estimated Average Requirements (generally the $RDA = EAR \times 1.2$). Because of this relationship, an RDA can be set for a nutrient only if the Food and Nutrition Board has enough information to determine an Estimated Average Requirement. Additional consideration in setting an RDA also can be given to a nutrient's ability to prevent chronic disease rather than just prevent deficiency.²⁰

Setting One RDA: Vitamin C

The amount of vitamin C needed each day to prevent scurvy is about 10 mg. However, as you will learn in Chapter 10, vitamin C has other functions as well, some of which are involved in the workings of the immune system (see Appendix C for details on the

Recommended Dietary Allowances (RDAs) Recommended intakes of nutrients that are sufficient to meet the needs of almost all individuals (97 to 98%) of similar age and gender.

immune system). Based on this relationship, the concentration of vitamin C in one component of the immune system—notably, white blood cells (specifically neutrophils)—can be used as a marker for vitamin C adequacy in an individual. The Food and Nutrition Board concluded that near-maximal saturation of white blood cells with vitamin C is, in fact, the best marker for optimal vitamin C status. It takes, on average, a daily intake of about 75 mg for men and about 60 mg for women for near-saturation of white blood cells. These average amounts then become the Estimated Average Requirement for young adult men and women.

The Estimated Average Requirement for vitamin C is multiplied by 1.2 to yield the RDA; in this case, the RDA becomes 90 mg/day for men and 75 mg/day for women. Other age groups have slightly different recommendations; smokers should add 35 mg/day to the RDA for their age and gender (see Chapter 10 for details).

Putting the RDA for Vitamin C to Use

If you total the amount of vitamin C you eat in 1 week and divide by 7, you will have your average daily vitamin C consumption. If that value is close to the RDA, you are most likely consuming enough vitamin C. Even if you eat less than the RDA, you will not likely suffer ill effects; your needs are most likely less than the RDA, which is set to include almost all individuals, some of whom probably need more vitamin C than you do. As a general rule, however, the further you stray below the RDA on a regular basis—particularly as you approach the Estimated Average Requirement—the greater your risk of a nutritional deficiency.²⁰ Symptoms of a vitamin C deficiency may be subtle and develop slowly. It takes a long time to detect problems such as a weakened immune system and even poor wound healing. If you suspect that your diet is not nutritious enough, don't wait for warning signs to develop. Start eating a diet that meets the RDAs set for vitamin C (and all the other nutrients listed for your age and gender), rather than risk the development of health problems from poor nutrition.

Adequate Intakes (AIs)

Nutrients for which there is not enough information to establish an Estimated Average Requirement are assigned **Adequate Intakes (AIs)** (see the inside cover). Adequate Intakes are based on estimates of the average nutrient intake that appears to maintain a defined nutritional state (e.g., bone health) in a certain population.²⁰ Adequate Intakes have been set for essential fatty acids, fiber, some B-vitamins, the vitamin-like compound choline, vitamin D, and some minerals such as calcium and fluoride. In addition, Adequate Intakes are set for infants under 1 year of age because experimentally studying the effects of nutrient deficiencies in infants would be unethical.

Estimated Energy Requirements (EERs)

RDAs and Adequate Intakes for nutrients are set high enough to meet the needs of almost all healthy individuals. In contrast, a different standard is used to express energy needs, called **Estimated Energy Requirements (EERs)**.⁴ These refer to the average needs for various age groups and genders (see the inside cover). Unlike for most vitamins and minerals, excess energy consumed (above energy needs) is not excreted. Thus, to promote weight maintenance, a more conservative standard is used for energy needs than for nutrient needs. Overall, an Estimated Energy Requirement is only a rough estimate, because energy needs depend on energy use, and in some cases the need for growth or human milk production. For most adults, the ability to obtain and maintain a healthy weight is the best yardstick of energy balance—energy intake matching energy output.

Tolerable Upper Intake Levels (Upper Levels, or ULs)

The **Tolerable Upper Intake Levels (ULs)** is the maximum level of daily intake of a nutrient that is unlikely to cause adverse health effects in almost all people (97 to 98%) in a population (see the inside cover).²⁰ The number applies to chronic daily use and is

Adequate Intakes (AIs) Recommendations for nutrient intake when not enough information is available to establish an RDA. AIs are based on observed or experimentally determined estimates of the average nutrient intake that appears to maintain a defined nutritional state (e.g., bone health) in a specific population. Used when no RDA can be set.

Estimated Energy Requirements (EERs) An estimate of the amount of energy intake that will balance energy needs of an average person within specific gender, age, and other considerations.

Tolerable Upper Intake Levels (ULs) Maximum chronic daily intake of a nutrient that is unlikely to cause adverse health effects in almost all people in a population. This number applies to a chronic daily use.



Energy needs in adulthood are based on an energy intake required to maintain weight.

set to protect even very susceptible people in the healthy general population. For vitamin C the amount is 2000 mg/day. Intakes greater than this amount can cause diarrhea and inflammation of the stomach lining.

The Upper Level is not a goal for nutrient intake but, rather, is a ceiling below which nutrient intake should remain. Still, for many of us there is a margin of safety above the UL before any adverse effects are likely to occur. Not enough information is available to set an Upper Level for all nutrients, but this does not mean that toxicity from these nutrients is impossible. Furthermore, there is no clear-cut evidence that intakes above the RDA or Adequate Intake confer any additional health benefits for most of us.

The Upper Level for most nutrients is based on the combined intake of food, water, supplements, and fortified foods. Four exceptions are the vitamin niacin and the minerals magnesium, zinc, and nickel, for which the Upper Level for each refers only to nonfood sources, such as medicines and supplements. This is because toxicity due to dietary intake of niacin, magnesium, zinc, or nickel is unlikely.²

Appropriate Uses of the DRIs

The DRIs are intended mainly for diet planning (Table 2-6). Specifically, a diet plan should aim to meet any RDAs set. If no RDA has been determined for a nutrient, use the Adequate Intake as a guide. Finally, the Upper Level for a nutrient should not be exceeded (Figure 2-4).^{2,20} Keep in mind also that none of these dietary standards are necessarily appropriate amounts for individuals who are already undernourished or for those with diseases that require higher intakes. This concept will be covered in Chapters 9 through 12.

Concept | Check

Dietary Reference Intakes are set for specific nutrients in order to guide food intake. These standards include Recommended Dietary Allowances (RDAs), Adequate Intakes (AIs), and Tolerable Upper Intake Levels (Upper Levels, or ULs). Recommended Dietary Allowances represent the nutrient needs for healthy individuals. RDAs are established for specific age and gender categories. No one knows his or her own nutritional requirements; the best general rule is that the further you stray from nutrient standards set for your age and gender, especially below the Estimated Average Requirement (EAR), the greater your chance of having a nutritional deficiency or toxicity. Adequate Intakes are set when there is not enough information to set a more precise RDA. An Estimated Energy Requirement (EER) has also been set for various ages and genders. Intakes above Upper Levels generally should not be consumed on a long-term basis unless a physician prescribes the amount and monitors the person carefully, because toxic effects are possible.

The Dietary Reference Intakes apply to both the United States and Canada because scientists from both countries worked together to establish them.

Table 2-6 | Putting the DRIs for Nutrient Needs to Use

RDA	Recommended Dietary Allowance. Use to evaluate your current intake for a specific nutrient. The further you stray above or below this value, the greater your chances of developing nutritional problems.
AI	Adequate Intake. Use to evaluate your current intake of nutrients, but realize that an AI designation implies that further research is required before scientists can establish a more definitive number.
EER	Estimated Energy Requirement. Use to estimate your energy needs according to your height, weight, gender, age, and physical activity pattern.
UL	Upper Level. Use to evaluate the highest amount of daily nutrient intake that is unlikely to cause you adverse health effects in the long run. This number applies to chronic use and is set to protect even very susceptible people in the healthy general population. As your intake increases above the Upper Level, the potential for adverse effects generally increases.

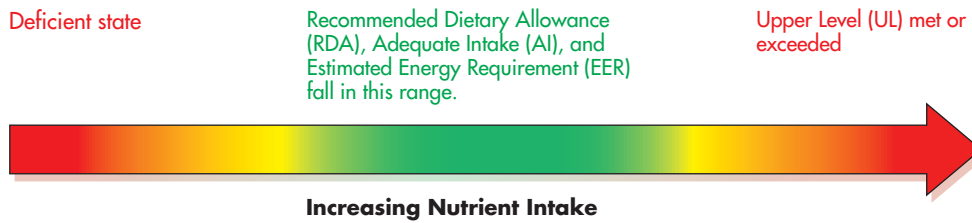


Figure 2-4 | Think of the nutrient standards that are part of DRIs as snapshots along a line. As nutrient intake increases, the Recommended Dietary Allowance (RDA) for the nutrient, if set, is eventually met and a deficient state is no longer present. An individual's needs most likely will be met because RDAs are set high to include almost all people. Related to the RDA concept of meeting an individual's needs are the standards of Adequate Intake (AI) and the Estimated Energy Requirement (EER). These can be used to estimate an individual's needs for some nutrients and energy, respectively. Still, keep in mind that these standards do not share the same degree of accuracy as the RDA. For example, EER may have to be adjusted upward if the individual is very physically active. Finally, as nutrient intake increases above the Upper Level (UL), poor nutritional health is again likely. However, this poor health is due now to the toxic effects of a nutrient rather than to those of a deficiency.

Recall from Chapter 1 that the Food and Nutrition Board has also established Adequate Macronutrient Distribution Ranges (AMDRs) for intake of carbohydrate, protein, fat, and certain other nutrients. These recommendations complement those made as part of the DRIs (e.g., RDAs).²⁰

Daily Values (DVs): The Standards Used for Food Labeling

The DRIs and accompanying nutrient standards are not used in food labeling because they are age and gender specific. We can't have different packages for men and women or for teens and adults. The US Food and Drug Administration (FDA) has developed a set of generic standards, called **Daily Values**, that are used to express the nutrient content of foods for the Nutrition Facts panel on food labels. The content of a particular nutrient is listed on labels as a percentage of the Daily Value. These percentages serve as a benchmark for evaluating the nutrient content of foods. They do not, however, represent a set of tailor-made recommendations for an adult. You will see why once the method for setting Daily Values is described.

The Daily Values are based on two sets of dietary standards. The first, **Reference Daily Intakes (RDIs)**, are for vitamins and minerals. The second, **Daily Reference Values (DRVs)**, are standards for protein and various dietary components that have no RDA or other established nutrient standard (e.g., total fat). These two terms—*Reference Daily Intakes* and *Daily Reference Values*—do not appear on labels. To make reading labels less confusing for consumers, the term *Daily Value* is used to represent the combination of these two sets of dietary standards, since the differences between Reference Daily Intakes and Daily Reference Values for typical consumers are inconsequential. For health professionals and nutrition experts, though, it is important to understand how nutrition label information (Reference Daily Intakes vs. Daily Reference Values) is actually derived:

Daily Values, used on food labels, are a combination of RDI and DRV standards.

RDIs: For food labels, standards set for nutrients that have RDAs or other established nutrient standards

DRVs: For food labels, standards set for many nutrients that do not have RDAs or other established nutrient standards

Daily Values Standard nutrient-intake values developed by FDA and used as a reference for expressing nutrient content on nutrition labels. The Daily Values include two types of standards—RDIs and DRVs.

Reference Daily Intakes (RDIs) Nutrient-intake standards set by FDA based on the 1968 RDAs for various vitamins and minerals. RDIs have been set for four categories of people: infants, toddlers, people over 4 years of age, and pregnant or lactating women. Generally the highest RDA value out of all categories is used as the RDI. The RDIs constitute part of the Daily Values used in food labeling.

Daily Reference Values (DRVs) Nutrient-intake standards established for protein, carbohydrate, and some dietary components lacking an RDA or a related nutrient standard, such as total fat intake. The DRVs for sodium and potassium are constant; those for the other nutrients increase as energy intake increases. The DRVs constitute part of the Daily Values used in food labeling.

Canada also has a set of Daily Values for use on food labels (see Appendix D).

Nutrition educators often instruct patients to look only at the total amount of a nutrient (shown on the left side of the Nutrition Facts panel) rather than the % Daily Value when watching a specific nutrient. This is because the % Daily Value is not correct unless that person consumes 2000 kcal/day. For example, if a person is to limit his or her saturated fat intake to 20 g per day, the % Daily Value does not provide adequate information to assess grams of saturated fat consumed in a day.



Use the Nutrition Facts label to learn more about the nutrient content of the foods you eat. Nutrient content is expressed as a percent of Daily Value. Canadian food laws and related food labels have a slightly different format (review Appendix D).

Reference Daily Intakes (RDIs)

Reference Daily Intakes (RDIs) make up the majority of the Daily Values (DVs). The Reference Daily Intakes have been set by FDA using a compilation of the nutrient standards published in 1968. Essentially, Reference Daily Intakes use the highest RDA values of any age category set in 1968. For example, consider iron: In 1968, the RDA for adult men was 10 mg/day and that for adult women and adolescents was 18 mg/day. The iron Reference Daily Intake for adults is the higher value: 18 mg/day. Table 2-7 lists the Reference Daily Intakes used for various age groups.

The Reference Daily Intake values currently in use, which are based on the 1968 RDAs, are generally slightly higher than current RDAs and related nutrient standards. FDA plans to eventually revise the Reference Daily Intakes to reflect the latest nutrient standards.

Daily Reference Values (DRVs)

The Daily Values for some food constituents are based on Daily Reference Values (DRVs) rather than RDIs. Daily Reference Values cover certain dietary components that have no RDA or related nutrient standard at this time, such as saturated fatty acids and cholesterol. (Protein is the exception, because it has a DRV and also an RDA.) Overall, the Daily Reference Values for energy-yielding nutrients are based on 30% of total energy intake from fat, 60% from carbohydrate, and 10% from protein.

Using the Daily Values

Note that some of the Daily Values, such as those for saturated fat, total fat, and fiber, are related to total energy intake. By accounting for this, you can evaluate your diet even if your energy intake is more or less than the standard energy intake, 2000 kcal, used on the food label. For example, if you consume only 1600 kcal per day, the total percentage of Daily Value for each of these nutrients should add up to no more than 80% because $1600 \div 2000 = 0.8$, or 80%. If you eat 2800 kcal, your total percentage of Daily Value for each nutrient in all the foods you eat in one day can add up to 140%, because $2800 \div 2000 = 1.4$, or 140%. However, the % Daily Values for some dietary constituents, such as cholesterol and sodium, are not adjusted for differences in energy intake.

In the same way, you can calculate the amount of a certain nutrient you have left in a day by using the % Daily Value. For example, if you consume 2000 kcal per day, your total fat intake for the day should be 65 g or less. If you consume 10 g of fat at breakfast, you have 55 g, or 85%, of your Daily Value left for the rest of the day.

The Nutrition Facts panel on the label of a food product lists various components of the food as a percentage of their Daily Values (for details, see this chapter's Nutrition Focus, titled Using Food Labels in Diet Planning). Use this information on food labels to learn more about your food choices. Unfortunately most adults do not do this. To practice using this information, suppose that one serving of a macaroni and cheese product contains 15% of the Daily Value for iron. Since the Daily Value for iron is 18 mg, this product contains about 3 mg of iron per serving ($18 \times 0.15 = 2.7$ mg).

Concept | Check

Daily Values are currently used as a benchmark for representing the nutrient content of foods on nutrition labels. Nutrient content is expressed as a percentage of the Daily Value for a nutrient, which in turn is based on a Reference Daily Intake (RDI) or Daily Reference Value (DRV). The Reference Daily Intakes for vitamins and minerals constitute the majority of Daily Values and are based on the 1968 RDA standards. The Daily Reference Values have been set for some nutrients that don't have an RDA or Adequate Intake, such as fat and cholesterol. To decrease confusion, the Daily Value is the only term that appears on food labels.

Table 2-7 | Comparison of Daily Values with the Latest RDAs and Other Nutrient Standards¹

Dietary Constituent	Unit of Measure	Current Daily Values for People over 4 Years of Age	RDA or Other Current Dietary Standard	
			Males 19 Years Old	Females 19 Years Old
Total Fat ²	g	<65-<107	—	—
Saturated fatty acids ²	g	<20-<36	—	—
Protein ²	g	50-80	56	46
Cholesterol ³	mg	<300	—	—
Carbohydrate ²	g	300-480	130	130
Fiber	g	25-37	38	25
Vitamin A	µg Retinol activity equivalents	1000	900	700
Vitamin D	International units	400	200	200
Vitamin E	International units	30	22-33	22-33
Vitamin K	µg	80	120	90
Vitamin C	mg	60	90	75
Folate	µg	400	400	400
Thiamin	mg	1.5	1.20	1.10
Riboflavin	mg	1.7	1.30	1.10
Niacin	mg	20	16	14
Vitamin B-6	mg	2	1.30	1.30
Vitamin B-12	µg	6	2.40	2.40
Biotin	mg	0.3	0.03	0.03
Pantothenic acid	mg	10	5	5
Calcium	mg	1000	1000	1000
Phosphorus	mg	1000	700	700
Iodide	µg	150	150	150
Iron	mg	18	8	18
Magnesium	mg	400	400	310
Copper	mg	2	0.9	0.9
Zinc	mg	15	11	8
Sodium ⁴	mg	<2400	1500	1500
Potassium ⁴	mg	3500	4700	4700
Chloride ⁴	mg	3400	2300	2300
Manganese	mg	2	2.3	1.8
Selenium	µg	70	55	55
Chromium	µg	120	35	25
Molybdenum	µg	75	45	45

Abbreviations: g = gram; mg = milligram; µg = microgram

¹Daily Values are generally set at the highest nutrient recommendation in a specific age and gender category. Many Daily Values exceed current nutrient standards. This is in part because aspects of the Daily Values were originally developed in the early 1970s using estimates of nutrient needs published in 1968. The Daily Values have yet to be updated to reflect the current state of knowledge. Note also that the Daily Values for some nutrients (e.g., total fat, saturated fatty acids, protein, carbohydrate, and fiber) increase as energy intake increases above 2000 kcal/day.

²The lowest Daily Values are based on a 2000 kcal diet. All based on a caloric distribution of 30% from fat (and one-third of this total from saturated fat), 60% from carbohydrate, and 10% from protein as energy intake ranges from 2000 kcal/day to 3200 kcal/day.

³Based on recommendations of federal agencies

⁴The considerably higher Daily Values for sodium and chloride are there to allow for more diet flexibility, but the extra amounts are not needed to maintain health.

I Recommendations for Food Choice

The following sections will describe various guidelines for planning healthy diets.

MyPyramid—A Menu-Planning Tool

Since the early twentieth century, researchers have worked to clarify the science of nutrition into practical terms, so that people with no special training could estimate whether their nutritional needs were being met. A seven food-group plan, based on foods traditionally eaten by people in North America, was one of the first formats designed by USDA. Daily food choices had to include items from each group. This plan had been simplified by the mid-1950s to a four food-group plan: a milk group, a meat group, a fruit and vegetable group, and a bread and cereal group. In 1992 this plan was illustrated using a pyramid shape.

In April 2005 USDA unveiled their latest food guide plan, MyPyramid. Entitled “Steps to a Healthier You,” MyPyramid provides a more individualized approach to improving diet and lifestyle than did previous food guides. Overall, MyPyramid translates the latest nutrition advice into 12 separate pyramids based on energy needs (1000 to 3200 kcal/day).¹⁵ Its goal is to provide advice that will help consumers live longer, better, and healthier lives. (MyPyramid replaces the Food Guide Pyramid introduced in 1992.)

The MyPyramid symbol represents the recommended proportion of foods from each food group that creates a healthy diet. Physical activity is a new element in the pyramid. To benefit from the individualized advice that is the hallmark of the plan, however, consumers need to utilize the website, MyPyramid.gov.¹⁴

MyPyramid, pictured in Figure 2-5, is designed to illustrate:

- *Personalization*, demonstrated at the MyPyramid website, MyPyramid.gov.
- *Gradual improvement*, encouraged by the title “Steps to a Healthier You.”
- *Physical activity*, represented by the steps and the person climbing them.
- *Variety*, symbolized by the six color bands representing the five food groups and oils. Foods from all groups are needed each day for good health. Orange is used for grains, green for vegetables, red for fruits, yellow for oils, blue for milk and milk products, and purple for meat & beans.
- *Proportionality*, indicated by the different widths of the food group bands. The widths suggest how much food a person should choose from each group. The bands are wider for grains, vegetables, and fruits because these groups should form the bulk of one’s diet. The narrowest band is for oils, indicating these should be eaten sparingly. All the widths are just a general guide, however, and not exact proportions. Check MyPyramid.gov for the amount that is right for you.
- *Moderation*, represented by the narrowing of each food group from bottom to top. The wider base represents foods with little or no solid fats, added sugars or caloric sweeteners, and salt. These should be selected more often to get the most nutrition from energy consumed.

An innovative aspect of MyPyramid is the interactive technology found on MyPyramid.gov. Here is a list of the programs:

MyPyramid Plan provides a quick estimate of what and how much food a person should eat from the different food groups based on age, gender, and activity level.

MyPyramid Tracker provides more detailed information on diet quality and physical activity status by comparing a day’s worth of foods eaten to the guidance provided by MyPyramid. It allows the user to select from 8000 foods and 600 activities. Nutrition and physical activity messages are based on the need to maintain current weight or to lose weight.



Appendix D contains the Canadian Food Guide to Healthy Eating.

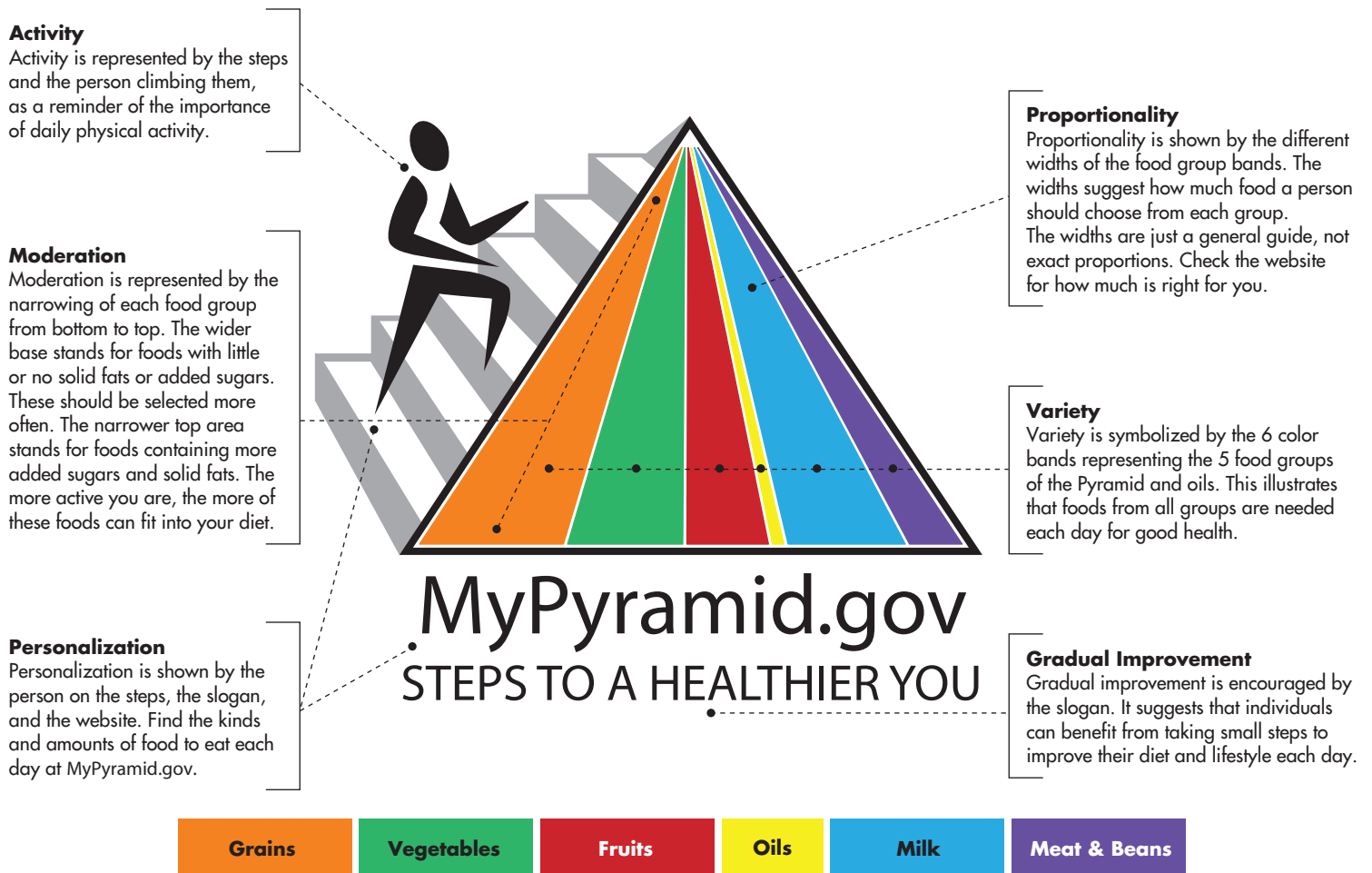


Figure 2-5 | The anatomy of MyPyramid. USDA's new MyPyramid symbolizes a personalized approach to healthy eating and physical activity. The symbol has been designed to be simple. It has been developed to remind consumers to make healthy food choices and to be active every day.

Inside MyPyramid provides in-depth information for every food group, including recommended daily amounts in commonly used measures, like cups and ounces, with examples and everyday tips. The section also includes recommendations for choosing healthy oils, **discretionary calories**, and physical activity (refer to Table 2-8 on page 58 for a listing of discretionary calories. Basically this term refers to the energy intake allowed from food choices rich in added sugars or solid fat. For most of us, very few discretionary calories are available in daily diet planning).

Start Today provides tips and resources that include downloadable suggestions on all the food groups and physical activity and a worksheet to track one's diet.

Putting MyPyramid into Action

To put MyPyramid into action, you first need to estimate your energy needs (the website helps you with the calculation). Figure 2-6 provides a rough guide.

Once you have determined the energy allowance that is appropriate for you, you can use Table 2-9 to discover how your energy needs correspond to the recommended number of servings from each food group.

discretionary calories The amount of energy theoretically allowed in a diet after the person has met overall nutrition need. This generally small amount of energy gives individuals the flexibility to consume some foods and beverages that may contain alcohol (e.g., beer and wine), added sugars (e.g., soft drinks, candy, and desserts), or added fats that are part of moderate- or high-fat foods (e.g., many snack foods).

Table 2-8 | Discretionary Calories Allowed in a Diet

Energy Intake (kcal)	Discretionary Calories (kcal)
1000	165*
1200	171*
1400	171*
1600	132
1800	195
2000	267
2200	290
2400	362
2600	410
2800	426
3000	512
3200	648

The overall intent is to not exceed this discretionary calorie allowance—the combination of foods and beverages with alcohol, added sugars, or added fats.

*The amount of discretionary calories is higher for 1000 to 1400 kcal diets than for a 1600 kcal diet because these diets with less energy are intended for children 2 to 8 years of age. Adults typically need at least 1600 kcal.

Counting Servings

MyPyramid provides serving sizes of foods for the various food groups in household units:

- *Grains*: 1 slice of bread, 1 cup of ready-to-eat breakfast cereal, or 1/2 cup cooked rice, pasta, or cooked cereal counts as a one-ounce equivalent.
- *Vegetables*: 1 cup of raw or cooked vegetables or vegetable juice or 2 cups of raw leafy greens counts as 1 cup.
- *Fruits*: 1 cup of fruit or 100% fruit juice or 1/2 cup of dried fruit counts as 1 cup.
- *Milk*: 1 cup of milk or yogurt, 1 1/2 ounces of natural cheese, or 2 ounces of processed cheese counts as one cup.
- *Meat & Beans*: 1 ounce of meat, poultry, or fish, 1 egg, 1 tablespoon of peanut butter, 1/4 cup cooked dry beans, or 1/2 ounce of nuts or seeds counts as a one-ounce equivalent.
- *Oils*: A teaspoon of any oil from plants or fish that is liquid at room temperature counts as a serving, as do such servings of foods rich in oils (e.g., mayonnaise and soft margarine).

Planning Menus with MyPyramid

Remember the following points when using MyPyramid to plan your daily menus:

1. The guide does not apply to infants or children under 2 years of age.
2. No one food is absolutely essential to good nutrition. Each food is rich in some nutrients but deficient in at least one essential nutrient (Table 2-10).
3. No one food group provides all essential nutrients in adequate amounts. Each food group makes an important, distinctive contribution to nutritional intake.
4. Variety is the key to success of the guide and is first guaranteed by choosing foods from all the groups. Furthermore, one should consume a variety of foods within each group. (When choosing products in the milk group, be especially careful to look at saturated fat content to minimize that intake.)
5. The foods within a group may vary widely with respect to nutrients and energy content. For example, the energy content of 3 oz of baked potato is 98 kcal, whereas that of 3 oz of potato chips is 470 kcal. Compare an orange and an apple with respect to vitamin C using the food composition table in Appendix N.

Pay close attention to the stated serving size for each choice when following MyPyramid. This aids in controlling total energy intake. See Figure 2-7 for a convenient guide to estimating common household measures. Note that serving sizes listed for one serving in a MyPyramid group or on a food label are often less than is typically served in restaurants today.

	Energy Intake Range (kcal)	
	Sedentary	Active
Children	→	
2–3 years	1000	1400
Females		
4–8 years	1200	1800
9–13	1600	2200
14–18	1800	2400
19–30	2000	2400
31–50	1800	2200
51+	1600	2200
Males		
4–8 years	1400	2000
9–13	1800	2600
14–18	2200	3200
19–30	2400	3000
31–50	2200	3000
51+	2000	2800

Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life.

Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour in addition to the light physical activity associated with typical day-to-day life.

Figure 2-6 | Estimates of energy needs provided by MyPyramid.

Table 2-9 | MyPyramid Recommendations for Daily Amounts of Foods to Consume from the Six Food Groups Based on Energy Needs

Energy Intake	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
Fruits	1 c	1 c	1.5 c	1.5 c	1.5 c	2 c	2 c	2 c	2 c	2.5 c	2.5 c	2.5 c
Vegetables ^{1,2}	1 c	1.5 c	1.5 c	2 c	2.5 c	2.5 c	3 c	3 c	3.5 c	3.5 c	4 c	4 c
Grains ³	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	6 oz-eq	6 oz-eq	7 oz-eq	8 oz-eq	9 oz-eq	10 oz-eq	10 oz-eq	10 oz-eq
Meat & Beans ²	2 oz-eq	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	5.5 oz-eq	6 oz-eq	6.5 oz-eq	6.5 oz-eq	7 oz-eq	7 oz-eq	7 oz-eq
Milk ⁴	2 c	2 c	2 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c
Oils ⁵	3 tsp	4 tsp	4 tsp	5 tsp	5 tsp	6 tsp	6 tsp	7 tsp	8 tsp	8 tsp	10 tsp	11 tsp
Discretionary calorie allowance ⁶	165	171	171	132	195	267	290	362	410	426	512	648

Abbreviations: c = cup or cups; oz-eq = ounces or equivalent; tsp = teaspoon

¹Vegetables are divided into five subgroups (dark green vegetables, orange vegetables, legumes, starchy vegetables, and other vegetables). Over a week's time a variety of vegetables should be eaten, especially green and orange vegetables.

²Dry beans and peas can be counted *either* as vegetables (dry beans and peas subgroup) or in the meat & beans group. Generally, individuals who regularly eat meat, poultry, and fish would count dry beans and peas in the vegetable group. Individuals who seldom eat meat, poultry, or fish (vegetarians) would consume more dry beans and peas and count some of them in the meat & beans group until enough servings from that group are chosen for the day.

³At least half of these servings should be whole-grain varieties.

⁴Most of these servings should be fat-free or low fat.

⁵Limit solid fats such as butter, stick margarine, shortening, and meat fat as well as foods that contain these.

⁶Discretionary calories refers to food choices rich in added sugars or solid fat.

Table 2-10 | Nutrient Contributions of Groups in the MyPyramid Food Guide Plan

Food Category	Major Nutrient Contributions	Food Category	Major Nutrient Contributions
Milk	Calcium Phosphorus Carbohydrate Protein Riboflavin Vitamin D Magnesium Zinc	Fruits (con't)	Magnesium Potassium Fiber
Meat & Beans	Protein Thiamin Riboflavin Niacin Vitamin B-6 Folate ¹ Vitamin B-12 ² Phosphorus Magnesium ¹ Iron Zinc	Vegetables	Carbohydrate Vitamin A Vitamin C Folate Magnesium Potassium Fiber
Fruits	Carbohydrate Vitamin A Vitamin C Folate	Grains	Carbohydrate Thiamin Riboflavin ³ Niacin Folate ⁴ Magnesium ⁵ Iron ^{3,4} Zinc ⁴ Fiber ⁵
		Oils	Fat Essential fatty acids Vitamin E

¹Primarily in plant protein sources

²Only in animal foods

³If enriched

⁴Whole grains and some enriched/fortified products

⁵Whole grains

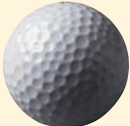





Portion Sizes				
	=	<table border="1"> <tr> <td>2 tbsp measure</td> <td>2 tbsp salad dressing, peanut butter, margarine, etc.</td> </tr> </table>	2 tbsp measure	2 tbsp salad dressing, peanut butter, margarine, etc.
2 tbsp measure	2 tbsp salad dressing, peanut butter, margarine, etc.			
	=	<table border="1"> <tr> <td>1/2 to 2/3 cup measure</td> <td>Medium/small fruit</td> </tr> </table>	1/2 to 2/3 cup measure	Medium/small fruit
1/2 to 2/3 cup measure	Medium/small fruit			
	=	<table border="1"> <tr> <td>1 standard bagel</td> <td>Bagel or English muffin</td> </tr> </table>	1 standard bagel	Bagel or English muffin
1 standard bagel	Bagel or English muffin			
	=	<table border="1"> <tr> <td>1/2 to 3/4 cup</td> <td>Baked potato; ground or chopped foods; 1/2 cup generally equals 2 ounces.</td> </tr> </table>	1/2 to 3/4 cup	Baked potato; ground or chopped foods; 1/2 cup generally equals 2 ounces.
1/2 to 3/4 cup	Baked potato; ground or chopped foods; 1/2 cup generally equals 2 ounces.			
 or 	=	<table border="1"> <tr> <td>1 cup</td> <td>Large apple or orange; 1 cup of ready-to-eat breakfast cereal</td> </tr> </table>	1 cup	Large apple or orange; 1 cup of ready-to-eat breakfast cereal
1 cup	Large apple or orange; 1 cup of ready-to-eat breakfast cereal			

Figure 2-7 | A golf ball, tennis ball, small yo-yo, computer mouse, baseball, and fist make convenient guides to judge MyPyramid serving sizes. Additional handy guides include:

thumb = 1 oz of cheese
 4 stacked dice = 1 oz cheese
 thumb tip to first joint = 1 tsp
 small (individual-size) matchbox = 1 oz meat
 bar of soap or deck of cards = 3 oz meat

palm of hand = 3 oz
 1 ice cream scoop = 1/2 cup
 handful = 1 or 2 oz of a snack food
 Ping-Pong ball = 2 tbsp

Overall, MyPyramid incorporates the foundations of a healthy diet: variety, balance, and moderation. The nutritional adequacy of diets planned using this tool, however, depends on selection of a variety of foods (Table 2-11).¹⁵ In addition, to ensure enough vitamin E, vitamin B-6, magnesium, and zinc—nutrients sometimes low in diets based on this plan—consider the following advice:

1. Choose primarily low-fat and fat-free items from the milk group. By reducing energy intake in this way, you can select more items from other food groups. If milk causes intestinal gas and bloating, emphasize yogurt and cheese. (See Chapter 5 for details on the problem of lactose maldigestion and lactose intolerance).

Table 2-11 | Putting MyPyramid into Practice

Meal	Food Group
Breakfast	
1 small orange	Fruits
3/4 cup Low-Fat Granola with 1 cup fat-free milk	Grains Milk
1/2 toasted, small raisin bagel with 1 tsp soft <i>trans</i> fat-free margarine	Grains Oils
Optional: coffee or tea	
Lunch	
Turkey sandwich 2 slices whole-wheat bread 2 oz turkey	Grains Meat & Beans
1 small apple	Fruits
1 oatmeal-raisin cookie (small)	Discretionary calories
Optional: diet soft drink or iced tea	
3 P.M. Study Break	
6 whole-wheat crackers	Grains
1 tbsp peanut butter	Meat & Beans
1 cup fat-free milk	Milk
Dinner	
Tossed salad	
1 cup romaine lettuce	Vegetables
1/2 cup sliced tomatoes	Vegetables
1 1/2 tbsp Italian dressing	Oils
1/2 carrot, grated	Vegetables
3 oz broiled salmon	Meat & Beans
1/2 cup rice	Grains
1/2 cup green beans with 1 tsp soft <i>trans</i> fat-free margarine	Vegetables Oils
Optional: coffee or tea	
Late-Night Snack	
1 cup “light” fruit yogurt	Milk
Nutrient Breakdown	
1800 kcal	
Carbohydrate	56% of kcal
Protein	18% of kcal
Fat	26% of kcal

This menu meets nutrient needs for all vitamins and minerals for an average adult.



Typical restaurant portions contain numerous servings from the individual groups in MyPyramid.

What about physical activity? Walking, gardening, briskly pushing a baby stroller, climbing the stairs, playing soccer, or dancing the night away are all good examples of being physically active. For health benefits, physical activity should be moderate or vigorous and add up to at least 30 minutes on most or all days of the week. For weight loss or preventing weight gain, about 60 minutes a day may be needed. (The same goal applies to children and teenagers in general.) For maintaining prior weight loss, at least 60 to 90 minutes a day may be required.



Tomatoes are a rich source of nutrients and phytochemicals.

2. Include plant foods that are good sources of protein, such as beans and nuts, at least several times a week because many are rich in vitamins (such as vitamin E), minerals (such as magnesium), and fiber.
3. For vegetables and fruits, try to include a dark green vegetable for vitamin A and a vitamin C–rich fruit, such as an orange, every day. Don’t focus primarily on potatoes (e.g., french fries) for your vegetable choices. Surveys show that fewer than 5% of adults eat a full serving of a dark green vegetable on any given day. Increased consumption of these foods is important because they contribute vitamins, minerals, fiber, and phytochemicals.
4. Choose whole-grain varieties of breads, cereals, rice, and pasta because they contribute vitamin E and fiber. A plate about two-thirds covered by grains, fruits, and vegetables and one-third or less covered by protein-rich foods promotes this diet advice. A daily serving of a whole-grain, ready-to-eat breakfast cereal is an excellent choice because the vitamins (such as vitamin B-6) and minerals (such as zinc) typically added to it, along with fiber, help fill in the potential nutrient gaps just listed.
5. Include some plant oils on a daily basis, such as those in salad dressing, and eat fish at least twice a week. This supplies you with health-promoting fatty acids.

Rating Your Current Diet

Regularly comparing your daily food intake with MyPyramid recommendations for your age, gender, and degree of physical activity is a relatively simple way to evaluate your overall diet. Strive to meet the recommendations.¹⁵ (The diets of most adults fail in this evaluation, especially with respect to servings of milk and milk products, vegetables, fruits, and whole-grain breads and cereals.¹⁶) If meeting the recommendations is not possible, identify the nutrients that are low in your diet based on the nutrients found in each food group (review Table 2-10). For example, if you do not consume enough servings from the milk group, your calcium intake is most likely too low. You need to then find foods you enjoy that supply calcium, such as calcium-fortified orange juice. Customizing MyPyramid to accommodate your own food habits may seem a daunting task now, but it is not difficult once you gain some additional nutrition knowledge.

Getting Going

Start putting MyPyramid into practice and use the MyTracker feature to follow your progress. Implementing even small diet and exercise changes can have positive results. Better health will likely follow as you strive to meet your nutrient needs and balance your physical activity and energy intake. In addition, follow the guidance from the *2005 Dietary Guidelines for Americans* (discussed in the next section) regarding alcohol and sodium intake and safe food preparation.

Concept | Check

MyPyramid translates the general needs for carbohydrate, protein, fat, vitamins, and minerals into the recommended number of daily servings from each of five major food groups. It is a convenient and valuable tool for planning daily menus.

Dietary Guidelines—Another Tool for Menu Planning

MyPyramid was designed to help meet nutritional needs for carbohydrate, protein, fat, vitamins, and minerals. However, most of the major chronic “killer” diseases in North America, such as cardiovascular disease, cancer, and alcoholism, are not primarily associated with deficiencies of these nutrients. Deficiency diseases such as beriberi (thiamin deficiency), scurvy (vitamin C deficiency), and pellagra (niacin deficiency) are no longer common in North America. For many North Americans, the primary dietary culprit is overconsumption of one or more of the following: total energy intake,



A salad with leafy green vegetables contributes many nutrients to a diet.

saturated fat, cholesterol, *trans* fat, alcohol, and sodium (salt). (Underconsumption of calcium, iron, folate and other B-vitamins, vitamin C, vitamin D, vitamin E, potassium, magnesium, and fiber is also a problem for some people.)

In response to concerns regarding these killer disease patterns, since 1980 the USDA and U.S. Department of Health and Human Services (DHHS) have published **Dietary Guidelines for Americans** (Dietary Guidelines for short) to aid diet planning. Compared to past reports, the latest *Dietary Guidelines for Americans* (2005) places stronger emphasis on monitoring one's energy intake and increasing physical activity.¹¹ This is because more of us are becoming overweight each year.

The report identifies 41 key recommendations, of which 23 are for the general public and 18 are for special populations. They are grouped into nine general topics:

- Adequate nutrient intake within calorie needs
- Weight management
- Physical activity
- Specific food groups to encourage
- Fats
- Carbohydrates
- Sodium and potassium
- Alcoholic beverages
- Food safety

Figure 2-8 lists the key recommendations within each general topic. The advice provided refers to people 2 years and older and will undoubtedly coincide with what you have already heard or read:¹⁷

- Consume a variety of nutrient-dense foods and beverages within and among the basic food groups of MyPyramid while choosing foods that limit the intake of saturated and *trans* fats, cholesterol, added sugars, salt, and alcohol (if used). Foods to emphasize are vegetables, fruits, legumes (beans), whole grains, and fat-free or low-fat milk or equivalent milk products.
- Maintain body weight in a healthy range by balancing energy intake from foods and beverages with that expended. For the latter, engage in at least 30 minutes of moderate-intensity physical activity, above usual activity, at work or home on most days of the week.

Appendix D contains nutrient guidelines for Canadians.

Dietary Guidelines for Americans General goals for nutrient intakes and diet composition set by the USDA and the U.S. Department of Health and Human Services.

ADEQUATE NUTRIENTS WITHIN ENERGY NEEDS

- Consume a variety of nutrient-dense foods and beverages within and among the basic food groups while choosing foods that limit the intake of saturated and *trans* fats, cholesterol, added sugars, salt, and alcohol.
- Meet recommended intakes within energy needs by adopting a balanced eating pattern, such as MyPyramid.

Key Recommendations for Specific Population Groups

- *People over age 50.* Consume vitamin B-12 in its crystalline form (i.e., fortified foods or supplements).
- *Women of childbearing age who may become pregnant.* Eat foods high in iron from animal products and/or consume iron-rich plant foods or iron-fortified foods with an enhancer of iron absorption, such as vitamin C-rich foods.
- *Women of childbearing age who may become pregnant and those in the first few months of pregnancy.* Consume adequate amount of the synthetic form of the B vitamin folate (i.e., folic acid) daily (from fortified foods or supplements) in addition to food forms of folate found in a varied diet.
- *Older adults, people with dark skin, and people exposed to insufficient ultraviolet band radiation (i.e., sunlight).* Consume extra vitamin D from vitamin D-fortified foods and/or supplements.



Figure 2-8 | Key recommendations within each general topic from the latest Dietary Guidelines for Americans.

continued

WEIGHT MANAGEMENT

- To maintain body weight in a healthy range, balance energy intake from foods and beverages with energy expended.
- To prevent gradual weight gain over time, make small decreases in energy intake from food and beverages and increase physical activity.



Key Recommendations for Specific Population Groups

- *Those who need to lose weight.* Aim for a slow, steady weight loss by decreasing energy intake while maintaining an adequate nutrient intake and increasing physical activity.
- *Overweight children.* Reduce the rate of body weight gain while allowing for growth and development. Consult a health-care provider before placing a child on a weight-reduction diet.
- *Pregnant women.* Ensure appropriate weight gain as specified by a health-care provider.
- *Breastfeeding women.* Moderate weight reduction is safe and does not compromise weight gain of the nursing infant.
- *Overweight adults and overweight children with chronic diseases and/or on medication.* Consult a health-care provider about weight-loss strategies prior to starting a weight-reduction program to ensure appropriate management of other health conditions.

PHYSICAL ACTIVITY

- Engage in regular physical activity and reduce sedentary activities to promote health, psychological well-being, and a healthy body weight.
- To reduce the risk of chronic disease in adulthood: Engage in at least 30 minutes of moderate-intensity physical activity, above usual activity, at work or home on most days of the week.
- For most people, greater health benefits can be obtained by engaging in physical activity of more vigorous intensity or longer duration.
- To help manage body weight and prevent gradual, unhealthy body weight gain in adulthood: Engage in approximately 60 minutes of moderate- to vigorous-intensity activity on most days of the week while not exceeding energy needs.
- To sustain weight loss in adulthood: Participate in at least 60 to 90 minutes of daily moderate-intensity physical activity while not exceeding energy needs. Some people (men over 40 years of age and women over 50 years of age) may need to consult with a health-care provider before participating in this level of activity.
- Achieve physical fitness by including cardiovascular conditioning, stretching exercises for flexibility, and resistance exercises or calisthenics for muscle strength and endurance.



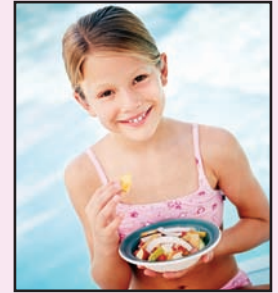
Key Recommendations for Specific Population Groups

- *Children and adolescents.* Engage in at least 60 minutes of physical activity on most, preferably all, days of the week.
- *Pregnant women.* In absence of medical complications, incorporate 30 minutes or more of moderate-intensity physical activity on most, if not all, days of the week. Avoid activities with a high risk of falling or abdominal trauma.
- *Breastfeeding women.* Be aware that neither acute nor regular exercise adversely affects the mother's ability to successfully breastfeed.
- *Older adults.* Participate in regular physical activity to reduce functional declines associated with aging and to achieve the other benefits of physical activity identified for all adults.

Figure 2-8 | Key recommendations within each general topic from the latest Dietary Guidelines for Americans. (continued)

FOOD GROUPS TO ENCOURAGE

- Consume a sufficient amount of fruits and vegetables while staying within energy needs. Two cups of fruit and 2 1/2 cups of vegetables per day are recommended for a reference 2000 kcal intake, with higher or lower amounts depending on one's energy needs.
- Choose a variety of fruits and vegetables each day. In particular, select from all five vegetable subgroups (dark green vegetables, orange vegetables, legumes, starchy vegetables, and other vegetables) several times a week.
- Consume 3 or more ounce-equivalents of whole-grain products per day, with the rest of the recommended grains coming from enriched or whole-grain products. In general, at least half the grains should come from whole grains.
- Consume 3 cups per day of fat-free or low-fat milk or equivalent milk products.



Key Recommendations for Specific Population Groups

- *Children and adolescents.* Consume whole-grain products often; at least half the grains should be whole grains. Children 2 to 8 years should consume 2 cups per day of fat-free or low-fat milk or equivalent milk products. Children 9 years of age and older should consume 3 cups per day of fat-free or low-fat milk or equivalent milk products.

FATS

- Consume less than 10 percent of energy intake from saturated fatty acids and less than 300 mg per day of cholesterol, and keep *trans* fatty acid consumption as low as possible.
- Keep total fat intake between 20 to 35% of energy intake, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.
- When selecting and preparing meat, poultry, dry beans, and milk or milk products, make choices that are lean, low-fat, or fat-free.
- Limit intake of fats and oils high in saturated and/or *trans* fatty acids, and choose products low in such fats and oils.



Key Recommendations for Specific Population Groups

- *Children and adolescents.* Keep total fat intake between 30 to 35% of energy intake for children 2 to 3 years of age and between 25 to 35% of energy intake for children and adolescents 4 to 18 years of age, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.

CARBOHYDRATES

- Choose fiber-rich fruits, vegetables, and whole grains often.
- Choose and prepare foods and beverages with little added sugars or caloric sweeteners, such as amounts suggested by MyPyramid.
- Reduce the incidence of dental caries by practicing good oral hygiene and consuming sugar- and starch-containing foods and beverages less frequently.



Figure 2-8 | Key recommendations within each general topic from the latest Dietary Guidelines for Americans. (continued)

SODIUM AND POTASSIUM

- Consume less than 2300 mg of sodium per day (approximately 1 tsp of salt).
- Choose and prepare foods with little salt. At the same time, consume potassium-rich foods, such as fruits and vegetables.

Key Recommendations for Specific Population Groups

- *Individuals with hypertension, blacks, and middle-aged and older adults.* Aim to consume no more than 1500 mg of sodium per day, and meet the potassium recommendation (4700 mg per day) with food.

ALCOHOLIC BEVERAGES

- Those who choose to drink alcoholic beverages should do so sensibly and in moderation—defined as the consumption of up to one drink per day for women and up to two drinks per day for men. (12 oz of a regular beer, 5 oz of wine or 1 1/2 oz of 80 proof distilled spirits count as a drink for purposes of explaining moderation.)
- Alcoholic beverages should not be consumed by some individuals, including those who cannot restrict their alcohol intake, women of childbearing age who may become pregnant, pregnant and lactating women, children and adolescents, individuals taking medications that can interact with alcohol, and those with specific medical conditions.
- Alcoholic beverages should be avoided by individuals engaging in activities that require attention, skill, or coordination, such as driving or operating machinery.



FOOD SAFETY

To avoid microbial foodborne illness:

- Clean hands, food contact surfaces, and fruits and vegetables. Meat and poultry should *not* be washed or rinsed to avoid spreading bacteria to other foods.
- Separate raw, cooked, and ready-to-eat foods while shopping, preparing, and storing foods.
- Cook foods to a safe temperature to kill microorganisms.
- Chill (refrigerate) perishable food promptly and defrost foods properly.
- Avoid raw (unpasteurized) milk or any products made from unpasteurized milk, raw or partially cooked eggs or foods containing raw eggs, or raw or undercooked meat and poultry, unpasteurized juices, and raw sprouts.



Key Recommendations for Specific Population Groups

- *Infants and young children, pregnant women, older adults, and those who are immunocompromised.* Do not eat or drink raw (unpasteurized) milk or any products made from unpasteurized milk, raw or partially cooked eggs or foods containing raw eggs, raw or undercooked meat and poultry, raw or undercooked fish or shellfish, unpasteurized juices, and raw sprouts.
- *Pregnant women, older adults, and those who are immunocompromised.* Only eat certain deli meats and frankfurters that have been reheated to steaming hot.

Figure 2-8 | Key recommendations within each general topic from the latest Dietary Guidelines for Americans. (continued)

- Practice safe food handling when preparing food. This includes cleaning hands, food contact surfaces, and fruits and vegetables before preparation, and cooking foods to a safe temperature to kill microorganisms.

A basic premise of the Dietary Guidelines is that nutrient needs should be met primarily through consuming foods.¹⁷ Foods provide an array of nutrients and other compounds that may have beneficial effects on health. In certain cases, fortified foods and dietary supplements may be useful sources of one or more nutrients that otherwise might be consumed in less than recommended amounts. These practices are especially important for people whose typical food choices lead to a diet that cannot meet one or more nutrient recommendations, such as for vitamin E or calcium. However, dietary supplements are not a substitute for a healthful diet.

Practical Use of the Dietary Guidelines

The Dietary Guidelines are designed to meet nutrient needs while reducing the risk of obesity, hypertension, cardiovascular disease, type 2 diabetes, alcoholism, and foodborne illness.

The Dietary Guidelines are not difficult to implement (Table 2-12).¹⁵ Despite popular misconceptions, this overall diet approach is not especially expensive. Fruits, vegetables, and low-fat and fat-free milk are no more expensive than the chips, cookies, and sugared soft drinks they should in part replace.

Note also that diet recommendations for adults have been issued by other scientific groups, such as the American Heart Association, Office of the U.S. Surgeon General, National Academy of Sciences, American Cancer Society, Canadian Ministries of Health (see Appendix D), and World Health Organization. All are consistent with the spirit of the Dietary Guidelines. These groups encourage people to modify their eating behavior in ways that are both healthful and pleasurable.

The Dietary Guidelines and You

When using the Dietary Guidelines, you should consider your own state of health. Make specific changes and see whether they are effective. Note that results are sometimes disappointing, even when you are following a diet change very closely. Some people can eat a lot of saturated fat and still keep blood cholesterol under control. Other people, unfortunately, have high blood cholesterol even if they eat a diet low in saturated fat. Differences in genetic background are a key cause, as you learned in Chapter 1. Your diet should be planned with this individuality in mind, taking into account your current health status and family history for specific diseases. However, tailoring a unique nutrition program for every North American citizen is currently unrealistic. MyPyramid and the Dietary Guidelines provide typical adults with simple advice that can be actively practiced by anyone willing to take a step toward good health.^{11,15}

There is no “optimal” diet. Instead, there are numerous healthful diets. Visit the website of the International Food Information Council (ific.org). This site is a great resource for current nutrition information.

Concept | Check

Dietary Guidelines for Americans have been set by a variety of private and government organizations. These guidelines are designed to reduce the risk of developing obesity, hypertension, type 2 diabetes, cardiovascular disease, alcoholism, and foodborne illness. To do so, they recommend eating a variety of foods, which is fostered by following MyPyramid. They also recommend performing regular physical activity, aiming for a healthy weight, and moderating total fat, saturated fat, *trans* fat, salt, sugar, and alcohol intake, while focusing more on fruits, vegetables, and whole-grain products in daily menu planning. Safe food preparation and storage are also highlighted.

A brochure designed for the public based on the 2005 Dietary Guidelines for Americans is entitled “Finding Your Way to a Healthier You.” It communicates the major themes of the 2005 Dietary Guidelines for Americans but uses simpler messages. The 2005 Dietary Guidelines for Americans (and the consumer brochure) are available at www.healthierus.gov/dietaryguidelines.

Advice from the American Dietetic Association suggests five basic principles with regard to diet and health.

- Be realistic, making small changes over time.
- Be adventurous, trying new foods regularly.
- Be flexible, balancing some sweet and fatty foods with physical activity.
- Be sensible, including favorite foods in smaller portions.
- Finally, be active, including physical activity in daily life.

Critical | Thinking

Shannon has grown up eating the typical American diet. Having recently read and heard many media reports about the relationship between nutrition and health, she is beginning to look critically at her diet and is considering making changes. However, she doesn't know where to begin. What advice would you give her?

The **Exchange System** is a final menu-planning tool. This tool organizes foods based on energy, protein, carbohydrate, and fat content. The result is a manageable framework for designing diets, especially for treatment of diabetes. For more information on the Exchange System see Appendixes E and F.

Table 2-12 | Recommended Diet Changes Based on the Dietary Guidelines

If You Usually Eat This,	Try This Instead	Benefit
White bread	Whole-wheat bread	<ul style="list-style-type: none"> Higher nutrient density, due to less processing More fiber
Sugary breakfast cereal	Low-sugar, high-fiber cereal with fresh fruit	<ul style="list-style-type: none"> Higher nutrient density More fiber More phytochemicals
Cheeseburger with french fries	Hamburger and baked beans	<ul style="list-style-type: none"> Less saturated fat and <i>trans</i> fat Less cholesterol More fiber More phytochemicals
Potato salad	Three-bean salad	<ul style="list-style-type: none"> More fiber More phytochemicals
Doughnuts	Bran muffin or bagel with light cream cheese	<ul style="list-style-type: none"> More fiber Less fat
Regular soft drinks	Diet soft drinks	<ul style="list-style-type: none"> Less energy
Boiled vegetables	Steamed or sauteed vegetables	<ul style="list-style-type: none"> Higher nutrient density, due to reduced loss of water-soluble vitamins
Canned vegetables	Fresh or frozen vegetables	<ul style="list-style-type: none"> Higher nutrient density, due to reduced loss of heat-sensitive vitamins Lower in sodium
Fried meats	Broiled meats	<ul style="list-style-type: none"> Less saturated fat
Fatty meats, such as ribs or bacon	Lean meats, such as ground round, chicken, or fish	<ul style="list-style-type: none"> Less saturated fat
Whole milk	Low-fat or fat-free milk	<ul style="list-style-type: none"> Less saturated fat Less energy More calcium
Ice cream	Sherbet or frozen yogurt	<ul style="list-style-type: none"> Less saturated fat Less energy
Mayonnaise or sour cream salad dressing	Oil and vinegar dressings or light creamy dressings	<ul style="list-style-type: none"> Less saturated fat Less cholesterol Less energy
Cookies	Popcorn (air popped with minimal margarine or butter)	<ul style="list-style-type: none"> Less energy and <i>trans</i> fat
Heavily salted foods	Foods flavored primarily with herbs, spices, lemon juice	<ul style="list-style-type: none"> Lower in sodium
Chips	Pretzels	<ul style="list-style-type: none"> Less fat



Nutrition recommendations are often made on a population-wide basis. However, in some cases, it would be more appropriate if these were made on an individual basis once a person's particular health status is known.

Case Scenario | Follow-Up



The most positive aspect of Andy's diet is that it contains adequate protein, zinc, and iron because it is rich in animal protein. On the downside, his diet is low in calcium, some B vitamins (such as folate), and vitamin C. This is because it is low in dairy products, fruits, and vegetables. It is also low in many of the phytochemical (plant-based) substances discussed at the beginning of Chapter 2. In addition, his fiber intake is low because fast-food restaurants primarily use refined grain products rather than whole-grain products. And since most super-sized options apply to foods rich in fat (french fries) and sugar (soft drinks), his diet is likely excessive in those two components.

He could alternate between tacos and bean burritos to gain the benefits of plant proteins in his diet. He could choose a low-fat granola bar instead of the candy bar for breakfast, or he could take the time to eat a bowl of whole-grain breakfast cereal with low-fat or fat-free milk to increase fiber and calcium intake. He could also order milk at least half the time at his restaurant visits and substitute diet soft drinks for the regular variety. This would help *moderate* his sugar intake. Overall, Andy could improve his intake of fruits, vegetables, and dairy products if he focused more on variety in food choice and balance among the food groups.

Using Food Labels in Diet Planning

Recall from Chapter 1 that the nutrition label uses the term *calorie* to express energy content in some cases but kilocalorie (kcal) values are actually listed.

Today, nearly all foods sold in the supermarket must be labeled with the product name, name and address of the manufacturer, amount of product in the package, and ingredients listed in descending order by weight. This food and beverage labeling is monitored in North America by government agencies such as the US Food and Drug Administration (FDA) in the United States. The listing of certain food constituents is also required—specifically, on a Nutrition Facts panel (Figure 2-9). Use this information to learn more about what you eat.

The following components must be listed: total calories (kcal), calories from fat, total fat, saturated fat, *trans* fat, cholesterol, sodium, total carbohydrate, fiber, sugars, protein, vitamin A, vitamin C, calcium, and iron. In addition to these required components, manufacturers can choose to list polyunsaturated and monounsaturated fat, potassium, and others. Listing these components is *required*, however, if a claim is made about the health benefits of the specific nutrient (see the section entitled Health Claims on Food Labels) or if the food is fortified with that nutrient.

Recall that the percentage of the Daily Value is usually given for each nutrient per serving. It is important to understand that these percentages are based on a 2000 kcal diet. Therefore, they are not as applicable to people who require considerably more or less than 2000 kcal per day with respect to fat and carbohydrate intake.

Serving sizes on the Nutrition Facts panel must be consistent among similar foods. This means that all brands of ice cream, for example, must use the same serving size on their label. However, these serving sizes may differ from those of MyPyramid since those of food labels are based on typical serving sizes. In addition, food claims made on packages must follow legal definitions (Table 2-13). For example, if a product claims to be “low sodium,” it must have 140 mg of sodium or less per serving.

Many manufacturers list the Daily Values set for dietary components such as fat, cholesterol, and carbohydrate on the Nutrition Facts panel. This can be useful as a reference point. As noted, they are based on 2000 kcal; if the label is large enough,

amounts based on 2500 kcal are listed as well for total fat, saturated fat, carbohydrate, and other components.

Exceptions to Food Labeling

Foods such as fresh fruits and vegetables, fish, meats, and poultry currently are not required to have Nutrition Facts labels. However, many grocers and some meat packers have voluntarily chosen to provide their customers with information about these products. Nutrition Facts labels on meat products will likely be required in the coming years. The next time you are at the grocery store, ask where you might find information on the fresh products that do not have a Nutrition Facts panel. You will likely find a poster or pamphlet near the product; often, these pamphlets contain recipes that use your favorite fruit, vegetable, or cut of meat. They may even assist you in your endeavor to improve your diet.

Because protein deficiency is not a public health concern in the United States, declaration of the % Daily Value for protein is not mandatory on foods for people over 4 years of age. If the % Daily Value is given on a label, FDA requires that the product be analyzed for protein quality. Because this procedure is expensive and time-consuming, many companies opt not to list a % Daily Value for protein rather than undergo the expense. However, labels on food for infants and children under 4 years of age must include the % Daily Value for protein, as must the labels on any food carrying a claim about protein content (see Chapter 17).

Health Claims on Food Labels

As a marketing tool directed toward the health-conscious consumer, food manufacturers like to assert that their products have all sorts of health benefits. After reviewing hundreds of comments on the proposed rule allowing health claims, FDA, which has legal oversight over most food products, has decided to permit some health claims with certain restrictions.

Nutrient and herbal supplement labels have a different layout that includes a “Supplement Facts” heading. Chapters 1 and 9 show examples of these labels.

Canada has established a set of health claims for their nutrition labels (see Appendix D).

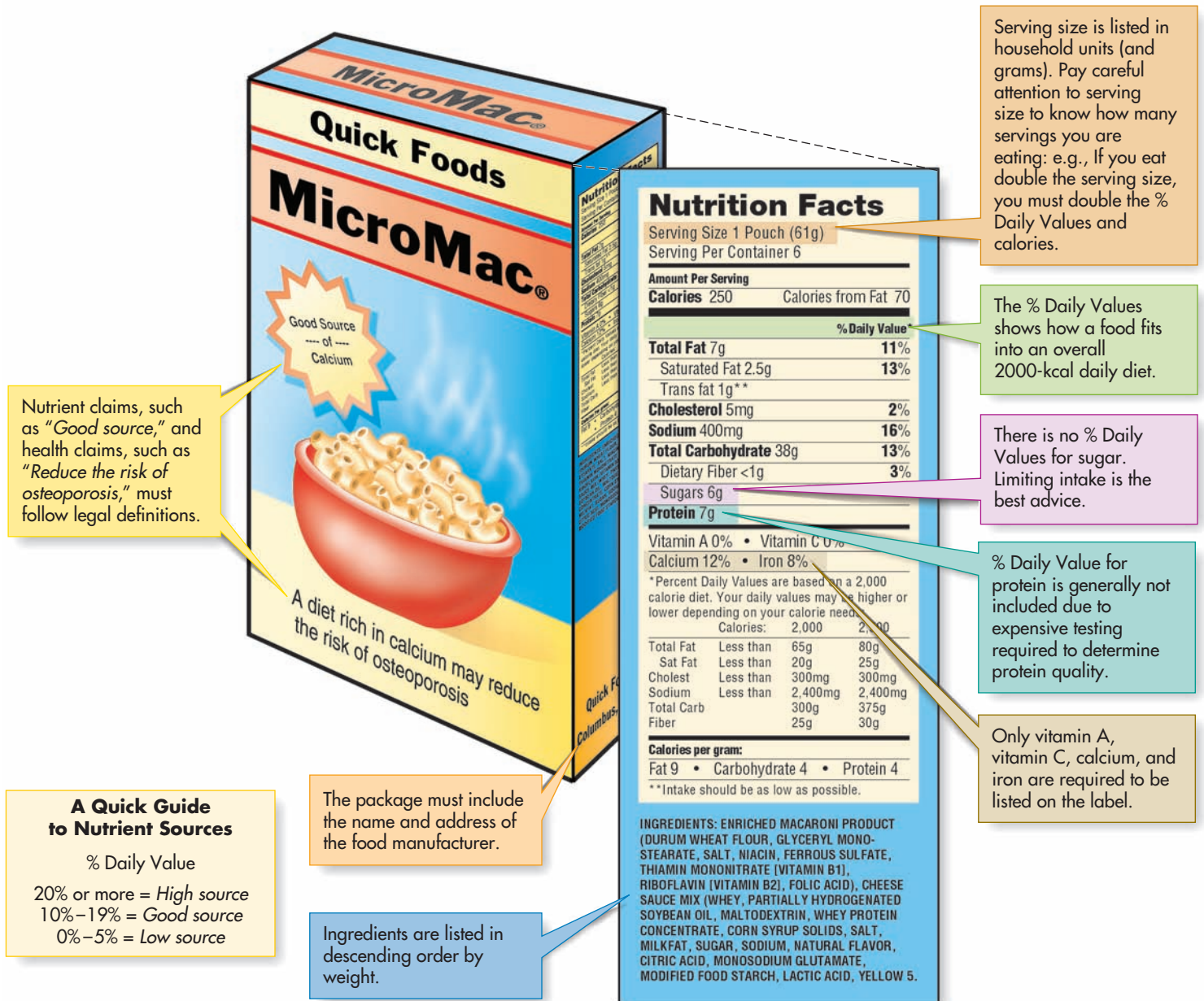


Figure 2-9 | The Nutrition Facts panel on a current food label. This nutrition information is required on virtually all processed food products. The % Daily Value listed on the label is the percentage of the generally accepted amount of a nutrient needed daily that is present in 1 serving of the product. You can use the % Daily Values to compare your diet with current nutrition recommendations for certain diet components. Let's consider fiber. Assume that you consume 2000 kcal per day, which is the energy intake for which the % Daily Values listed on labels have been calculated. If the total % Daily Value for dietary fiber in all the foods you eat in one day adds up to 100%, your diet meets the recommendations for fiber. Food labels also contain the name and address of the food manufacturers. This allows consumers to contact the manufacturer if they desire.

Table 2-13 | Definitions for Comparative and Absolute Nutrient Claims on Food Labels

<p>Sugar</p> <ul style="list-style-type: none"> • Sugar free: less than 0.5 g per serving • No added sugar; without added sugar; no sugar added: <ul style="list-style-type: none"> • No sugars were added during processing or packing, including ingredients that contain sugars (for example, fruit juices, applesauce, or jam). • Processing does not increase the sugar content above the amount naturally present in the ingredients. (A functionally insignificant increase in sugars is acceptable for processes used for purposes other than increasing sugar content.) • The food that it resembles and for which it substitutes normally contains added sugars. • If the food doesn't meet the requirements for a low- or reduced-calorie food, the product bears a statement that the food is not low calorie or calorie reduced and directs consumers' attention to the Nutrition Facts panel for further information on sugars and calorie content. • Reduced sugar: at least 25% less sugar per serving than reference food <p>Calories</p> <ul style="list-style-type: none"> • Calorie free: fewer than 5 kcal per serving • Low calorie: 40 kcal or less per serving and, if the serving is 30 g or less or 2 tbsp or less, per 50 g of the food • Reduced or fewer calories: at least 25% fewer kcal per serving than reference food <p>Fiber</p> <ul style="list-style-type: none"> • High fiber: 5 g or more per serving. (Foods making high-fiber claims must meet the definition for low fat, or the level of total fat must appear next to the high-fiber claim.) • Good source of fiber: 2.5 to 4.9 g per serving • More or added fiber: at least 2.5 g more per serving than reference food <p>Fat</p> <ul style="list-style-type: none"> • Fat free: less than 0.5 g of fat per serving • Saturated fat free: less than 0.5 g per serving, and the level of <i>trans</i> fatty acids does not exceed 0.5 g per serving • Low fat: 3 g or less per serving and, if the serving is 30 g or less or 2 tbsp or less, per 50 g of the food. 2% milk can no longer be labeled 	<p>low-fat, as it exceeds 3 g per serving. <i>Reduced fat</i> is the term used instead.</p> <ul style="list-style-type: none"> • Low saturated fat: 1 g or less per serving and not more than 15% of kcal from saturated fatty acids • Reduced or less fat: at least 25% less per serving than reference food • Reduced or less saturated fat: at least 25% less per serving than reference food <p>Cholesterol</p> <ul style="list-style-type: none"> • Cholesterol free: less than 2 mg of cholesterol and 2 g or less of saturated fat per serving • Low cholesterol: 20 mg or less cholesterol and 2 g or less of saturated fat per serving and, if the serving is 30 g or less or 2 tbsp or less, per 50 g of the food • Reduced or less cholesterol: at least 25% less cholesterol and 2 g or less of saturated fat per serving than reference food <p>Sodium</p> <ul style="list-style-type: none"> • Sodium free: less than 5 mg per serving • Very low sodium: 35 mg or less per serving and, if the serving is 30 g or less or 2 tbsp or less, per 50 g of the food • Low sodium: 140 mg or less per serving and, if the serving is 30 g or less or 2 tbsp or less, per 50 g of the food • Light in sodium: at least 50% less per serving than reference food • Reduced or less sodium: at least 25% less per serving than reference food <p>Other Terms</p> <ul style="list-style-type: none"> • Fortified or enriched: Vitamins and/or minerals have been added to the product in amounts in excess of at least 10% of that normally present in the usual product. Enriched generally refers to replacing nutrients lost in processing, whereas fortified refers to adding nutrients not originally present in the specific food. • Healthy: An individual food that is low fat and low saturated fat and has no more than 360 to 480 mg of sodium or 60 mg of cholesterol per serving can be labeled "healthy" if it provides at least 10% of the Daily Value for vitamin A, vitamin C, protein, calcium, iron, or fiber. • Light or lite: The descriptor <i>light</i> or <i>lite</i> can mean two things: first, that a nutritionally altered product contains one-third fewer kcal or 	<p>half the fat of reference food (if the food derives 50% or more of its kcal from fat, the reduction must be 50% of the fat) and, second, that the sodium content of a low-calorie, low-fat food has been reduced by 50%. In addition, "light in sodium" may be used for foods in which the sodium content has been reduced by at least 50%. The term <i>light</i> may still be used to describe such properties as texture and color, as long as the label explains the intent—for example, "light brown sugar" and "light and fluffy."</p> <ul style="list-style-type: none"> • Diet: A food may be labeled with terms such as <i>diet</i>, <i>dietetic</i>, <i>artificially sweetened</i>, or <i>sweetened with nonnutritive sweetener</i> only if the claim is not false or misleading. The food can also be labeled <i>low calorie</i> or <i>reduced calorie</i>. • Good source: <i>Good source</i> means that a serving of the food contains 10 to 19% of the Daily Value for a particular nutrient. If 5% or less it is a low source. • High: <i>High</i> means that a serving of the food contains 20% or more of the Daily Value for a particular nutrient. • Organic: Federal standards for organic foods allow claims when much of the ingredients do not use chemical fertilizers or pesticides, genetic engineering, sewage sludge, antibiotics, or irradiation in their production. At least 95% of ingredients (by weight) must meet these guidelines to be labeled "organic" on the front of the package. If the front label instead says "made with organic ingredients," only 70% of the ingredients must be organic. For livestock, the animals need to be allowed to graze outdoors and as well be fed organic feed. They also cannot be exposed to large amounts of antibiotics or growth hormones. • Natural: The food must be free of food colors, synthetic flavors, or any other synthetic substance. <p>The following terms apply only to meat and poultry products regulated by USDA.</p> <ul style="list-style-type: none"> • Extra lean: less than 5 g of fat, 2 g of saturated fat, and 95 mg of cholesterol per serving (or 100 g of an individual food) • Lean: less than 10 g of fat, 4.5 g of saturated fat, and 95 mg of cholesterol per serving (or 100 g of an individual food)
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Many definitions are from FDA's *Dictionary of Terms*, as established in conjunction with the 1990 Nutrition Education and Labeling Act (NELA).

Currently, FDA limits the use of health messages to specific instances in which there is significant scientific agreement that a relationship exists between a nutrient, food, or food constituent and the disease.⁸ The claims allowed at this time may show a link between the following:

- A diet with enough calcium and a reduced risk of osteoporosis
- A diet low in total fat and a reduced risk of some cancers
- A diet low in saturated fat and cholesterol and a reduced risk of cardiovascular disease (typically referred to as heart disease on the label)
- A diet rich in fiber—containing grain products, fruits, and vegetables and a reduced risk of some cancers
- A diet low in sodium and high in potassium and a reduced risk of hypertension and stroke
- A diet rich in fruits and vegetables and a reduced risk of some cancers
- A diet adequate in the synthetic form of the vitamin folate (i.e., folic acid) and a reduced risk of neural tube defects (a type of birth defect)
- Use of sugarless gum and a reduced risk of tooth decay, especially when compared with foods high in sugars and starches
- A diet rich in fruits, vegetables, and grain products that contain fiber and a reduced risk of cardiovascular disease. Oats (oatmeal, oat bran, and oat flour) and **psyllium** are two fiber-rich ingredients that can be singled out in reducing the risk of cardiovascular disease, as long as the statement also says the diet should also be low in saturated fat and cholesterol.
- A diet rich in whole-grain foods and other plant foods as well as low in total fat, saturated fat, and cholesterol and a reduced risk of cardiovascular disease and certain cancers
- A diet low in saturated fat and cholesterol that also includes 25 g/day of soy protein and a reduced risk of cardiovascular disease. The statement “one serving of (name of food) provides ____ g of soy protein” must also appear as part of the health claim.
- Fatty acids from oils present in fish and a reduced risk of cardiovascular disease
- Margarines containing plant stanols and sterols and a reduced risk of cardiovascu-

lar disease (see Chapter 6 for more details on plant stanols and sterols).

A “may” or “might” qualifier must be used in any statement.

In addition, before a health claim can be made for a food product, it must meet two general requirements. First, the food must be a “good source” (before any fortification) of fiber, protein, vitamin A, vitamin C, calcium, or iron. The legal definition of *good source* appears in Table 2-13. Second, a single serving of the food product cannot contain more than 13 g of fat, 4 g of saturated fat, 60 mg of cholesterol, or 480 mg of sodium. If a food exceeds any one of these requirements, no health claim can be made for it despite its other nutritional qualities. For example, even though whole milk is high in calcium, its label can’t make the health claim about calcium and osteoporosis because whole milk contains 5 g of saturated fat per serving.

In addition, the product must meet criteria specific to the health claim being made. For example, a health claim regarding fat and cancer can be made only if the product contains 3 g or less of fat per serving, which is the standard for low-fat foods.

Overall, claims on foods fall into one of four categories:

- Health claims—closely regulated by FDA
- Preliminary health claims—regulated by FDA but evidence may be scant for the claim
- Nutrient claims—closely regulated by FDA (review Table 2-13)
- Structure/function claims—as discussed in Chapter 1, these are not FDA approved or necessarily valid



Eating fish at least twice a week contributes to overall health.



The nutrition information on the food labels on these three products can be combined to indicate nutrient intake for a peanut butter and jelly sandwich.

psyllium A type of dietary fiber found in the seeds of the plantago plant.

In December 2002, FDA created three new preliminary classes of health claims. The agency announced that it would now allow health claims for foods based on incomplete scientific evidence as long as the label qualified it with a disclaimer such as “this evidence is not conclusive.”⁸ These preliminary health claims haven’t shown up on many foods at this time (nuts, such as walnuts, and fish have been some of the first examples). These claims also cannot be used on foods considered unhealthy (review Table 2-13 for the definition of *healthy* with regard to a food).

Summary

1. *Variety*, *balance*, and *moderation* are three watchwords of diet planning.
2. Nutrient density is a useful concept. It reflects the nutrient content of a food in relation to its energy content. Nutrient-dense foods are relatively rich in nutrients in comparison with energy content.
3. Energy density of a food is determined by comparing content with the weight of food. A food that is rich in energy but weighs relatively little, such as nuts, cookies, fried foods in general, and most snack foods (including fat-free brands), is considered energy dense. Foods with low energy density include fruits, vegetables, and any food that incorporates lots of water during cooking, such as oatmeal.
4. A person's nutritional state can be categorized as *desirable nutrition*, in which the body has adequate stores for times of increased needs; *undernutrition*, which may be present with or without clinical symptoms; and *overnutrition*, which can lead to vitamin and mineral toxicities and various chronic diseases.
5. Evaluation of nutritional state involves analyzing background factors as well as anthropometric, biochemical, clinical, dietary, and economic assessments. It is not always possible to detect nutritional inadequacies via nutrition assessment because signs and symptoms of deficiencies are often nonspecific and may not appear for many years.
6. Recommended Dietary Allowances (RDAs) are set for many nutrients. These amounts yield enough of each nutrient to meet the needs of healthy individuals within specific gender and age categories. Adequate Intakes (AIs) are used when not enough information is available to set an RDA. Estimated Energy Requirements (EERs) provide a benchmark for energy needs. Tolerable Upper Intake Levels (Upper Levels, or ULs) for nutrient intake have been set for some vitamins and minerals. All of the many dietary standards fall under the term *Dietary Reference Intakes (DRIs)*. Daily Values are used as a basis for expressing the nutrient content of foods on the Nutrition Facts panel and are based for the most part on the RDAs published in 1968.
7. MyPyramid is designed to translate nutrient recommendations into a food plan that exhibits variety, balance, and moderation. The best results are obtained by using low-fat or fat-free dairy products; incorporating some vegetable proteins into the diet in addition to animal-protein foods; including citrus fruits and dark green vegetables; and emphasizing whole-grain breads and cereals.
8. Dietary Guidelines for Americans have been issued to help reduce chronic diseases. The guidelines emphasize eating a variety of foods; performing regular physical activity; maintaining or improving weight; moderating consumption of fat, *trans* fat, cholesterol, sugar, salt, and alcohol; eating plenty of whole-grain products, fruits, and vegetables; and safely preparing and storing foods, especially perishable foods.
9. Food labels are a useful tool to track your nutrient intake and learn more about the nutritional characteristics of the foods you eat. Any health claims listed must follow criteria set by FDA.

Study Questions

1. Describe the philosophy underlying the creation of MyPyramid. What dietary changes would you need to make to meet the pyramid guidelines on a regular basis?
2. Trace the progression, in terms of physical results, of a person who went from an undernourished to an overnourished state.
3. How could the nutritional status of the person at each state in question 2 be evaluated?
4. Describe the intent of the Dietary Guidelines for Americans. Point out one criticism for its general application to all North American adults.
5. Based on the discussion of the Dietary Guidelines for Americans, suggest two key dietary changes the typical North American adult should consider making.
6. How do RDAs and Adequate Intakes differ from Daily Values in intention and application?
7. How would you explain the concepts of nutrient density and energy density to a fourth-grade class?
8. Nutritionists encourage all people to read labels on food packages to learn more about what they eat. What four nutrients could easily be tracked in your diet if you read the Nutrition Facts panels regularly on food products?
9. Explain why consumers can have confidence in FDA-approved health claims on food packages.
10. Relate the importance of variety in a diet, especially with regard to fruit and vegetable choices, to the discovery of various phytochemicals in foods.

BOOST YOUR STUDY

Check out the **Perspectives in Nutrition: Online Learning Center** www.mhhe.com/wardlawpers7 for quizzes, flash cards, activities, and web links designed to further help you learn about various tools for diet planning.

Annotated References

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Functional foods are foods that have health-promoting properties beyond those provided by nutrient content alone. The many potential benefits of functional foods are described in the article. Still, since foods naturally contain numerous different nutrients and phytochemicals, an important focus is to consider any functional food to be a part of an otherwise healthy diet, especially one rich in fruits and vegetables.
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4. Food and Nutrition Board: *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids*. Washington DC: National Academy Press, 2002.
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6. Hasler CM: Functional foods: Benefits, concerns, and challenges—A position paper from the American Council on Science and Health. *Journal of Nutrition* 132:3772, 2002.
We now know that our diet and its constituents from both plant and animal sources provide more than the essential nutrients such as protein and vitamins, namely a variety of phytochemical and other components that also contribute to health. Foods rich in specific phytochemicals are often termed functional foods. This article lists a variety of phytochemicals under study as well as current approved health claims for food labels.
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The combination of increasing portion size and increasing energy density resulted in a greater food intake in the women in this study. The researchers suggest that both factors may be contributing to the excess energy intake seen in some adults.
8. Liebman B: Claims crazy: Which ones can you believe? *Nutrition Action HealthLetter* 30(5):1, 2003 (June).
Consumers can rely on the accuracy of the various health claims approved by FDA. Structure/function claims and the forthcoming preliminary health claims (i.e., those that must carry a disclaimer concerning FDA approval) should be viewed cautiously.
9. Liebman B: Bigger means: Smaller waists. *Nutrition Action HealthLetter*, p. 1, June 2005.
The article contains a discussion on energy density and practical applications to a daily diet. Highlighted is the work of Dr. Barbara Rolls, the author of this chapter's Expert Opinion.
10. Marcus JB: New age foods for disease prevention. *Today's Dietitian*, p. 24, May 2003.
Fruits, vegetables, nuts, and whole grains are good sources of phytochemicals. Dietary guidance should be based on consuming these foods, ideally in their whole state.
11. Meadows M: Healthier eating. *FDA Consumer*, p. 10, May–June 2005.
The latest Dietary Guidelines for Americans (2005) are reviewed. The article provides practical advice to put these guidelines into action—a task too few adults are doing well.
12. Meerschaert CM: One size does not fill all—The New Food Guidance System. *Today's Dietitian*, p. 42, August, 2005.
This article discusses the pros and cons of the new MyPyramid plan promoted by USDA. It also reviews the various tools offered on the www.mypyramid.gov website.
13. Milner JA: Molecular targets for bioactive food components. *Journal of Nutrition* 134:2492S, 2004.
The phytochemicals found in a healthy diet provide numerous health benefits. These affect cell metabolism at a very basic level, in turn helping to prevent diseases such as cancer.
14. Mitka M: Government unveils a new food pyramid. *Journal of the American Medical Association* 293:2581, 2005.
Both the pros and cons of MyPyramid are raised by nutrition and medical experts. The biggest criticism is that the tool is practically useless unless a person logs on to the MyPyramid website to find out the details regarding the diet plan.
15. Rebuilding the pyramid. *Tufts University Health & Nutrition Letter*, p. 1, June 2005.
The latest nutrition advice from MyPyramid is discussed. Applying the recommendations to everyday life is highlighted.
16. Reeves MJ, Rafferty AP: Healthy lifestyle characteristics among adults in the United States, 2000. *Archives of Internal Medicine* 165:854, 2005.
Few adults (about 3% of those in the survey) are following all of the four keys to a healthy lifestyle. The keys are nonsmoking, healthy weight, consuming a combination of at least 5 fruit and vegetables servings per day, and performing at least 30 minutes of physical activity 5 days or more per week.
17. Revised Dietary Guidelines to help Americans live better lives. *FDA Consumer*, p. 18, March–April 2005.
This article summarizes the latest dietary guidelines in simple terms. Colorful graphics are included to emphasize the major points.
18. Stampfer JM and others: Primary prevention of coronary heart disease in women through diet and lifestyle. *The New England Journal of Medicine* 343:16, 2000.
Women who consume a varied diet (one rich in fiber, includes some fish, and is low in fried foods and animal fat), avoid overweight, drink small amounts of alcohol, exercise on a daily basis for about 30 minutes, and avoid smoking reduce their risk of heart attack by over 80% compared to other women.
19. Uncle Sam's diet book. *Tufts University Health & Nutrition Letter*, p. 1, March 2005.
Implementation of the latest Dietary Guidelines for Americans is discussed. The authors suggest that even small changes that conform to this plan can provide health benefits.
20. Yates AA: Dietary Reference Intakes: Rationale and Applications. In Shils ME and others (eds.): *Modern nutrition in health and disease*. 10th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2006.
The author provides a detailed discussion of the rationale and development of the Dietary Reference Intakes. Included is a discussion of how to implement the various standards.



Take | Action

I. Does Your Diet Meet MyPyramid Recommendations?

Using your food-intake record from Chapter 1, place each food item in the appropriate group of the accompanying MyPyramid chart. That is, for each food item, indicate how many servings it contributes to each group based on the amount you ate (see page 58 for serving sizes). Note that many of your food choices may contribute to more than one group. For example, toast with soft margarine contributes to two categories: (1) the grains group; and (2) the oils group. After entering all the values, add the number of servings consumed in each group. Finally, compare your total in each food group with the recommended number of servings shown in Table 2-9 or obtained from the www.MyPyramid.gov website. Enter a minus sign (–) if your total falls below the recommendation or a plus sign (+) if it equals or exceeds the recommendation.

Indicate the Number of Servings from MyPyramid That Each Food Yields:

Food or Beverage	Amount Eaten	Milk	Meat & Beans	Fruits	Vegetables	Grains	Oils
Group totals							
Recommended servings							
Shortages in numbers of servings							

Take | Action



II. Are You Putting the Dietary Guidelines into Practice?

As noted in this chapter, the advice provided by the 2005 Dietary Guidelines for Americans can be summarized into three main points and a number of related activities. Fill out the following inventory to see to what extent you are following the basic intent of the Guidelines.

Food Intake

Do you:

Y N Consume a variety of nutrient-dense foods and beverages within and among the basic food groups of MyPyramid?

Choose foods that limit the intake of:

Y N Saturated fat

Y N *Trans* fats

Y N Cholesterol

Y N Added sugars

Y N Salt

Y N Alcohol (if used).

Emphasize in your food choices:

Y N Vegetables

Y N Fruits

Y N Legumes (beans)

Y N Whole grain breads and cereals

Y N Fat-free or low-fat milk or equivalent milk products

Body Weight

Y N Maintain body weight in a healthy range by balancing energy intake from foods and beverages with energy expended

Y N Engage in at least 30 minutes of moderate-intensity physical activity, above usual activity, at work or home on most days of the week.

Safe Food Handling

Y N Clean hands, food contact surfaces, and fruits and vegetables before preparation

Y N Cook foods to a safe temperature to kill microorganisms

Figure 2-8 points to other health practices that are part of the 2005 Dietary Guidelines for Americans, but this abbreviated list includes the major points to consider.



Take | Action

III. Applying the Nutrition Facts Label to Your Daily Food Choices

Imagine that you are at the supermarket looking for a quick meal before a busy evening. In the frozen food section, you find two brands of frozen cheese manicotti (see labels *a* and *b*). Which of the two brands would you choose? What information on the Nutrition Facts label contributed to this decision?

Nutrition Facts	
Serving Size 1 Package (260g) Servings Per Container 1	
Amount Per Serving	
Calories 390	Calories from Fat 160
% Daily Value*	
Total Fat 18g	27%
Saturated Fat 9g	45%
Trans Fat 2g	**
Cholesterol 45mg	14%
Sodium 880mg	36%
Total Carbohydrate 38g	13%
Dietary Fiber 4g	15%
Sugars 12g	
Protein 17g	
Vitamin A 10% • Vitamin C 4%	
Calcium 40% • Iron 8%	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
Calories: 2,000 2,500	
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4	
**Intake of <i>trans</i> fat should be as low as possible.	

(a)

Nutrition Facts	
Serving Size 1 Package (260g) Servings Per Container 1	
Amount Per Serving	
Calories 230	Calories from Fat 35
% Daily Value*	
Total Fat 4g	6%
Saturated Fat 2g	10%
Trans Fat 1g	**
Cholesterol 15mg	4%
Sodium 590mg	24%
Total Carbohydrate 28g	9%
Dietary Fiber 3g	12%
Sugars 10g	
Protein 19g	
Vitamin A 10% • Vitamin C 10%	
Calcium 35% • Iron 4%	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
Calories: 2,000 2,500	
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Potassium	3,500mg 3,500mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4	
**Intake of <i>trans</i> fat should be as low as possible.	

(b)