NUTRITION

for Foodservice and Culinary Professionals

Ninth Edition

KAREN EICH DRUMMOND & LISA M. BREFERE

WILEY

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Ed.D., R.D.N., L.D.N., F.A.N.D., F.M.P. C.E.C., A.A.C.

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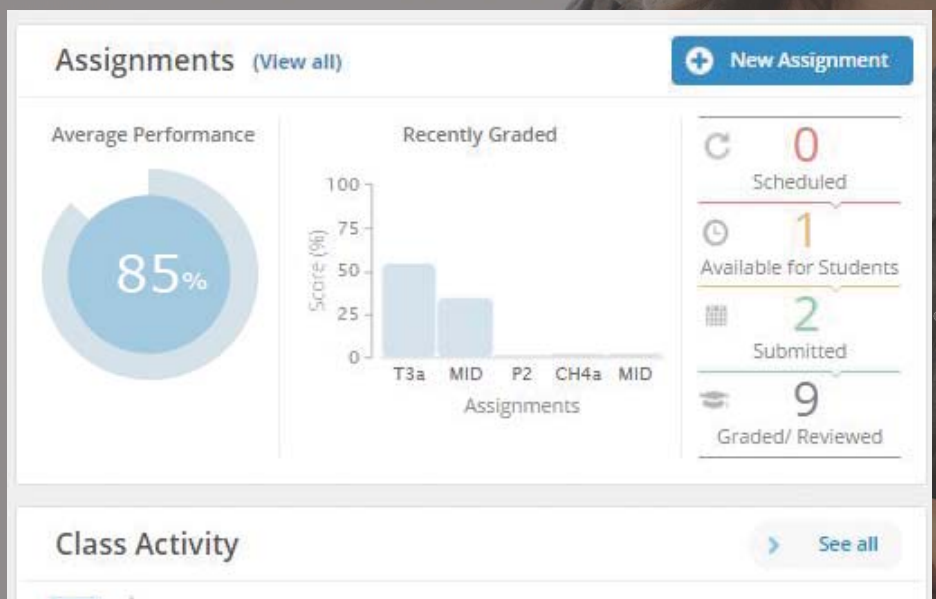

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In memory of my parents, Frank and Doris Eich.

KAREN EICH DRUMMOND

To my husband, Joe, and
my four children, Joe Jr., Julia, John, and Jeremy.

Thank you for inspiring and motivating my passion for wholesome, balanced, and pure cooking through moderation in ingredients and without compromising taste, flavor, presentation, or satisfaction. The kitchen is truly the hub of our family.

LISA M. BREFERE

Contents

Preface

Nutrition for Foodservice and Culinary Professionals, Ninth Edition, is written for students in culinary programs, as well as those in hotel, restaurant, and onsite management programs. Practicing culinary and management professionals will find it useful as well. As with previous editions, this is meant to be a practical how-to book tailored to the needs of students and professionals.

Nutrition is constantly in the news, with reports on how to lose weight, choose good fats, eat vegetarian foods, and many more topics being streamed on the Internet 24/7 and reported by other media as well. Hectic lifestyles force many people to eat out or get take-out meals several times a week. As a foodservice professional, you have a responsibility to your clients to understand contemporary cooking techniques that are balanced, moderate in rich ingredients, well prepared, and, of course, great tasting. You have a captive audience of people who depend on the chefs, cooks, and foodservice employees to prepare nutritious foods for them with the balance they require to maintain their current lifestyles.

This book is written to help you use nutritional principles to examine your own diet as well as evaluate and modify menus and recipes and respond knowledgeably to customers' questions and needs. As in the previous editions, co-author Lisa Brefere, C.E.C., A.A.C., lends her firsthand experiences applying nutrition to selecting, cooking, and menuing balanced foods in restaurants and food services.

WHAT'S NEW FOR THE NINTH EDITION

Each chapter of this book has been revised and updated using current nutrition and culinary knowledge and applications. Some major changes are noted below.

Latest nutrition news:

- The new 2015 Dietary Guidelines for Americans are included.
- The new food label to start in January 2018 is displayed, and its new features are discussed.
- Nutrition labeling in restaurants is also explained.

Overall changes:

- The text is more conversational and easier for students to read and understand.
- Many new photographs have been added to help students understand and review key concepts. For example, a chart shows the six classes of nutrients with photos of representative foods from each nutrient group.
- The "Hot Topics," which used to appear at the end of the chapters, are now incorporated into the chapters. This way, students won't miss important content such as sustainable food systems or weight loss myths.
- Chapters 1–8 have been streamlined to keep related topics together. For example, in the Carbohydrates chapter, the section on sugars includes sweeteners, low- or no-kcalorie sweeteners, and dietary recommendations for sugars.

Changes by chapter:

- Chapter 1: There is a new section, "Nutrition and Food Terms to Know," to make sure students are familiar with important terms, such as processed food or organic food, from the start. Also, sustainable food systems are discussed in detail in this chapter. New photographs show chefs, such as Daniel Humm, involved in farm-to-table activities. The chapter ends with a discussion of how to find reliable nutrition and health information.
- Chapter 2: New Dietary Guidelines for Americans (2015), changes to food labels, and nutrition labeling in restaurants are explained.
- Chapter 3–5 (Carbohydrates, Fat, Protein): In the carbohydrates chapter, a new chart with photos shows how much fiber is in different food groups. Likewise, in the fat chapter, a new chart with photos shows how much fat is in various food groups. New charts (with photos) in each of these chapters show ten ways to eat healthy carbohydrates, fats, and proteins. A new Question and Answer format in Chapter 5 introduces vegetarian eating to students.
- Chapters 6 and 7 (Vitamins, Water and Minerals): A chart at the end of each chapter summarizes the functions and sources of the vitamins or minerals. The Culinary Focus on fruits and vegetables in Chapter 6 has been expanded, with a new graphic showing how to store fruits and vegetables in a walk-in refrigerator.
- Chapter 8 (Building Flavor and Balanced Baking): The herb and spice charts have been updated and expanded, and now include photos. The chapter has been reorganized to show 10 ingredient groups, 10 preparation techniques, and 9 cooking methods to build flavor. Balanced baking is discussed at the end of chapter and includes new material and an expanded chart on baking substitutions.
- Chapters 9 (Recipe Makeovers) and 10 (Balanced Menus): More recipe makeovers and new culinary techniques and ideas are included, as well as new photos.
- Chapter 12 (Weight Management): The section on behavior modification has been expanded with a new summary chart. Also, new research on the 3500-kcalorie rule (you can lose one pound by eating 3500 fewer kcalories per week) is discussed.

ORGANIZATION

The Ninth Edition of *Nutrition for Foodservice and Culinary Professionals* is organized into three major parts, beginning with an introduction to nutrition and foods, then advice on developing healthy recipes and menus, and finally more on applying nutrition.

- **Part I: Fundamentals of Nutrition and Foods** (Chapters 1–7) consists of two introductory chapters, followed by five chapters on the nutrients. The first two chapters introduce basic nutrition concepts and explain how to use MyPlate, the Dietary Guidelines for Americans (2015), and food labels when planning menus. The next chapters focus on the nutrients: carbohydrates, fats, proteins, vitamins, water, and minerals.
- **Part II: Balanced Cooking and Menus** (Chapters 8–10) begins with a chapter dedicated to the foundations of balanced cooking, including descriptions of how to use

ingredients, preparation techniques, and cooking methods to create balanced, delicious dishes. In Chapter 9, Recipe Makeovers, Chef Lisa Brefere explains exactly how she accomplished each makeover, including many tips on ingredients and how to modify recipes and build flavor. These recipes include not only main dishes but also sauces, dressings, desserts, and others. Chapter 10, Balanced Menus, offers hundreds of examples of healthy menu items for meals and snacks, and includes examples of plate presentation.

- **Part III: Applied Nutrition** (Chapters 11–13) begins with a chapter that explains how to handle customers' special nutrition requests—such as no gluten or low sugar. Charts are given to help you determine which menu items would be appropriate for each section of the menu. Chapters 12 and 13 discuss weight management and lifespan nutrition. Chef Lisa Brefere includes many ideas on providing healthy meals to children.

LEARNING TOOLS

Nutrition for Foodservice and Culinary Professionals contains many special features that enable students to better understand concepts and extend and test their knowledge. These pedagogical tools include tables, charts, and illustrations, as well as the following.

- **Learning Objectives:** Each major section within a chapter corresponds to the learning objective for that section.
- **Key Terms and Concepts:** Whenever key terms and concepts are first introduced, their definitions can be found in the margin, located near the bolded term.
- **Chef's Tips:** Chef's Tips provide an experienced chef's advice on all aspects of cooking, including which foods go together, how to use foods' natural colors to create an attractive dish, and how to use culinary techniques to create healthy and delicious dishes.
- **Culinary Focus:** Culinary Focus examines various food groups from the perspective of a chef. Organized into "Chef's Tips: Preparing" and "Menus and Presentation," this feature is full of tips for you to use to produce tasty and healthy menu items. A Culinary Focus feature is found in Chapters 3–7, and each one covers foods that have the nutrients discussed in that chapter.
- **Summary:** Designed to help students focus on the important concepts within each section of the chapter, a summary is given at the end of each chapter.
- **Check-Out Quiz:** At the end of each chapter, a Check-Out Quiz allows students to check their comprehension of the chapter's concepts. Answers to odd-numbered questions are in Appendix C.
- **Glossary:** All key terms and definitions are listed in the Glossary, easily found in the back of the book.
- **Appendices:** A very useful reference for readers, the appendices include a variety of useful information, including serving sizes for MyPlate food groups and the Dietary Reference Intake charts. Additional appendix materials on the nutritive value of foods, food patterns, sample menus, recipes, and growth charts for children and adolescents can also be found on the Book Companion Website: www.wiley.com/college/drummond.

MEDIA AND SUPPLEMENTS

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Through a flexible course design, instructors can quickly organize learning activities, manage student collaboration, and customize your course—having full control over content as well as the amount of interactivity between students.

WileyPLUS Learning Space lets the instructor:

- Assign activities and add your own materials
- Guide your students through what's important in the interactive e-textbook by easily assigning specific content
- Set up and monitor group learning
- Assess student engagement
- Gain immediate insights to help inform teaching

Defining a clear path to action, the visual reports in **WileyPLUS Learning Space** help both you and your students gauge problem areas and act on what's most important.

Create-a-Plate and Revise-a-Recipe

WileyPlus Learning Space contains **Create-a-Plate** and **Revise-a-Recipe** exercises for every chapter. **Create-a-Plate** interactive exercises help students create their own virtual plate of food by selecting from a menu and seeing real-time nutritional analysis based on their selections. In addition to creating balanced meals, students use this exercise to create meals with specific guidelines such as low in kcalories or high in fiber or protein.

Through the **Revise-a-Recipe** interactivity, students are provided recipes to revise to meet a specific nutritional goal. As ingredients are adjusted or substituted, they can see how the recipe's nutritional values change and if the goal is met. Both **Revise-a-Recipe** and **Create-a-Plate** activities can be saved and printed by students to hand in.

SUPPLEMENTARY MATERIALS

A ***Study Guide*** (ISBN: 978-1-119-27177-2) for students is available to help reinforce nutrition concepts and allow students to make nutrition applications.

A ***Companion Website*** (www.wiley.com/college/drummond) provides links to both the Student and Instructor Websites. The **Student Website** includes PowerPoints and interactive Worksheets for each chapter. The Student Website also includes Supplementary Recipes.

From the **Instructor Website**, instructors can download the Instructor's Manual as well as PowerPoint slides and Student Worksheets for each chapter. A selection of recipes are also available here.

An ***Instructor's Manual*** (available online) that includes class outlines, classroom activities, student worksheets, and test questions and answers is available. Please visit the Companion Website to download a copy.

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Introduction to Nutrition

LEARNING OBJECTIVES

- **Explain why nutrition is important, including the components of a healthy diet.**
- **Give examples of nutrition and food terms discussed in this section.**
- **Discuss five factors that influence what you eat.**
- **Identify factors that influence how many kcalories you burn each day, and the functions, kcalories, and Dietary Reference Intakes of each class of nutrients.**
- **Explain how food is digested and absorbed in the gastrointestinal tract.**
- **Give examples of how a chef may run a sustainable restaurant, particularly in terms of purchasing food.**
- **Identify reliable sources of nutrition and health information.**

1

INTRODUCTION

Since 2009, nutrition has been one of the top 20 food trends noted in the "What's Hot" annual survey of chefs conducted by the National Restaurant Association. Why does nutrition continue to be a hot topic for chefs and foodservice managers? Americans do continue to eat out for a meal or snack several times a week, but more importantly, surveys consistently report that over half of American adults are trying to eat more healthfully at restaurants now than they did in the past. In addition, at any point in time, more than half of American adults are watching their diets for reasons such as trying to lose weight or simply for general health.

Consumer habits have been changing. Fresh, quality foods have become more important to different ages—from millennials to baby boomers. Locally grown food and sustainability are not only chefs' priorities but also customer priorities. Growing chains around the country—including Tender Greens and LYFE Kitchen—offer organic produce, sustainable seafood, and local products. Other chains such as Seasons 52 use seasonally inspired ingredients and limit the kcalories in their menu items. Obviously, few restaurants limit kcalories, but most do offer some balanced options on their menus to bring in more customers.

As foodservice professionals, we have a responsibility to our clients to understand contemporary cooking techniques that are balanced, moderate in rich ingredients, and well prepared to possess nutrition stability. Balanced cooking encompasses an understanding of ingredients that help develop flavor. You can no longer rely on more than moderate use of salt, sugar, and butter/cream for flavor.

WHY IS NUTRITION IMPORTANT AND WHAT IS A HEALTHY DIET?

Nutrition A science that studies nutrients found in foods and their actions in the body. Nutrition also explores the relationship between nutrients and disease, as well as why you choose the type of diet you eat.

Nutrients The nourishing substances in food that provide energy and/or promote the growth and maintenance of your body.

Diet The foods and beverages you normally eat and drink, also called *eating pattern*.

Nutrition is a science that studies nutrients (such as protein or vitamin C) found in foods and their actions in the body. Nutrition is important because what you eat can affect your health. Almost daily you may hear or read news reports that something in the food you eat, perhaps a nutrient such as sugar, may not be good for you—that it may indeed cause or complicate conditions such as heart disease. Nutrition researchers look closely at the relationships between nutrients and disease, as well as how you choose what to eat.

Nutrients are the nourishing substances in food that give you energy, allow your body to grow, and keep you feeling healthy. They help regulate many processes that go on in your body, such as the beating of your heart and the digesting of food in your stomach. Examples of nutrients include carbohydrates, fats, protein, water, and vitamins.

In summary, nutrition is a science that studies nutrients and other substances in foods, and how they affect the body, especially in terms of health and disease. Nutrition also explores why you choose the foods you do—in other words, why you eat a certain type of diet.

Diet is a word that has several meanings. Anyone who has tried to lose weight has no doubt been on a diet. In this sense, diet means a weight-reducing diet and is often thought of in a negative way. But a more general definition of diet is the foods and beverages you normally eat and drink every day. Of course, your normal diet, or eating pattern, may change—for instance when you started college and had new places to eat.

So why are nutrition and diet important? Your lifestyle choices, such as diet and exercise, strongly influence whether you might get diseases such as heart disease. According to the Dietary Guidelines (2015) Committee, about half of all American adults have one or more preventable diseases that are related to poor diet and physical inactivity, including heart disease, high blood pressure, diabetes, and some cancers. In addition, more than two-thirds of

adults and nearly one-third of children and youth are overweight or obese, which also increases their risk for diseases.

Unfortunately, few, if any, improvements in Americans' food choices have been seen in recent decades. On average, the American diet is:

- *low* in vegetables, fruit, whole grains (such as whole-wheat bread or brown rice), and dairy; and
- *high* in kcalories, sodium (in salt), saturated fat (found in animal fats such as in beef or cheese), refined grains (anything made with white flour), and added sugars (such as in regular soft drinks).

Our intake of fruits and vegetables is especially low, and eating more has several benefits. First, most vegetables and fruits are major contributors of a number of nutrients that Americans don't get enough of—such as fiber and potassium. Second, consumption of vegetables and fruits is associated with reduced risk of heart disease and stroke. Third, most vegetables and fruits, when prepared without added fats or sugars, are low in calories.

The evidence examined by the 2015 Dietary Guidelines Committee identified a *healthy diet* as:

- *higher* in vegetables, fruits, whole grains, low- or non-fat dairy, seafood, legumes (beans and peas), and nuts;
- *moderate* in alcohol; and
- *lower* in red and processed meats and low in sugar-sweetened foods/drinks and refined grains.

Figure 1-1 shows components of a healthy diet.

FIGURE 1-1 A healthy dietary pattern is higher in vegetables, fruits, whole grains, low- or non-fat dairy, seafood, legumes, and nuts; moderate in alcohol; lower in red and processed meats; and low in refined grains and sugar-sweetened foods and drinks.
Photo by Peter Pioppo.

You can combine foods in a variety of flexible ways to achieve a healthy or balanced diet, and these strategies should be tailored to meet your health needs, dietary preferences, and cultural traditions. For most people, this will mean:

- improving food and menu choices, modifying recipes, and watching portion sizes
- including more fresh vegetables and fruits (processed are fine as long as they are not high in sodium or sugar)
- including more whole grains, seafood, nuts, legumes, and low/non-fat dairy or dairy alternatives, such as soymilk (without added sugars)
- reducing consumption of red and processed meats, refined grains, added sugars, and sodium
- replacing solid animal fats (such as butter) with vegetable oils and nuts (except palm or coconut oil)

Current research also strongly demonstrates that regular physical activity promotes health and reduces chronic disease risk.

Understanding good nutrition is important for you on both a personal and a professional level. This introductory chapter explores why we choose the foods we eat and then explains several important nutrition concepts that build a foundation for the remaining chapters. You will learn more about how to recognize whole foods, processed foods, and organic foods; kcalories and nutrients; and digestion.

NUTRITION AND FOOD TERMS TO KNOW

Whole foods Foods as we get them from nature; some may be minimally processed.

When people talk about food, you may hear some terms that you are not familiar with or are unsure of. **Whole foods** (besides being the name of a chain of natural and organic grocery stores) are foods pretty much as we get them from nature. Examples include eggs, fresh fruits and vegetables, beans and peas, whole grains, and fish (Figure 1-2). Whole foods are generally not processed or refined and do not have any added ingredients. Some whole foods, such as milk, are minimally processed to make it safe to drink. Fresh meat is also minimally processed so that consumers can buy just what they want.

Processed foods Foods that have been prepared using certain procedures such as canning, cooking, freezing, dehydration, or milling.

Processed foods (Figure 1-3) have been prepared using a certain procedure: milling (wheat is milled to make white flour), cooking and freezing (such as frozen pancakes or dinners), canning (canned vegetables), dehydrating (dried fruits), or culturing with bacteria (yogurt). In some cases, processing removes nutrients, as when whole wheat is milled to make white flour. In other cases, processing helps retain nutrients, as when freshly picked vegetables are frozen.

Whereas the food supply once contained mostly whole farm-grown foods, today's supermarket shelves are stocked with a lot of processed foods. Many processed foods contain parts of whole foods and often have added ingredients such as sugars and fats.

For instance, cookies are made with eggs and flour. Then sugar and fat are added. Highly processed foods, such as many breakfast cereals, cookies, crackers, sauces, canned or frozen soups, baking mixes, frozen entrées, snack foods, and condiments, are staples nowadays.

FIGURE 1-2 Whole foods are generally not processed or refined.

Photo by Peter Pioppo.

FIGURE 1-3 Processed foods are prepared various ways such as milling, cooking, freezing, or canning.

Photo by Peter Pioppo.

Enriched A food to which nutrients are added to replace the same nutrients that were lost in processing.

Fortified A food to which nutrients are added that were not present originally or nutrients are added that increase the amount already present.

Natural Meat or poultry products that contain no artificial ingredient or added color and are only minimally processed; for other foods, natural means that there are no added colors, artificial flavors, or synthetic ingredients.

Organic foods Food produced without antibiotic or growth hormones, most conventional pesticides, fertilizers made with synthetic ingredients or sewage sludge, bioengineering, or ionizing radiation.

When processing adds nutrients, the resulting food is either an **enriched** or a **fortified** food. For example, white flour must be enriched with several vitamins and iron to make up for some of the nutrients lost during milling. A food is considered enriched when nutrients are added to it to replace the same nutrients that are lost in processing.

Milk is often fortified with vitamin D because there are few good food sources of this vitamin. A food is considered fortified when nutrients are added that were not present originally or nutrients are added that increase the amount already present. For example, orange juice does not contain calcium, so when calcium is added to orange juice, the product is called calcium-fortified orange juice. Many breakfast cereals are fortified with some vitamins and minerals (Figure 1-4). Probably the most notable fortified food is iodized salt, introduced in 1924 to decrease iodine deficiency in Americans.

Another term you see on food labels is **natural**. When you are buying meat or poultry, natural products contain no artificial ingredient or added color and are only minimally processed. For other foods, natural means that there are no added colors, artificial flavors, or synthetic ingredients.

Organic foods are produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to improve the environment for future generations. Organic meat, poultry, eggs, and dairy products come from animals that are given no antibiotics or growth hormones, and have access to the outdoors. Organic food is produced without using most conventional pesticides, fertilizers made with synthetic ingredients, bioengineering, or ionizing radiation. Before a product can be labeled organic, a government-approved certifier inspects the farm where the food is grown to make sure the farmer is following all the rules necessary to meet USDA organic standards. Companies that handle or process organic food before it gets to your local supermarket or restaurant must be certified, too.

Sometimes when consumers see a box of organic crackers or cookies, they mistakenly think that the product must be healthier and lower in kcalories than a nonorganic product. The truth is that an organic cookie does contain organic ingredients, but it could still use white flour, butter, and sugar just like the nonorganic cookie and contain an equal number of kcalories.

FIGURE 1-4 Fortified foods provide additional sources of nutrients.

Courtesy of B. Calkins/Shutterstock.

Products labeled "100 percent organic" must contain only organically produced ingredients. Products labeled "organic" must consist of at least 95 percent organically produced ingredients. Products meeting the requirements for "100 percent organic" and "organic" may display the USDA Organic seal (Figure 1-5).

Processed products that contain at least 70 percent organic ingredients can use the phrase "made with organic ingredients" and list up to three of the organic ingredients or food groups on the label. Processed products that contain less than 70 percent organic ingredients *cannot* use the term organic other than to identify in the ingredients statement the specific ingredients that are organically produced.

FIGURE 1-5 The USDA Organic seal signifies that the product is at least 95 percent organic.

Courtesy of the U.S. Department of Agriculture.

Some studies show that organic foods may be higher in certain vitamins and/or minerals compared with conventionally grown foods. However, there is no solid body of research yet. The nutrient composition of any food grown in soil will vary due to many factors, such as differences in soil quality, the amount of sunshine, and the amount of rain. Vitamins in plants are created by the plants themselves as long as they get adequate sunshine, water, carbon dioxide, and fertilizer. Minerals must come from the soil.

Many chefs feel that organic foods taste better than their conventional counterparts. Whether organic foods taste better is to some extent a matter of personal taste. Also, taste will vary among any fresh produce, depending on their freshness, the seeds used, where they were grown, and so on.

Another food term you may have heard is **superfood**. Certain foods, such as blueberries or spinach, have been advertised as superfoods because they are nutrient-rich and promote your health. Many of the health-promoting ingredients in superfoods are called phytochemicals. **Phytochemicals** are compounds found in plant foods, such as fruits and vegetables, and many promote health and may even decrease your risk of certain diseases. Following are some examples of what you can think of as superfoods because they naturally contain lots of phytochemicals and have health benefits.

Superfood Nutrient-rich food that promotes your health.

Phytochemicals Compounds found in plant foods, such as fruits and vegetables, that promote health and may decrease your risk of certain diseases.

- *Nuts.* A growing number of clinical studies indicate that the beneficial effect of tree nuts may be due not only to the fact that they contain healthy types of fats—monounsaturated and polyunsaturated fats—but also that they contain phytochemicals that may be heart healthy.
- *Cocoa.* Cocoa, which is used to make chocolate, is made from cacao beans. Cocoa is a rich source of antioxidants that may help protect your blood vessels and heart. Dark chocolate contains more cocoa than milk chocolate and therefore contains more antioxidants.
- *Tea.* In recent years, scientists have investigated the potential benefits of green and black tea because tea is a rich source of polyphenols, which act as antioxidants in the body. Green tea goes through a fermentation process in order to be made into black tea. Black tea also contains polyphenols, but not quite as much as green tea. Polyphenols in tea appear to be heart healthy and may have a cancer-fighting role.
- *Spinach.* Spinach contains lutein, a phytochemical that seems to help protect the eyes from cataracts and macular degeneration, a progressive condition affecting the central part of the retina that leads to the loss of sharpness in vision. Spinach is a powerhouse of antioxidants.

Moderate diet A diet that avoids excessive amounts of kcalories or any particular food/food group.

Balanced diet A diet in which foods are chosen to provide kcalories and nutrients in the right proportions.

Varied diet A diet in which you eat a wide selection of foods to get necessary nutrients.

Figure 1-6 gives more information on four classes of phytochemicals.

Finally, let's take a look at some nutrition terms related to diet. A nutritious diet is considered to be moderate, balanced, and varied. A **moderate diet** means you avoid excessive amounts of kcalories or eating more of one food or food group than is recommended. So you choose appropriate portion sizes of different foods, and indulge occasionally in "junk foods" such as ice cream or cookies. A **balanced diet** is one in which you choose foods to provide kcalories and nutrients in the right proportions that you need. A **varied diet**, meaning you eat a wide selection of foods in each food group, helps you to eat a balanced diet. By eating a wide variety of foods, you are more likely to get the nutrients you need in the right amounts, as well as helpful phytochemicals.

Four Classes of Phytochemicals

Phytochemicals	Foods	Health Effects
Carotenoids 	Yellow, orange, and red pigmented fruits and vegetables, as well as some green vegetables such as yellow, orange, red bell peppers; carrots; pumpkin; winter squash; sweet potato; spinach; collards; kale	Act as antioxidants, possibly reducing risk of cancer.
Flavonoids (Phenols) 	Citrus fruits, berries, purple grapes Onions Tea (black and green) Cocoa and chocolate Legumes, soybeans, and soy products Whole wheat	Act as antioxidants and also fight inflammation, possibly reducing risk of heart disease.
Indoles 	Cruciferous vegetables such as broccoli, Brussels sprouts, cabbage, cauliflower, kale, rutabaga, horseradish	May help combat cancer cells.
Allicin 	Garlic, chives, leeks, onions, scallions, shallots	May prevent cancer, lower cholesterol and blood pressure. Stimulates the immune system.

FIGURE 1-6 The four classes of phytochemicals include carotenoids, flavonoids, indoles, and allicin. These compounds are found in fruits and vegetables of all colors.

Photos by Peter Pioppo.

WHY DO YOU EAT THE FOODS YOU DO?

Think about what you ate for your last meal yesterday. Did you eat at your job, at home, or out with friends? Were you making food choices based on cost or convenience, taste, or simply what foods were available to you? As you can see from this list, many factors influence what you eat:

- Flavor
- Other aspects of food (such as cost, convenience, nutrition)
- Demographics
- Culture and religion
- Health
- Social and emotional influences
- Marketing and the media
- Environmental concerns

Now we will look at these factors in depth.

Flavor An attribute of a food that includes its taste, smell, feel in the mouth, texture, temperature, and even the sounds made when it is chewed.

Taste Sensations perceived by the taste buds on the tongue.

Taste buds Clusters of cells found on the tongue, cheeks, throat, and roof of the mouth. Each taste bud houses 60 to 100 receptor cells that bind food molecules dissolved in saliva and alert the brain to interpret them.

FLAVOR

The most important consideration when choosing something to eat is the taste of the food (Figure 1-7). You may think that taste and flavor are the same thing, but taste is actually a component of flavor. **Flavor** is an attribute of a food that includes its taste, smell, feel in the mouth or texture, temperature, and even the sounds made when it is chewed. Flavor is a combination of all five senses: taste, smell, touch, sight, and sound. The taste buds in your mouth and the smell receptors in your nose work together to deliver signals to the brain that are translated into the flavor of food.

Taste

Taste comes from 10,000 **taste buds**—clusters of cells that resemble the sections of an orange. Taste buds, found on the tongue, cheeks, throat, and roof of the mouth, house 60 to 100 receptor cells each. The body regenerates taste buds about every three days.

These taste cells bind food molecules dissolved in saliva and alert the brain to interpret them. Although the tongue is often depicted as having regions that specialize in particular taste sensations—for example, the tip is said to detect sweetness—researchers know that taste buds for each sensation (sweet, salty, sour, bitter, and umami) are actually scattered around the tongue. In fact, a single taste bud can have receptors for all five sensations. We also know that the back of the tongue is more sensitive to bitter, and that food temperature can influence taste. For example, sugar seems sweeter at warmer temperatures whereas salt tastes stronger at colder temperatures.

Taste buds are most numerous in children under age six, and this might explain why youngsters are such picky eaters (Figure 1-8). We know that many children do not like bitter

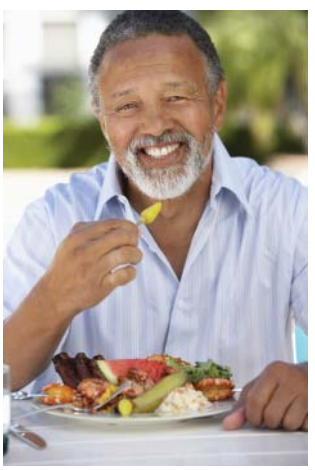

FIGURE 1-7 The most important consideration when choosing something to eat is taste.

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