

# SECTION 1

## The Basics of Sports Nutrition

This section provides an introduction to sports nutrition, including a review of general nutrition concepts; an overview of digestion and energy metabolism; a thorough explanation of macronutrients, micronutrients, and water and their relation to athletic performance; and, finally, a discussion of nutritional ergogenics.

### **Chapter 1**

Introduction to Sports Nutrition

### **Chapter 2**

Nutrients: Ingestion to Energy Metabolism

### **Chapter 3**

Carbohydrates

### **Chapter 4**

Fats

### **Chapter 5**

Proteins

### **Chapter 6**

Vitamins

### **Chapter 7**

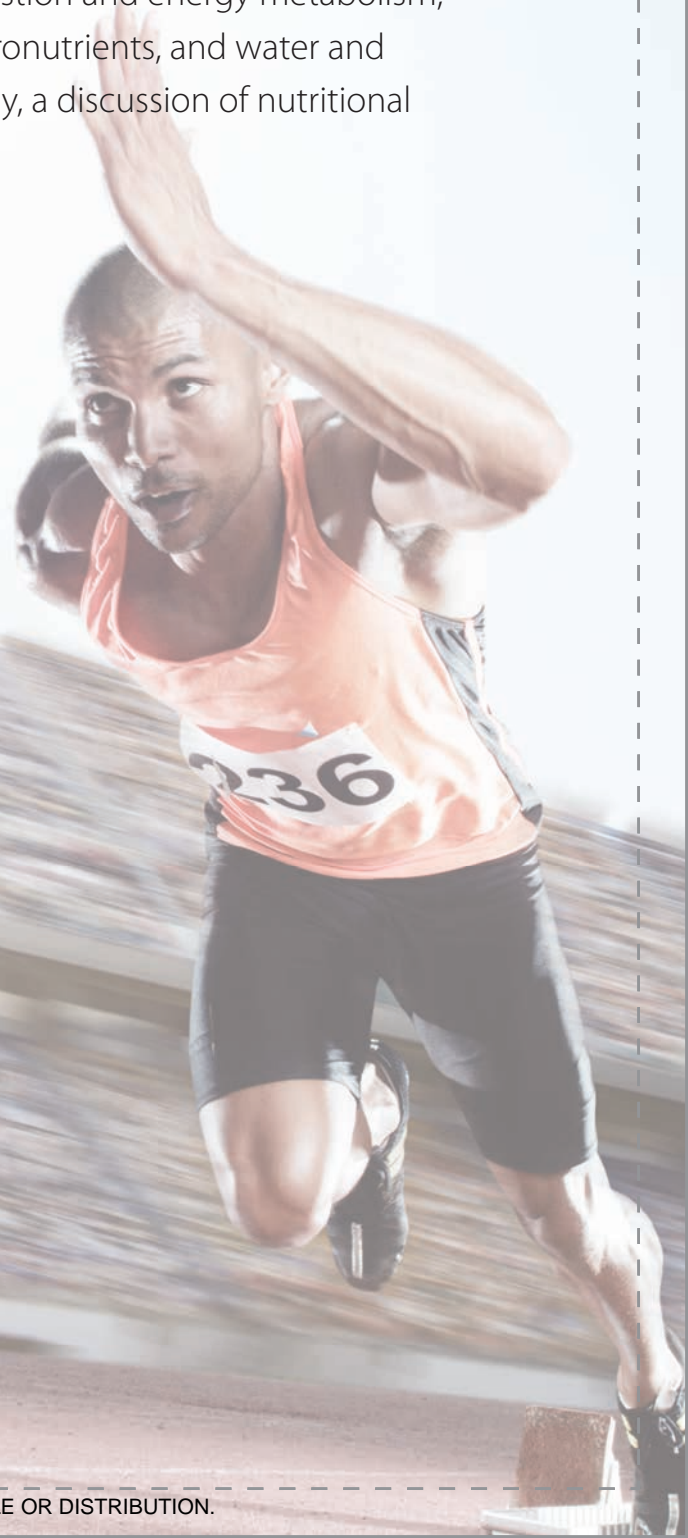
Minerals

### **Chapter 8**

Water

### **Chapter 9**

Nutritional Ergogenics







## CHAPTER 1

# Introduction to Sports Nutrition

### Key Questions Addressed

1. What is sports nutrition?
2. Why study sports nutrition?
3. What are the basic nutrients?
4. How does the body produce energy?
5. What are the Dietary Reference Intakes?
6. What are enriched and fortified foods?
7. What are the basic nutrition guidelines?
8. How should athletes interpret the information on food labels?
9. What are the factors to consider when developing an individualized sports nutrition plan for athletes?
10. How can sports nutrition knowledge be converted into practical applications?



### You Are the Nutrition Coach

Jennifer is a 42-year-old tennis player. She states that recently her energy levels have dropped and that she has had a hard time recovering from long tennis matches. She also complains of being “hungry all the time.” The constant hunger has been frustrating because she is trying to maintain her current weight by attempting to control her total daily intake. She has been “eating well” since finding out 2 years ago that she has high cholesterol. She received counseling from a dietitian at the time of her diagnosis and subsequently made major changes in her diet, such as switching to nonfat foods and eliminating dairy. Her goals are to increase her energy levels, decrease recovery time, and create a meal plan that will also be healthy for her husband and three sons.

### Question

- What should Jennifer’s top priority be—her high cholesterol, struggle to maintain her weight, constant hunger, low energy levels, or long recovery time?



## What is sports nutrition?

**Sports nutrition** is a specialization within the field of nutrition that partners closely with the study of the

**sports nutrition** A specialty area of study and practice within the field of nutrition.

human body and exercise science. Sports nutrition can be defined as the application of nutri-

tion knowledge to a practical daily eating plan focused on providing the fuel for physical activity, facilitating the repair and rebuilding process following hard physical work, and optimizing athletic performance in competitive events, while also promoting overall health and wellness. The area of sports nutrition is often thought to be reserved only for “athletes,” which insinuates the inclusion of only those individuals who are performing at the elite level. In this text, the term *athlete* refers to any individual who is regularly active, ranging from the fitness enthusiast to the competitive amateur or professional. Differences may exist in specific nutrient needs along this designated spectrum of athletes, creating the exciting challenge of individualizing sports nutrition plans.

To fully understand and subsequently apply sports nutrition concepts, professionals instructing athletes on

proper eating strategies first need to have a command of general nutrition as well as exercise science. The second step is to gain the knowledge of how nutrition and exercise science are intertwined, under-

standing that physical training and dietary habits are reliant on each other to produce optimal performance. The final step can be considered one of the most critical—the practical application of sports nutrition knowledge to individual athletes participating in a sport or physical activity.

Sports nutrition professionals must be able to teach athletes by putting “book” knowledge into practice with actual food selection and meal planning, while keeping in mind the challenges presented by busy schedules of exercise, competitions, work, school, and other commitments. It is this third step that many professionals lack after graduating from an undergraduate or graduate program in sports nutrition, dietetics, exercise science, or athletic training. Our focus is to review sports nutrition concepts while also translating the information into specific meal plans, recipes, and case study scenarios. Students are encouraged to seek additional opportunities outside the classroom to work with recreational and elite athletes to gain more experience in applying sports nutrition concepts before searching for a job in the “real world.”



### Gaining the Performance Edge

The field of sports nutrition requires a command of general nutrition and exercise science, an understanding of their interrelationship, and the knowledge of how to practically apply sports nutrition concepts.

## Why study sports nutrition?

Sports nutrition has emerged as a recognized specialty area within the field of nutrition. Athletes challenge their bodies on a regular basis through physical training and competitions. To keep up with the physical demands of their activity or sport, athletes need to fuel their bodies adequately on a daily basis. This fueling process requires a specialized approach; therefore, athletes who want to make dietary changes should seek out professionals who are experts in sports nutrition and experienced in developing individualized plans.

Sports nutrition research is providing new and exciting information on a regular basis. It is critical that sports nutrition professionals stay current so they can be **evidence-based practitioners**.

Gone are the days of suggesting dietary practices based on anecdotal observations or experiences. Becoming an evidence-based practitioner requires use of nutrition guidelines and dietary practices that have been documented as being

effective through peer-reviewed research. Professionals who have studied sports nutrition, have experience in the field, and continue to stay abreast of the latest nutrition research can prescribe individualized dietary plans that meet basic nutritional needs, enhance performance, and speed recovery in athletes of all sports. Becoming an evidence-based sports nutrition practitioner can lead to an exciting and fulfilling career.



### Gaining the Performance Edge

The field of sports nutrition is growing, increasing the demand for qualified sports nutrition professionals. To be considered an “expert” in sports nutrition, a professional must obtain the appropriate education and certification background as well as hands-on experience working with athletes.

**evidence-based practitioner** An individual whose professional practice is based upon information, guidelines, or interventions that have been shown through research to be safe and effective.

## What are the basic nutrients?

Foods and beverages are composed of six nutrients that are vital to the human body for producing energy, contributing to the growth and development of tissues, regulating body processes, and preventing deficiency and degenerative diseases. The six nutrients are carbohydrates, proteins, fats, vitamins, minerals, and water and are classified as

**essential** nutrients. The body requires these nutrients to function properly;

**essential** A nutrition descriptor referring to nutrients that must be obtained from the diet.

however, the body is unable to endogenously manufacture them in the quantities needed daily, and therefore these nutrients must be obtained from the diet. Carbohydrates, proteins, and

**macronutrients** These include carbohydrates, proteins, and fats and are classified as such because they have caloric value and the body has a large daily need for them.

**micronutrients** Vitamins and minerals are classified as micronutrients because the body's daily requirements for these nutrients are small.

fats are classified as **macronutrients** because they have a caloric value and the body needs a large quantity of them on a daily basis. The **micronutrients** include vitamins and minerals; the prefix *micro* is used because the body's daily requirements

for these nutrients are small. Water fits into its own class, and requirements for it vary greatly among individuals. These nutrients will be discussed briefly in this section.

### What are carbohydrates?

Carbohydrates are compounds constructed of carbon, hydrogen, and oxygen molecules. Carbohydrates are converted into glucose in the body, providing the main source of fuel (4 calories per gram of carbohydrate) for all physical activity. Carbohydrates are found in a wide variety of foods, including grains, fruits, and vegetables, as well as in the milk/alternative (soy, rice, nut, and other nondairy products) group.

### What are proteins?

Amino acids are the building blocks of proteins, which are constructed of carbon, hydrogen, oxygen, and nitrogen molecules. Amino acids can be made within the body (**nonessential**) or obtained from

**nonessential** A nutrient descriptor referring to nutrients that can be made within the body.

dietary sources. Proteins are involved in the development, growth, and repair of muscle and other bodily tissues and are therefore critical for recovery from intense physical training. Proteins ensure that the body stays healthy and continues working efficiently by aiding in many bodily processes. Protein can also be used for energy, providing 4 calories per gram; however, it is not used efficiently and therefore is not a source of energy preferred by the body. Proteins are found in a variety of foods, including grains and vegetables, but are mainly concentrated in the milk/alternative as well as meat and beans/alternative (soy products, nuts, seeds, beans, and other nonanimal products) groups.

### What are fats?

Fats, like the other macronutrients, are compounds made up of carbon, hydrogen, and oxygen molecules. Fats are also known as lipids, and they come from both plant and

animal sources in our diet. Triglycerides are the most common type of fat. Other fats include cholesterol and phospholipids. With 9 calories per gram, fats are a concentrated source of energy. Fat is primarily used as a fuel at rest and during low-to moderate-intensity exercise. Fats are also involved in providing structure to cell membranes, aiding in the production of hormones, forming the insulation that wraps nerve cells, and facilitating the absorption of fat-soluble vitamins. Fats are concentrated in butter, margarines, salad dressings, and oils, but they are also found in meats, dairy products, nuts, seeds, olives, avocados, and some grain products.

### What are vitamins?

Vitamins are a large class of nutrients that contain carbon and hydrogen, as well as possibly oxygen, nitrogen, and other elements. There are two main requirements for a substance to be classified as a vitamin. First, the substance must be consumed exogenously because the body cannot produce it or cannot produce it in sufficient quantities to meet its needs. Second, the substance must be essential to at least one vital chemical reaction or process in the human body. Vitamins do not directly provide energy to the body; however, some vitamins aid in the extraction of energy from macronutrients. Vitamins are involved in a wide variety of bodily functions and processes that help to keep the body healthy and disease free. Vitamins are classified as either water-soluble (B vitamins and vitamin C) or fat-soluble (vitamins A, D, E, and K), depending on their method of absorption, transport, and storage in the body.

Vitamins are found in nearly all foods, including fruits, vegetables, grains, meat and beans/alternative, milk/alternative, and some fats.

### What are minerals?

Minerals are also a large group of nutrients. They are composed of a variety of elements; however, they lack carbon. Minerals have a role in the structural development of tissues as well as the regulation of bodily processes. Physical activity places demands on muscles and bones, increases the need for oxygen-carrying compounds in the blood, and increases the loss of sweat and electrolytes from the body, all of which hinge on the adequate



#### Gaining the Performance Edge

Each of the six nutrients has a role in the health and proper functioning of the human body. Physical activity places extra demands on the body, increasing the importance of the nutrients' presence in the diet. Many of the nutrients are so critical to optimal athletic performance that the total daily requirements are increased to meet the demands placed on the body. The six basic nutrients each have distinct, but also intertwining, roles, making it critical to consume adequate amounts of each nutrient on a daily basis.

intake and replacement of dietary minerals. Minerals are categorized into major minerals (calcium, sodium, potassium, chloride, phosphorus, magnesium, and sulfur) and trace minerals (iron, zinc, copper, selenium, iodine, fluoride, molybdenum, and manganese) based on the total quantity required by the body on a daily basis. Similar to vitamins, minerals are found in a wide variety of foods, but mainly are concentrated in the meat and beans/alternative and milk/alternative groups.

### What is water?

Forming a category of its own, water deserves to be highlighted because of its vital roles within the body. The human body can survive for a much greater length of time without any of the macro- or micro-nutrients than without water. The body is 55–60% water, representing a nearly ubiquitous presence in bodily tissues and fluids. In athletics, water is important for temperature regulation, lubrication of joints, and the transport of nutrients to active tissues. In addition to plain water, water can be obtained from juices, milk, coffee, tea, and other beverages, as well as watery foods such as fruits, vegetables, and soups.

### How does the body produce energy?

The body derives its energy from foods ingested daily. Carbohydrates, fats, and proteins are known as the **energy**

**energy nutrients** Carbohydrates, proteins, and fats serve as the body's source of energy and are considered the energy nutrients.

**nutrients** because they serve as the body's source for energy. These energy nutrients are quite literally chemicals

that have energy trapped within the bonds between the atoms of which they are made. The energy trapped within these nutrients is released when metabolic pathways within the cells break down the foods into their constituent parts, carbon dioxide and water. Some of the energy released is conserved or captured and used to make

**adenosine triphosphate (ATP)** The molecule that serves as the body's direct source of energy for cellular work.

another high-energy chemical called **adenosine triphosphate (ATP)**. The rest of the energy is lost as heat.

ATP is the body's direct source of energy for cellular work. Without a constant source of ATP, muscles would not be able to generate force, and thus athletes would not be able to move or perform any physical activity.

### What are the dietary reference intakes?

Several different terms are used to describe the recommendations for macronutrients and micronutrients. The **Recommended Dietary Allowances (RDAs)** were

**Recommended Dietary Allowance (RDA)** The average daily dietary intake level that is sufficient to meet the nutrient requirements of the overwhelming majority (i.e., 98%) of a healthy population.

**Dietary Reference Intakes (DRIs)** A newer way to quantify nutrient needs and excesses for healthy individuals. The DRI expands on the older Recommended Dietary Allowance (RDA) and takes into consideration other dietary quantities such as Estimated Average Requirement (EAR), Adequate Intake (AI), and Tolerable Upper Intake Level (UL).

**Estimated Average Requirement (EAR)** The estimated daily intake level of a vitamin or mineral needed to meet the requirements, as defined by a specified indicator of adequacy, of half of the healthy individuals within a given life stage or gender group.

**Adequate Intake (AI)** A reference intake for nutrients that is used instead of the Recommended Dietary Allowance. When insufficient scientific evidence is available to calculate an Estimated Average Requirement (EAR), then an AI is used. Similar to the EAR and the Recommended Dietary Allowance (RDA), the AI values are based on intake data of healthy individuals.

**Tolerable Upper Intake Level (UL)** The highest level of daily nutrient intake that poses no adverse health effects for almost all individuals in the general population.

developed in 1941 by the U.S. National Academy of Sciences. The RDAs were the primary values health professionals used to assess and plan diets for individuals and groups and to make judgments about excessive intakes. The RDAs still exist for many nutrients; however, a newer way to quantify nutrient needs and excesses for healthy individuals has been developed and termed the **Dietary Reference Intakes (DRIs)**. The DRIs expand on the RDAs and take into consideration other dietary quantities such as **Estimated Average Requirement (EAR)**, **Adequate Intake (AI)**, and **Tolerable Upper Intake Level (UL)**. DRIs are continually being reviewed, and reports on various groups of nutrients are published as scientific data are gathered. This comprehensive effort to develop all components of the DRIs is

under the auspices of the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes of the Food and Nutrition Board, the Institute of Medicine, and the National Academy of Sciences of the United States, along



#### Gaining the Performance Edge

The DRIs encompass the EAR, RDA, AI, and UL for each macronutrient, vitamin, and mineral based on recent research and epidemiological data of healthy populations. As more information and data are discovered, these recommendations will be updated and revised.



**Table 1.1****Review of the Nutrient Intake Descriptors**

Descriptor	Definition
Dietary Reference Intake (DRI)	Umbrella term for all nutrient classifications, including RDA, EAR, AI, and UL.
Recommended Dietary Allowance (RDA)	Average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly an entire (i.e., 98%) healthy population. The established RDAs can vary based on life stage, including age; gender; and, if appropriate, pregnancy and lactation.
Estimated Average Requirement (EAR)	Daily intake level of a vitamin or mineral estimated to meet the requirements, as defined by a specified indicator of adequacy in half of the healthy individuals within a life stage or gender group.
Adequate Intake (AI)	Intake recommendation when insufficient scientific evidence is available to calculate an EAR/RDA. AI values are based on intake data of healthy individuals. However, the results of studies regarding the nutrient in question are not conclusive enough or more study is required before an EAR/RDA can be established.
Tolerable Upper Intake Level (UL)	The highest level of daily nutrient intake that poses no adverse health effects for almost all individuals in the general population. At intakes above the UL, the risk of adverse effects increases.

with Health Canada.<sup>1</sup> The definitions of the various DRIs are reviewed in **TABLE 1.1**.

## What are enriched and fortified foods?

When grains are milled, the germ and bran are removed. Because the germ and bran contain a majority of the vitamins and minerals in whole grains, the resulting refined product is less nutritious. Refined grain products include white flours, bread, pasta, rice, crackers, and cereals. To prevent deficiency diseases, the Food and Drug Administration (FDA) mandated in 1943 that the nutrients lost during the milling process of wheat, rice, and corn be replaced. The nutrients identified and thus added to refined grain products include thiamin, riboflavin, niacin,

**enrichment** The addition of vitamins and minerals to refined/processed products to increase their nutritional value.

**fortification** The process of adding vitamins or minerals to foods or beverages that did not originally contain them.

and iron. The addition of vitamins and minerals to refined products is termed **enrichment**.

**Fortification** is the addition of a vitamin or mineral to a food or beverage in which it was not originally present.

The first successful fortification program was the addition of iodine to salt in the 1920s to prevent goiter and other iodine deficiency conditions. In general, fortification is not required by the FDA, with the exception of folic acid in grains and vitamin D in milk. Other fortification programs are designed to enhance the quality of a product, such as the addition of vitamin A to milk and other dairy foods, as well as lysine to specific corn products to enhance protein quality. The food industry has the freedom to add any vitamin or mineral to a product. However, the FDA does require companies to show that a dietary insufficiency exists and therefore requires fortification in otherwise standardized products. Some products contain vitamins or minerals not naturally found in the food or beverage, such as added vitamin D and vitamin B<sub>12</sub> in soy



### Gaining the Performance Edge

Enrichment and fortification of foods and beverages are intended to help individuals meet their daily nutrient needs.

milk. Other products boost existing vitamin or mineral content, such as extra vitamin C added to orange juice. Sport supplements, such as bars and shakes, are highly fortified

with a variety of vitamins and minerals. Athletes should check labels to ensure that their total daily consumption of any vitamin or mineral is not in excess of upper dietary limits. For more information about enrichment and fortification, visit the FDA's website at [www.fda.gov](http://www.fda.gov).

## What are the basic nutrition guidelines?

The keys to healthful eating are to consume a diet that provides adequate nutrients to maintain health, includes a variety of foods, is balanced, and is consumed in moderation. Government agencies have developed several tools that provide general healthful eating guidelines that include balance, variety, and moderation to help the American population maintain or improve health. The Dietary Guidelines for Americans and the MyPlate<sup>2</sup> food guidance system are two such tools that convert scientific evidence into practical applications that Americans can use to eat more healthfully. These general guidelines are applicable to sedentary and athletic individuals alike.

### What are the Dietary Guidelines for Americans?

The Dietary Guidelines for Americans, developed jointly by the U.S. Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA), are revised and published every 5 years. The first Dietary Guidelines were published in 1980. The most recent version of the Dietary Guidelines for Americans was published in 2015.<sup>3</sup> The guidelines provide science-based advice for people age 2 years and older on dietary and physical activity habits that can promote health and reduce the risk for chronic illnesses and conditions such

as cardiovascular disease, diabetes, and hypertension. A healthful diet that is not excessive in calories, follows the nutrition recommendations contained in the guidelines, and is combined with physical activity should enhance the health of most individuals.

The primary purpose of the Dietary Guidelines is to provide the public with information about nutrients and food components that are known to be beneficial for health and to provide recommendations that can be implemented into an eating and exercise plan. The 2015–2020 Dietary Guidelines cover five interrelated themes. These themes and the key recommendations from the 2015–2020 Dietary Guidelines report are as follows (<http://health.gov/dietaryguidelines/2015/guidelines/executive-summary/>):<sup>3</sup>

### Themes

#### 1. **Follow a healthy eating pattern across the lifespan.**

All food and beverage choices matter. Choose a healthy eating pattern at an appropriate calorie level to help achieve and maintain a healthy body weight, support nutrient adequacy, and reduce the risk of chronic disease.

#### 2. **Focus on variety, nutrient density, and amount.** To meet nutrient needs within calorie limits, choose a variety of nutrient-dense foods across and within all food groups in recommended amounts.

#### 3. **Limit calories from added sugars and saturated fats and reduce sodium intake.** Consume an eating pattern low in added sugars, saturated fats, and sodium. Cut back on foods and beverages higher in these components to amounts that fit within healthy eating patterns.

#### 4. **Shift to healthier food and beverage choices.** Choose nutrient-dense foods and beverages across and within all food groups in place of less healthy choices. Consider cultural and personal preferences to make these shifts easier to accomplish and maintain.

#### 5. **Support healthy eating patterns for all.** Everyone has a role in helping to create and support healthy eating patterns in multiple settings nationwide, from home to school to work to communities.

### Key Recommendations

**Consume a healthy eating pattern that accounts for all foods and beverages within an appropriate calorie level.**

The Dietary Guidelines' Key Recommendations for healthy eating patterns should be applied in their entirety, given the interconnected relationship that each dietary component can have with others.

*A healthy eating pattern includes:*

- A variety of vegetables from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other
- Fruits, especially whole fruits
- Grains, at least half of which are whole grains
- Fat-free or low-fat dairy, including milk, yogurt, cheese, and/or fortified soy beverages

- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products

#### Oils

*A healthy eating pattern limits:*

- Saturated fats and trans fats, added sugars, and sodium

Key Recommendations that are quantitative are provided for several components of the diet that should be limited. These components are of particular public health concern in the United States, and the specified limits can help individuals achieve healthy eating patterns within calorie limits:

- Consumption of added sugars to less than 10% of calories per day
- Consumption of saturated fats to less than 10% of calories per day
- Consumption of sodium to less than 2,300 mg per day
- If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and up to two drinks per day for men—and only by adults of legal drinking age.

### Meet the Physical Activity Guidelines for Americans.

Americans of all ages—children, adolescents, adults, and older adults—should meet the *Physical Activity Guidelines for Americans* to help promote health and reduce the risk of chronic disease. Americans should aim to achieve and maintain a healthy body weight (see **FIGURE 1.1**). The



**Figure 1.1**  
Exercising regularly, combined with a diet that does not exceed calorie needs, helps manage weight.

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relationship between diet and physical activity contributes to calorie balance and managing body weight.

Although the Dietary Guidelines listed here were developed with the American population's health in mind, athletes can benefit from implementing the guidelines in their daily nutrition planning. By selecting a variety of nutrient-dense foods, as dictated in the guidelines, athletes can meet their energy, macronutrient, and micronutrient needs for a high level of sport performance. The MyPlate food guidance system can be used to further plan an athlete's daily food intake by practically applying the information in the Dietary Guidelines.

### What is the MyPlate food guidance system?

The USDA released the MyPlate food guidance system in 2011 ([www.ChooseMyPlate.gov](http://www.ChooseMyPlate.gov)). The USDA's Center for Nutrition Policy and Promotion, established in 1994, developed the MyPlate system to improve the nutrition and well-being of Americans. The MyPlate system (see **FIGURE 1.2**) is a revision of the MyPyramid that was released in 2005. The new icon was developed for two main purposes: (1) to improve the effectiveness in motivating consumers to make healthier food choices and (2) to incorporate the latest nutrition science information into the new system. MyPlate and the Dietary Guidelines for Americans complement each other and can provide basic guidelines and practical applications for healthful eating to improve health and well-being.

The MyPlate website encourages individuals to find their healthy eating style and build it throughout their lifetime. The website reminds individuals that every

food and beverage consumed matters. The right mix of foods and nutrients can help athletes be healthier now and in the future. Long-term health can be accomplished by:

- Focusing on variety, amount, and nutritional value of foods
- Choosing foods and beverages with less saturated fat, sodium, and added sugars
- Starting with small changes to build healthier eating styles
- Supporting healthy eating for everyone

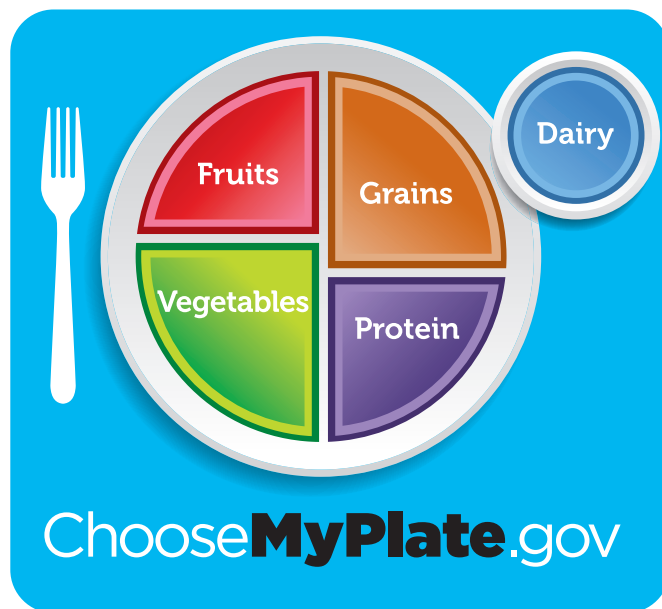
Graphically, the MyPlate food guidance system is a useful and intuitive way for athletes to eat well and improve their health. The MyPlate icon provides a visual representation of a balanced, nutritious meal. The icon is a plate split into four sections, each representing a different type of food (protein, whole grains, fruits, and vegetables). The sections vary in size depending on the recommended portion of each food an athlete should eat. A circle shape next to the plate represents dairy products, especially milk. Each of the food groups are further described in print and electronic format to help consumers make positive nutrition changes. The concepts and main messages in each food category are described briefly in the following paragraphs.

The key message in the grain group of MyPlate is that at least half of the total grains consumed should be from whole grain sources. The goal is to eat three or more ounce-equivalents of whole-grain products each day. Individuals who require more calories will need to consume more than this amount daily. Examples of whole grains include brown rice, bulgur, oatmeal, and whole wheat breads, crackers, and pastas. Consumers can check the food label for the words "whole grain" and the ingredient panel for the word "whole" or "whole grain" before the grain ingredient.

In the fruit group, MyPlate encourages not only consuming the recommended amount of fruit each day, but also consuming a wide variety of fruits. Fruits consumed fresh, canned, frozen, dried, or as 100% juice all count toward the fruit recommendation. However, MyPlate recommends focusing on whole fruits versus fruit juices. This recommendation is made because fruit juices tend to be more calorie dense and contain little fiber compared to whole fruits.

Similar to the fruit category, emphasis is placed not only on consuming enough vegetables daily, but also on choosing different vegetables throughout the week to obtain a greater variety of the nutrients provided from vegetables. The vegetables are listed in five subgroups based on nutrient content: dark green, orange, starchy, dry beans and peas, and other vegetables. The main consumer message with vegetables and fruits is to "make half of your plate vegetables and fruits."

The protein foods group includes items made from meat, poultry, fish, dry beans or peas, eggs, nuts, and seeds. The key concept for this group is to make choices



**Figure 1.2**  
**Anatomy of MyPlate.**

Courtesy of USDA.

that are low fat or lean when selecting meat and poultry. The dry beans and peas, including soy products, are part of this group as well as the vegetable group. Dry beans and peas are naturally low in fat and nutrient dense. Nuts, seeds, and some fatty fishes contain higher fat content, but these fats are from healthy oils and should be chosen frequently as a substitute for meat or poultry.

The dairy group of MyPlate contains liquid milk products, yogurt, cheeses, and many foods made from milk. The key concept for the dairy category is to consume three cups of fat-free or low-fat (1%) milk or an equivalent amount of yogurt or cheese per day. Foods made from milk that retain calcium after processing (such as cheese and yogurt) are part of this food group, but foods made from milk that do not contain appreciable calcium (such as cream cheese and butter) are not included in this group. Individuals who do not or cannot consume milk and milk products should consume dairy alternative products (soy, nut, or grain-based milk, yogurt, and cheese) and other calcium-rich foods daily.

A variety of different foods are part of the oils and empty calories categories of MyPlate. Please note that these categories are not food groups. Although Americans are encouraged to minimize sources of empty calories, some essential nutrients are provided by oils. The key concept in the oils category is to choose mainly monounsaturated and polyunsaturated fats contained in foods such as fish, nuts, seeds, and vegetable oils. Oils used in liquid form, such as canola, corn, olive, and sunflower, are considered unsaturated and are commonly used in cooking. Other foods that are composed primarily of oils include items such as mayonnaise, salad dressing, and soft margarine. Consumers should review the Nutrition Facts panel of these foods to ensure that no trans fats are present. Foods and beverages containing solid fats and added sugars are considered empty calories because they provide extra calories with few to no nutrients. Although small amounts of these foods can be included daily, most Americans are consuming far more than is healthy and therefore should focus on limiting their intake. Examples of empty calories include butter, shortening, desserts, and sodas.

Physical activity is not depicted in the MyPlate icon but is encouraged as part of a healthy lifestyle. The key message is to become less sedentary and to engage in regular physical activity. Physical activity includes movement that uses energy. Adults should engage in at least 2 hours and 30 minutes of aerobic physical activity at a moderate level each week or 1 hour and 15 minutes of aerobic physical activity at a vigorous level each week. For example, moderate or vigorous

activities include walking briskly, hiking, gardening/yard work, golf (walking and carrying clubs), weight training, bicycling, swimming, and aerobics. Physical activities that are not intense enough to meet the recommendations might include walking at a casual pace or doing light household chores.

To personalize a plan, individuals can go to [www.ChooseMyPlate.gov](http://www.ChooseMyPlate.gov)<sup>2</sup> and use the SuperTracker tool to get information that is specific to their needs for energy, nutrient composition, and physical activity level. **FIGURE 1.3** shows the food group recommendations, examples of foods that count for each food group, and nutrition tips for an individual requiring a 2000 calorie diet. This individualization is helpful because not all individuals at the same age and gender have the same physical activity level and energy needs.



**Figure 1.3**  
The SuperTracker tool allows individuals to get information that is specific to their needs for energy, nutrient composition, and physical activity level.

Courtesy of USDA.

### Food for Thought 1.1

#### ChooseMyPlate Diet Assessment

In this exercise, you will learn how to use the online SuperTracker dietary assessment tool as you analyze your personal diet.

The MyPlate website provides a wealth of information for consumers to apply healthful eating and exercise patterns into their daily lifestyle. Athletes can use the website tools to learn their personalized nutrient needs. Many athletes who train extensively daily will need a significantly higher number of calories than the average person. These additional calories should be consumed in nutrient-dense foods from the MyPlate food groups. In summary, MyPlate provides detailed guidelines for improving overall health, as well as athletic performance, with adequate daily nutrition and physical activity.

## How should athletes interpret the information on food labels?

The nutrition guidelines presented in this text are a combination of the current research in sports nutrition and the practical application of that knowledge. A large part of the practical portion is athletes' awareness of how the foods they eat contribute to their total daily needs. The food label (see **FIGURE 1.4**) provides athletes with credible and reliable nutrition information about various food and beverage products, ultimately empowering them to make wise food choices on a daily basis. However, some athletes find the food label confusing and difficult to



**Figure 1.4**  
Information on food labels. Federal regulations determine what can and cannot appear on food labels.

interpret. This section will provide a brief overview of the food label, the components that pertain directly to sports nutrition, and how to apply the label information to individual scenarios. A full report and explanation of the food label and associated regulations can be found at [www.fda.gov](http://www.fda.gov).

## Who created the food label regulations?

The **Food and Drug Administration (FDA)** is the governing body responsible for ensuring the safety of foods sold in the

**Food and Drug Administration (FDA)** The governing body responsible for ensuring the safety of foods sold in the United States. This includes oversight of the proper labeling of foods.

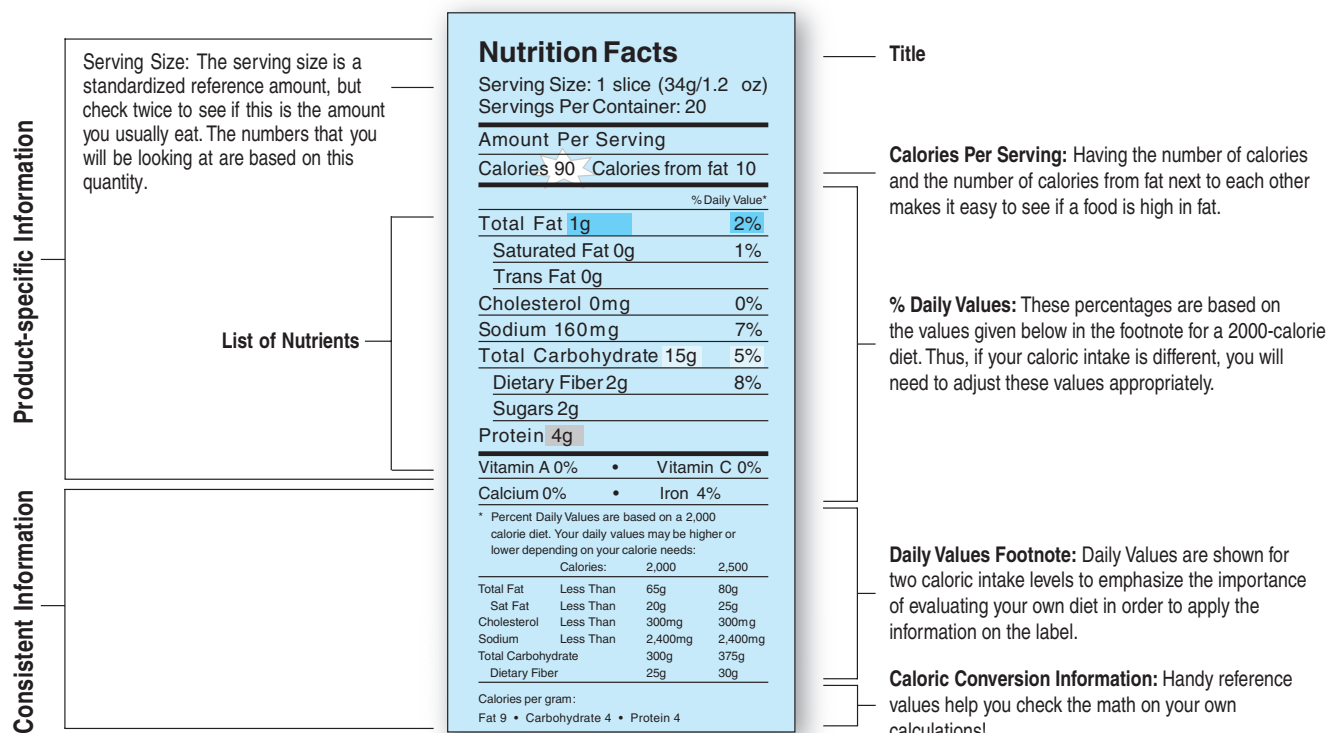
United States; this includes overseeing the proper labeling of foods. In 1990, Congress passed the Nutrition Labeling and Education Act (NLEA) based on the demand for consistent consumer information and labeling of all foods. The passage (1990) and implementation (1994) of the NLEA resulted in a series of changes on food packages. A nutrition label is now required on most food packages, with a few exceptions, such as small, individual food packages (modified label required) and meat products (governed by the USDA, therefore no labeling is required). The nutrition labeling of food products must follow specific FDA guidelines and include the following: (1) a statement of identity; (2) the net contents; (3) the name and address of the manufacturer, packer, or distributor; (4) an ingredient list; and (5) a Nutrition Facts panel. The statement of identity is prominently displayed on the front of the food label and gives the commonly used name or a descriptive title to the food contained within the package. Also on the front of the food label along the bottom edge, the net contents can be found. The net contents give the quantity of food within the package and are expressed in units of weight, volume, or numeric count. The name and address of the producer or distributor of the product is usually in the small print found beneath the list of ingredients. Contact information is important in case the athlete has further questions about the

**nutrient content claims** Nutrition-related claims on food labels that highlight certain characteristics of the food.

**health claim** A description placed on a food label that describes potential health benefits of a food or nutrient.

product or needs to report problems. The food label may also include FDA-approved **nutrient content claims** or **health claims** that highlight certain characteristics or potential benefits of the food. Finally, the list of ingredients and Nutrition Facts panel must be shown on the label. Each is discussed in the following sections.





**Figure 1.5**  
The Nutrition Facts panel.

### How can the ingredient list be useful to athletes?

An ingredients list is required on all foods that contain more than one ingredient. The ingredients must be listed in descending order of predominance in the product. The order of predominance is determined by weight, with the ingredient that weighs the most listed first and the one that weighs the least listed last. Athletes can use this nutrition tool to evaluate the nutrition quality of a product as well as to ensure that they avoid any food/additive to which they may be allergic or intolerant.

The nutrition quality of a product can be evaluated by the presence of a specific ingredient as well as the order of listed ingredients. For example, many athletes are instructed to increase their daily intake of fiber. Knowing that whole-grain products will contain more fiber than refined flour products, athletes can use the ingredients label to choose breads, muffins, bagels, and pastas that contain “whole wheat flour” versus “enriched white flour.” Another common example pertains to choosing a healthy cereal. Many cereals contain a large quantity of added refined sugars. By studying the order of ingredients on the label and choosing a brand that does not have “sugar,” “sucrose,” “corn syrup,” or other types of sugar in the first two or three ingredients, athletes can feel confident that they have chosen a lower-sugar, and potentially healthier, cereal.

### How can the nutrition facts panel be useful to athletes?

The Nutrition Facts panel informs consumers about the specific nutrient content of foods in quantifiable terms. Manufacturers must use the Nutrition Facts panel within the specified FDA guidelines and must provide accurate information about the nutrient content of the food. In May of 2016, the FDA updated labeling requirements; however, manufacturers will not have to be in full compliance with the new guidelines until July 2018. As a result, consumers will see both the current/original Nutrition Facts panel and the new version of the Nutrition Facts panel as manufacturers begin phasing in the required changes to their food labels. An example and description of the current/original Nutrition Facts panel are presented in **FIGURE 1.5**. Foods that are not required to carry a Nutrition Facts panel include delicatessen-style foods; fresh bakery products; foods that provide no significant nutrition, such as instant coffee and most spices; and multiunit packages. Smaller packages may require a modified Nutrition Facts panel, as shown in **FIGURE 1.6**.

Starting just below the Nutrition Facts heading on each food label, the following required components are all applicable to athletes:

- **Serving size and servings per container:** Athletes need to understand what counts as one serving. Often,



**Figure 1.6**  
Nutrition Facts panel on small packages. Food products that have small packages can use an abbreviated version of the Nutrition Facts panel.

athletes consider one package to be “one serving,” when in fact there could be multiple servings included in a container, as stated on the Nutrition Facts panel. Because the nutrition information is presented for one serving, athletes will need to multiply the nutrition information listed on the Nutrition Facts panel by the number of servings consumed to obtain an accurate estimate of total nutrient intake.

- **Calories and calories from fat:** Reviewing the calorie content of foods eaten throughout the day will enable athletes to ensure adequate total energy consumption. To obtain the percentage of calories from fat, the “calories from fat” can be divided by the total “calories” and then multiplied by 100. On the newly revised Nutrition Facts panel, “calories from fat” has been removed, thus it needs to be calculated. To do so, locate “total fat” on the panel and multiply the total fat in grams by 9. Athletes should aim for a diet that includes no more than 30–35% of total calories from fat, indicating it is low to moderate in fat. Calculating the percentage for each food chosen throughout the day can help athletes make healthy choices.
- **Total fat, saturated fat, and trans fat:** Fat is important in an athlete’s diet; however, it should be consumed in moderation. Athletes can compare different brands or types of food to find low- or moderate-fat options. Saturated and trans fats are detrimental to heart health; therefore, athletes should attempt to minimize their intake of these fats.
- **Cholesterol:** Cholesterol is not a required nutrient in the diet. Cholesterol is made in the body and therefore does not need to be consumed daily.
- **Sodium:** Classified as an electrolyte, sodium is an essential nutrient for athletes because it is lost in sweat. Sodium has also been linked to high blood pressure. Athletes should consume enough to meet their needs but avoid excessive intake.
- **Total carbohydrates, dietary fiber, and sugars:** Carbohydrates are the master fuel for all athletics and should compose a majority of an athlete’s diet. Dietary fiber plays a role in weight management and disease prevention and aids in the maintenance of blood sugar levels that deliver a consistent dose of energy to the body. The “dietary fiber” section on the Nutrition Facts

panel represents the total quantity of fiber present in a product but does not distinguish between soluble and insoluble fibers. The “sugar” category is a combination of naturally occurring and refined sugars. Because there is no distinction between naturally occurring and added refined sugars on the current nutrition facts panel, an athlete should review the ingredients list for the presence of fruits and fruit juices (naturally occurring sugars often accompanied by many other nutrients) or any refined sugar product (providing calories and carbohydrates but devoid of other nutritional value). There is no Percent Daily Value (%DV, discussed in the following section) for sugars because there are no RDA values or Daily Reference Values (DRVs) established specific to sugars. It should be noted that this has been changed on the newly revised Nutrition Facts panel that now must show “added sugars” and their %DV.

- **Protein:** The total quantity of protein, another indispensable nutrient for athletes, is provided on the Nutrition Facts panel.
- **Vitamins and minerals:** On the current Nutrition Facts panel only two vitamins (vitamins A and C) and two minerals (calcium and iron) are required on the food label. On the newly revised Nutrition Facts panel vitamin D and potassium are also required to be listed. Of course, all vitamins and minerals are important for athletes; however, these four nutrients are generally consumed in suboptimal quantities in the United States and therefore deserve special attention.
- **Daily Values footnote and calorie conversion:** The concept of Daily Values will be discussed in the following section. The calorie conversion information is a handy reference for athletes so that they can perform their own calculations based on individual needs and goals.

As noted earlier, the FDA has revised its guidelines for the Nutrition Facts panel and manufacturers will have to comply with the new labeling requirements by July 2018.

**FIGURE 1.7** shows a side-by-side comparison of the current and revised Nutrition Facts panels. While the basic look of the label remains similar, there are several feature changes that better highlight important consumer information. These feature changes include increases in the font size of “Calories”, “Servings Per Container”, and the “Serving Size”. Also the “Calories” and “Serving Size” have been bolded for further emphasis and easy location on the label. Finally, the footnote at the bottom of each Nutrition Facts panel has been revised to better explain what percent daily value means.

The revised labeling also includes some informational changes. Food manufacturer’s will not only have to continue to list the percent Daily Values for certain nutrients, they will also need to report the actual amounts of those nutrients in grams. In regard to vitamins and

Nutrition Facts			
Serving Size 2/3 cup (55g)			
Servings Per Container About 8			
Amount Per Serving			
Calories 230		Calories from Fat 40	
		% Daily Value*	
Total Fat	8g		12%
Saturated Fat	1g		5%
Trans Fat	0g		
Cholesterol	0mg		0%
Sodium	160mg		7%
Total Carbohydrate	37g		12%
Dietary Fiber	4g		16%
Sugars	1g		
Protein	3g		
Vitamin A			10%
Vitamin C			8%
Calcium			20%
Iron			45%
* 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

Nutrition Facts	
8 servings per container	
Serving size	2/3 cup (55g)
Amount per serving	
<b>Calories</b>	<b>230</b>
% Daily Value*	
<b>Total Fat</b> 8g	<b>10%</b>
Saturated Fat 1g	<b>5%</b>
Trans Fat 0g	
<b>Cholesterol</b> 0mg	<b>0%</b>
<b>Sodium</b> 160mg	<b>7%</b>
<b>Total Carbohydrate</b> 37g	<b>13%</b>
Dietary Fiber 4g	<b>14%</b>
Total Sugars 12g	
Includes 10g Added Sugars	<b>20%</b>
<b>Protein</b> 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 235mg	6%
* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.	

Figure 1.7

Side-by-side comparison of the current Nutrition Facts Label (left) to the newly revised label (right).

Reproduced from FDA. Changes to the Nutrition Facts Label. Retrieved from: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm>

minerals that must be listed on the label, Vitamin D and potassium have been added, while Vitamins A and C have been dropped from required listing to optional listing. Calcium and iron will continue to be required on the list of nutrients. The amount of “added sugar” will need to appear on the label along with its percent daily value. While the “Total Fat”, “Saturated Fat” and “Trans Fat” content will continue to be required information on the label, the “Calories from Fat” has been removed due to the fact that the calories from fat is not as important as the type of fat consumed.

Finally, serving sizes have been adjusted based on packaging size and what people are likely to eat in regard to amount consumed in one sitting, rather than what they are supposed to eat (i.e., a suggested serving size). In addition, products that are packaged with

more than one serving but that could be consumed in one sitting will be required to add a second column to indicate the amount of calories and contents per package (see **FIGURE 1.8**)

For the purposes of this book, the newly revised labeling guidelines will be used and referred to in subsequent chapters.

### How can the percent daily value be useful to athletes?

The Percent Daily Value (%DV) is listed on the food label for a variety of macronutrients, vitamins, and minerals. The %DV can be used to determine how a particular product meets an athlete’s needs as well as to compare the nutrient content of two different products. For example, the DV for cholesterol is less than 300 milligrams.



Nutrition Facts			
2 servings per container			
Serving size		1 cup (255g)	
Calories	Per serving	Per container	
	110	220	
	% DV*	% DV*	
<b>Total Fat</b>	5g 6%	10g	13%
Saturated Fat	2g 10%	4g	20%
Trans Fat	0g	0g	
<b>Cholesterol</b>	15mg 5%	30mg	10%
<b>Sodium</b>	240mg 10%	480mg	21%
<b>Total Carb.</b>	35g 13%	70g	25%
Dietary Fiber	6g 21%	12g	43%
Total Sugars	7g	14g	
Includes Added Sugars	4g 8%	8g	16%
<b>Protein</b>	9g	18g	
Vitamin D	5mcg 25%	10mcg	50%
Calcium	200mg 15%	400mg	30%
Iron	1mg 6%	2mg	12%
Potassium	470mg 10%	940mg	20%

\* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Figure 1.8

An example of the newly revised Nutrition Facts label on a packaged food product that contains more than one serving, and is packaged in such a way that the entire contents could be eaten in one sitting.

Reproduced from FDA. Changes to the Nutrition Facts Label. Retrieved from: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm>

The %DV represents what percentage of the daily total is provided in one serving of a product. If the product provides 100 milligrams of cholesterol, the %DV will be 33%, because 100 is one-third of 300. The overall concept is that athletes can tally up the percentages of all foods consumed throughout the day and aim for a grand total of 100%, indicating that all needs have been met. However, the caveat is that the %DV is based on the needs of an individual following a 2000-calorie diet. Many athletes require substantially more than 2000 calories daily, and therefore obtaining 100% of all nutrients may not necessarily be adequate. The Daily Values footnote, listed on most current Nutrition Facts panels, presents additional information for those following a 2500-calorie diet; however, even the 2500-calorie goals may not be enough for most athletes. In general, athletes may find it easier to know their individual daily needs and evaluate a product based on their own goals versus the %DV goals. TABLES 1.2 and 1.3 summarize the reference

Table 1.2

## Daily Values on Food Labels

Food component	2000 kcal intake
Fat	65 g
Saturated fat	20 g
Protein	50 g
Cholesterol	300 mg
Carbohydrates	300 g
Fiber	25 g
Sodium	2400 mg

Data from U.S. Food and Drug Administration. Available at: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm064928.htm>.

amounts used to develop the %DV for macronutrients and micronutrients.

Whether or not the %DV can be useful for an athlete's individual needs, it can be used to compare the nutrient density of various products. As an example, athletes who need to consume more iron can look at the %DV of several brands of cereal and know that the brand with the highest %DV for iron contains the greatest total quantity of iron, therefore making that brand the best choice. The benefit of this type of comparison is that athletes are not required to memorize how much iron they need in a day; they merely need to look for the product with the highest percentage (highest %DV). See FIGURE 1.9 for an example of this type of comparison.

### How can nutrient content claims be useful to athletes?

In addition to the Nutrition Facts section, the NLEA of 1990 included guidelines for food manufacturers to place nutrition-related claims on food labels. These claims highlight certain characteristics of the food and are called *nutrient content claims*. Foods can be labeled with claims such as “low fat,” “reduced sugar,” or “high in fiber” only if they meet certain criteria. The definitions of the approved nutrient content claims are presented in **Fortifying Your Nutrition Knowledge**. These nutrition descriptor statements allow athletes to quickly identify the products that meet their individual needs or dietary goals. For example, if an athlete has high cholesterol levels, a product labeled “cholesterol free” would be easily identifiable.

Currently, there are no approved regulations on nutrition descriptors or content claims regarding total carbohydrates. Because of the growing trend of consumers choosing low-carbohydrate foods in hopes of losing weight, food manufacturers are placing terms such as “low carb” and “net carbs” on food labels. The FDA is currently gathering evidence and developing a statement

**Table 1.3****Daily Values for Athletes Older Than 4 Years**

Food component	Daily value
Protein	50 g
Vitamin A	5000 IU <sup>a</sup>
Vitamin D	400 IU
Vitamin E	30 IU
Vitamin K	80 µg <sup>b</sup>
Vitamin C	60 mg
Folate	400 µg
Thiamin	1.5 mg
Riboflavin	1.7 mg
Niacin	20 mg
Vitamin B <sub>6</sub>	2 mg
Vitamin B <sub>12</sub>	6 µg
Biotin	300 µg
Pantothenic acid	10 mg
Calcium	1000 mg
Phosphorus	1000 mg
Iodine	150 µg
Iron	18 mg
Magnesium	400 mg
Copper	2 mg
Zinc	15 mg
Chloride	3400 mg
Manganese	2 mg
Selenium	70 µg
Chromium	120 µg
Molybdenum	75 µg

<sup>a</sup>IU = international units

<sup>b</sup>µg = micrograms

Note: Some DVs are based on old DRI values and thus may not reflect current recommendations.

Data from U.S. Food and Drug Administration. Available at: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm064928.htm>.

outlining carbohydrate food-labeling guidelines. Guidelines are likely to be similar to those established for such terms as “low fat” or “reduced sugar.” In the meantime, athletes should recognize that carbohydrates are the master fuel for athletics, and therefore products touting a lower carbohydrate content may not be an ideal choice.

### How can health claims be useful to athletes?

Health claims describe the potential health benefits of a food or nutrient. The FDA strictly regulates allowable health claims on food labels and allows only health

claims that have been well supported in the scientific literature. To date, the following health claims have been approved ([www.fda.gov](http://www.fda.gov)):

1. *Calcium and osteoporosis*: Adequate calcium may reduce the risk of osteoporosis.
2. *Sodium and hypertension (high blood pressure)*: Low-sodium diets may help lower blood pressure.
3. *Dietary fat and cancer*: Low-fat diets decrease the risk for some types of cancer.
4. *Dietary saturated fat and cholesterol and the risk of coronary heart disease*: Diets low in saturated fat and cholesterol decrease the risk for heart disease.
5. *Fiber-containing grain products, fruits, and vegetables and cancer*: Diets low in fat and rich in high-fiber foods may reduce the risk of certain cancers.
6. *Fruits, vegetables, and grain products that contain fiber, particularly soluble fiber, and the risk of coronary heart disease*: Diets low in fat and rich in soluble fiber may reduce the risk of heart disease.
7. *Fruits and vegetables and cancer*: Diets low in fat and rich in fruits and vegetables may reduce the risk of certain cancers.
8. *Folate and neural tube defects*: Adequate folate status before and early in pregnancy may reduce the risk of neural tube defects (a birth defect).
9. *Dietary noncariogenic carbohydrate sweeteners and dental caries (cavities)*: Foods sweetened with sugar alcohols, D-tagatose, and sucralose do not promote tooth decay.
10. *Soluble fiber from certain foods and risk of coronary heart disease*: Diets low in fat and rich in these types of fiber can help reduce the risk of heart disease.
11. *Soy protein and risk of coronary heart disease*: Foods rich in soy protein as part of a low-fat diet may help reduce the risk of heart disease.
12. *Plant sterol/stanol esters and risk of coronary heart disease*: Diets low in saturated fat and cholesterol that also contain several daily servings of plant stanols/sterols may reduce the risk of heart disease.
13. *Whole-grain foods and risk of heart disease and certain cancers*: Diets high in whole-grain foods and other plant foods and low in total fat, saturated fat, and cholesterol may help reduce the risk of heart disease and certain cancers.
14. *Potassium and the risk of high blood pressure and stroke*: Diets that contain good sources of potassium may reduce the risk of high blood pressure and stroke.
15. *Fluoridated water and reduced risk of dental caries*: Drinking fluoridated water may reduce the risk of dental caries or tooth decay.

### Food for Thought 1.2

#### Reading Food Labels

In this exercise, you will locate various pieces of key information on the food label and use it to interpret the nutritional value of a food.



Nutrition Facts		
18 servings per container		
Serving size	1 cup (28g)	Nutrition
Amount per serving		
<b>Calories</b>	100	140
% Daily Value*		
<b>Total Fat</b> 0g	0%	0%
Saturated Fat 0g	0%	0%
Trans Fat 0g		
<b>Cholesterol</b> 0mg	0%	0%
<b>Sodium</b> 300mg	13%	15%
<b>Total Carbohydrate</b> 24g	8%	10%
Dietary Fiber 1g	4%	4%
Total Sugars 23g		
Includes 10g Added Sugars	20%	
<b>Protein</b> 3g		
Vitamin D 2mcg	10%	25%
Calcium 0mg	0%	15%
Iron 9mg	45%	45%
Potassium 25mg	25%	7%
* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.		


Nutrition Facts		
15 servings per container		
Serving size	1 cup (30g)	Nutrition
Amount per serving		
<b>Calories</b>	60	100
% Daily Value*		
<b>Total Fat</b> 1g	2%	2%
Saturated Fat 0g	0%	0%
Trans Fat 0g		
<b>Cholesterol</b> 0mg	0%	1%
<b>Sodium</b> 125mg	5%	8%
<b>Total Carbohydrate</b> 24g	8%	10%
Dietary Fiber 13g	52%	52%
Total Sugars 11g		
Includes 0g Added Sugars	0%	
<b>Protein</b> 4g		
Vitamin D 2mcg	0%	10%
Calcium 78mg	6%	20%
Iron 5mg	25%	25%
Potassium 230mg	7%	12%
* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.		

Figure 1.9

Comparing iron content of two cereals. These labels are from two different breakfast cereals: (left) cornflakes and (right) wheat bran. Comparing the iron content of both cereals is easy using the Percent Daily Values of each.

16. Saturated fat, cholesterol, and trans fat, and reduced risk of heart disease: Replacing saturated fat with similar amounts of unsaturated fats may reduce the risk of heart disease. To achieve this benefit, total daily calories should not increase.

New health claims can be approved at any time based on scientific evidence, and, therefore, this list may expand in the future.



**Gaining the Performance Edge**

The food label can be very helpful to athletes choosing to follow a more healthful diet. Athletes should review all the information on the Nutrition Facts panel as well as the ingredients list to aid in making informed food and beverage choices. Nutrient content claims and health claims identify products that might be appealing to individual athletes based on their nutrition goals and needs; however, these statements should not take the place of reviewing the Nutrition Facts panel and ingredients list.

## What are the factors to consider when developing an individualized sports nutrition plan for athletes?

As mentioned earlier, one of the exciting aspects of the field of sports nutrition is individualizing eating plans for athletes. Each athlete is different—there is no “one-size-fits-all” type of meal plan, training diet, or competition hydration schedule. Certainly the basic sports nutrition concepts and guidelines can be applied universally; however, each athlete will require a unique approach by tweaking those guidelines to fit individual needs. For example, all athletes should consume a combination of carbohydrates and protein after exercise to initiate the repair and rebuilding process. However, one athlete may enjoy a turkey sandwich with a banana, whereas another athlete may crave an omelet, toast, and orange juice. Both of these meals meet the carbohydrate–protein combination requirement but also take into consideration personal taste preferences. This individualized approach is much more challenging and requires a greater breadth of knowledge than “cookie-cutter” plans. Sports nutrition



professionals with this philosophy will succeed because of the recognition that their plans are based on solid research and current guidelines while also being practical, easy to implement, and specific to an athlete's sport and lifestyle.

Several factors must be considered when calculating nutrient needs and developing a meal plan for an athlete, including the individual's health history, the bioenergetics of the athlete's sport, total weekly training and competition time, living arrangements, access to food, and travel schedules.

### Why should a sports nutrition plan consider an athlete's health history?

First and foremost, an athlete must be healthy to train and compete to his or her potential. Proper nutrition plays a vital role in preventing deficiency and degenerative diseases, while also aiding in the treatment of existing medical conditions. An athlete's health history must be the "team captain" in the sports nutrition game plan, with sport-specific planning, training/competition schedules, living arrangements, and personal preferences rounding out the starting lineup.

## Fortifying Your Nutrition Knowledge



### Approved Nutrient Content Claims

**Free:** Food contains no amount (or trivial or "physiologically inconsequential" amounts). May be used with one or more of the following: fat, saturated fat, cholesterol, sodium, sugar, and calorie. Synonyms include *without*, *no*, and *zero*.

**Fat-free:** Less than 0.5 g of fat per serving.

**Saturated fat-free:** Less than 0.5 g of saturated fat and less than 0.5 g trans fat per serving.

**Cholesterol-free:** Less than 2 mg of cholesterol per serving.

**Sodium-free:** Less than 5 mg of sodium per serving.

**Sugar-free:** Less than 0.5 g of sugar per serving.

**Calorie-free:** Fewer than 5 calories per serving.

**Low:** Food can be eaten frequently without exceeding dietary guidelines for one or more of these components: fat, saturated fat, cholesterol, sodium, and calories. Synonyms include *little*, *few*, and *low source of*.

**Low fat:** 3 g or less per serving.

**Low saturated fat:** 1 g or less of saturated fat; no more than 15% of calories from saturated fat.

**Low cholesterol:** 20 mg or less per serving.

**Low sodium:** 140 mg or less per serving.

**Very low sodium:** 35 mg or less per serving.

**Low calorie:** 40 calories or less per serving.

**High, Rich in, Excellent source of:** Food contains 20% or more of the Daily Value for a particular nutrient in a serving.

**Good source, Contains, Provides:** Food contains 10–19% of the Daily Value for a particular nutrient in one serving.

**Lean and Extra lean:** The fat content of meal and main dish products, seafood, and game meat products.

**Lean:** Less than 10 g fat, 4.5 g or less saturated fat, and less than 95 mg of cholesterol per serving and per 100 g.

**Extra lean:** Less than 5 g fat, less than 2 g saturated fat, and less than 95 mg of cholesterol per serving and per 100 g.

**Reduced, Less:** Nutritionally altered product containing at least 25% less of a nutrient or of calories than the regular or reference product. (Note: A "reduced" claim can't be used if the reference product already meets the requirement for "low.")

**Light:** This descriptor can have two meanings:

1. A nutritionally altered product contains one-third fewer calories or half the fat of the reference food. If the reference food derives 50% or more of its calories from fat, the reduction must be 50% of the fat.
2. The sodium content of a low-calorie, low-fat food has been reduced by 50%. Also, light in sodium may be used on a food in which the sodium content has been reduced by at least 50%.

**Note:** "Light" can still be used to describe such properties as texture and color as long as the label clearly explains its meaning (e.g., light brown sugar or light and fluffy).

**More, Fortified, Enriched, Added, Extra, Plus:** A serving of food, whether altered or not, contains a nutrient that is at least 10% of the Daily Value more than the reference food. May only be used for vitamins, minerals, protein, dietary fiber, and potassium.

**Healthy:** A healthy food must be low in fat and saturated fat and contain limited amounts of cholesterol ( $\leq 95$  mg) and sodium ( $\leq 480$  mg for individual foods and  $\leq 600$  mg for meal-type products). In addition, a single-item food must provide at least 10% or more of one of the following: vitamins A or C, iron, calcium, protein, or fiber. A meal-type product, such as a frozen entrée or dinner, must provide 10% of two or more of these vitamins or minerals, or protein, or fiber, in addition to meeting the other criteria. Additional regulations allow the term *healthy* to be applied to raw, canned, or frozen fruits and vegetables and enriched grains even if the 10% nutrient content rule is not met. However, frozen or canned fruits or vegetables cannot contain ingredients that would change the nutrient profile.

**Fresh:** Food is raw, has never been frozen or heated, and contains no preservatives. *Fresh frozen*, *frozen fresh*, and *freshly frozen* can be used for foods that are quickly frozen while still fresh. Blanched foods also can be called fresh.

**Percent fat free:** Food must be a low-fat or a fat-free product. In addition, the claim must reflect accurately the amount of nonfat ingredients in 100 g of food.

**Implied claims:** Implied claims suggest that a nutrient is absent or present in a certain amount or suggests a food may be useful in maintaining healthy dietary practices. These claims are prohibited when they wrongfully imply that a food contains or does not contain a meaningful level of a nutrient. For example, a product cannot claim to be made with an ingredient known to be a source of fiber (such as "made with oat bran") unless the product contains enough of that ingredient (in this case, oat bran) to meet the definition for "good source" of fiber. As another example, a claim that a product contains "no tropical

oils" is allowed, but only on foods that are "low" in saturated fat, because consumers have come to equate tropical oils with high levels of saturated fat.

*Source:* Reproduced from Food and Drug Administration. Food Labeling and Nutrition: Nutrient Content Claims Definitions and Approved Claims. Available at: <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm2006828.htm>.

For example, an athlete with diabetes must carefully balance his or her intake of carbohydrates with daily doses of insulin to prevent hyper- or hypoglycemia. Whereas most athletes would not think twice about drinking a large glass of juice in the morning before a workout, a diabetic athlete consuming only juice (a carbohydrate source without a protein source to stabilize the digestion of food and blood sugar levels) may experience blood sugar swings that can potentially affect performance. In addition to performance in a single workout, long-term poor blood sugar management can lead to a plethora of associated medical conditions later in life. An athlete's health history must be considered first and then, subsequently, recommendations can intertwine with sport-specific suggestions.

### Why should a sports nutrition plan consider a sport's bioenergetics and logistics?

Energy metabolism is the foundation of sports nutrition. Consideration of the cellular machinery and metabolic pathways responsible for making the energy needed to participate in a specific sport is critical for the development of an individualized eating plan. For example, the calorie, macronutrient, and micronutrient needs of a football player (intermittent exertion over the course of several hours) will be different from the needs of a rower (continuous effort for typically less than 10–20 minutes). Even within one sport, such as running, different events (100-meter sprint versus a marathon) will highlight various energy systems (short, intense effort versus sustained moderate effort). In addition to the bioenergetics of a sport, nutrition plans for athletes must also consider the logistics of training sessions and competitions. Some sports are very conducive to drinking and eating during activity (biking), whereas other sports make fluid and energy consumption difficult (open water swimming). Sports nutrition professionals must devise plans that are specific to the energy systems utilized during training and competition as well as realistic to the nature of an athlete's sport.

### Why should a sports nutrition plan consider an athlete's total weekly training and competition time?

Athletes can range from the weekend warrior to the full-time professional. Each athlete will dedicate a period of

time each day to training and competition. Obviously, the athletes who are more active will have greater energy and nutrient needs. However, it is not always as simple as telling highly active athletes to "eat more." Many athletes struggle to meet their daily needs because of the time constraints of meal planning and preparation, as well as short periods of time between workouts, work, school, and other life commitments. Sports nutrition professionals need to be creative in helping athletes to determine how to consume adequate amounts of energy and nutrients while making meal planning easy, convenient, and quick.

A sports nutrition plan also includes the development of a fueling and hydration schedule for training and competition. The timing of meals and snacks must be strategically scheduled to provide enough time for food to digest before training sessions and to prevent too much time from elapsing after training. Fluid requirements vary considerably among athletes. Therefore, the construction of a hydration schedule is individualized for the athlete and specific to the sport. The energy and nutrients consumed before, during, and after exercise are part of an overall daily sports nutrition plan that can literally make or break an athlete's performance. The more time an athlete spends training each week, the more strategic planning needs to occur to create an appropriate, individualized regimen (see **FIGURE 1.10**).



#### Gaining the Performance Edge

Individualization in nutrition planning for athletes is essential for success as a sports nutrition professional. Standardized plans will contribute to the great success of some athletes, while leaving others on the sidelines. Incorporating factors such as an athlete's health history, the bioenergetics and logistics of the sport, weekly training/competition time, living arrangements, access to food/beverages, and travel schedules into an individualized nutrition program will ultimately lead to the athlete's success and peak performance.

### Why should a sports nutrition plan consider an athlete's living arrangements, access to food, and travel schedule?

A perfectly calculated nutrition plan is worthless if the athlete cannot execute the plan because of a lack of control over the foods available to him or her on a daily basis. For example, a college athlete who lives in a dorm is at the mercy of what is served in the university cafeterias. Therefore, the cafeteria menus should be built into the sports nutrition plan for this athlete. Sports nutrition professionals must fully understand each athlete's living arrangements and access to food before developing an individualized program.



**Figure 1.10**

Athletes may travel to events and stay at the competition venue for several hours or all day. Athletes need to plan ahead to fuel and hydrate adequately throughout the event day.

Access to food can also be a factor before, during, or after competitions. Many athletes are required to eat with the team at their training table before a game, thereby limiting their food choices to what is provided for the team. Recreational athletes who are participating in weekend events, such as running or walking road races, often must rely on the products supplied on the course for hydration and fueling. Developing an appropriate race day plan for these athletes involves investigating the foods and beverages available on the course and then planning for the athletes to practice with these specific items throughout training to prevent any surprises on race day. Consuming the optimal blend of nutrients after exercise is also of great importance. Each athlete will vary in his or her ability to pack a postexercise snack or decipher the most appropriate food/beverage option from a buffet of available items.

Proper nutrition while traveling is a challenge for everyone—athletes and nonathletes alike. Travel forces individuals to change their routine, sometimes wreaking havoc on an athlete's good intentions and typical nutrition habits. Athletes must be educated on how to make healthy choices and appropriate substitutions while on the road. Creative planning, packing nonperishable foods for the trip, and learning to be flexible will help athletes remain optimally fueled while traveling.

## How can sports nutrition knowledge be converted into practical applications?

One of the biggest challenges facing all health promotion professionals is helping people make permanent behavior changes. When working with individuals, possessing “book” knowledge is only one part of the equation; professionals must know how to assess a person's readiness for change, engage in active listening, and then provide the appropriate information or guidance. This process is particularly applicable to counseling athletes on dietary changes to improve performance. Not only should meal plans be based on individual needs, but the construction of the plans also must take into consideration the athlete's preparedness for change. One tool that can be used to counsel athletes is the Transtheoretical Model,<sup>4</sup> which assesses a person's readiness for change.

The skill of active listening can be a powerful tool for helping athletes initiate change. Athletes want to know that a sports nutrition professional cares about them, their performance, and their capabilities for change. Sports nutrition professionals should refrain from developing a “dictatorship” where athletes simply sit quietly and listen to

the dietary changes they “need” to make to improve their performance and/or health. Instead, athletes should be active participants in their meal planning and goal setting. Food selections should be based on an athlete's likes and dislikes versus which foods are “best” for them—if an athlete does not enjoy the foods in

the established meal plan, adherence will be poor. Goals should be realistic and manageable to plant the seeds for success and accomplishment that will motivate athletes to continue working on healthy eating behaviors. Listen to athletes—know their goals, questions, and concerns—and then build an individualized plan that is mutually acceptable and productive.



### Gaining the Performance Edge

Knowing the current sports nutrition research, established dietary guidelines, and performance-enhancing recommendations is not enough; sports nutrition professionals must be skilled in helping athletes convert the sports nutrition knowledge into practical, daily guidelines for food and beverage intake.

### Food for Thought 1.3



#### You Are the Nutrition Coach

Practically apply the concepts from this chapter to several case studies.



# The Box Score

## Key Points of Chapter

- Sports nutrition can be defined as the conversion of nutrition knowledge into a practical daily eating plan focused on providing the fuel for physical activity, facilitating the repair and rebuilding process following hard physical work, and optimizing athletic performance in competitive events, while also promoting overall health and wellness.
- In this text, the term *athlete* refers to any individual who is regularly active, ranging from the fitness enthusiast to the competitive amateur or professional.
- Sports nutrition professionals must have a command of general nutrition and exercise science, understand how nutrition and physical training are intertwined, and practice the practical application of sports nutrition knowledge.
- The area of sports nutrition is a growing field, with many opportunities for a rewarding and exciting career.
- Foods and beverages are composed of six nutrients that are vital to the human body for producing energy, contributing to the growth and development of tissues, regulating body processes, and preventing deficiency and degenerative diseases. The six nutrients are carbohydrates, proteins, fats, vitamins, minerals, and water.
- The body derives its energy from carbohydrates, fats, and proteins, which are collectively known as the energy nutrients. Their breakdown within the cells of the body provides the energy to make ATP, which is the body's direct source of energy for not only sport performance, but also all biological work.
- The Dietary Reference Intakes were developed to expand on the Recommended Dietary Allowance values and to set new recommendations for nutrients that did not have an RDA. The DRIs identify the reference amount of a specific nutrient needed for individuals to prevent deficiency conditions in generally healthy individuals. The DRIs include the RDA, EAR, AI, and UL for each vitamin, mineral, and macronutrient.
- Processing of foods often destroys or removes vitamins. Enrichment is a process by which vitamins are restored to foods after processing. Fortification is another way to improve the nutrient value of foods. It involves adding vitamins or minerals to foods in which the vitamins or minerals were not originally present.
- The 2015–2020 Dietary Guidelines for Americans emphasize the fact that nutrition choices and physical activity interact to improve health and prevent chronic conditions. The guidelines focus on making smart choices from all food groups, balancing food intake with physical activity to maintain weight, and choosing nutrient-dense foods.
- MyPlate, along with the 2015–2020 Dietary Guidelines for Americans, encourages individuals to make better food choices. The MyPlate icon provides a visual representation of a balanced, nutritious meal.
- The food label allows athletes to obtain credible and reliable nutrition information about various food and beverage products, ultimately empowering them to make wise food choices on a daily basis.
- Developing an individualized sports nutrition plan for athletes involves considering the individual's health history, the bioenergetics and logistics of the athlete's sport, total weekly training and competition time, living arrangements, access to food, and travel schedules.
- When working with athletes, possessing “book” knowledge is only one part of the equation; professionals must know how to assess a person's readiness for change, engage in active listening, and then provide the appropriate information or guidance.
- Sports nutrition professionals should listen closely to the goals, questions, and concerns of athletes and then build an individualized nutrition plan that is mutually acceptable and productive. Athletes should be active participants in their meal planning and goal setting.

## Study Questions

1. What is sports nutrition? Is it applicable only to competitive athletes? Defend your answer.
2. What are the six nutrient categories? Which nutrients are termed the “energy nutrients”?
3. What is the difference between Dietary Reference Intake (DRI) and Recommended Dietary Allowance (RDA)? What do EAR, AI, and UL stand for?
4. What do the terms *enriched* and *fortified* mean? How are they different?
5. What information can be learned about a food from its food label?
6. What is the MyPlate food guidance system? In what ways does it apply to sports nutrition?
7. When developing an individualized nutrition plan for an athlete, what factors must be taken into consideration?

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