

Fitness and Nutrition : Nutrition Basics

Lesson 2 Overview

What does good nutrition mean? It means different things to different people. For an infant, good nutrition results in adequate growth and physical and mental development, whereas for a college athlete, good nutrition might mean the ability to give maximum performances on the playing field and in the classroom. Good nutrition for a senior citizen might mean maintaining strong bones and physical and mental acuity. Some nutritional needs are the same over a life span; others vary over time.

The purpose of this lesson is to learn the importance of carbohydrates, fats, proteins, and vitamins and minerals to good health and nutrition at any stage of life. The lesson introduces tools you can use in making wise choices in meal planning.

2.1 Describe how the body processes calories and nutrients

How the Body Handles Nutrients

READING ASSIGNMENT

Nutrients, those parts of food that the body needs for it to grow, replenish, move, and feel good, are divided into two broad categories. The *energy-giving* (or *calorie-containing*) *nutrients* are carbohydrates, proteins, and fats. The *non-energy-giving* (or *no-calorie*) *nutrients* are vitamins, minerals, and water.

Your body can obtain energy, in the form of calories, only from carbohydrates, proteins, and fats. Most carbohydrates, whether from popcorn, baked apples, or maple syrup, contain four calories per gram. Although alcohol is considered a carbohydrate, it contains seven calories per gram. Alcohol, however, doesn't have the redeeming values of vitamins, minerals, or fiber and shouldn't be considered a nutrient. All fats, whether olive oil or bacon grease, contain nine calories per gram. All proteins, whether prime rib or peanut butter, contain four calories per gram. Obviously, your body appreciates a fresh apple more than a fried apple fritter, but when we're just talking calories, carbs are carbs, fats are fats, and proteins are proteins.

Here are some calorie counts:

1 Gram of Food	Calorie Count
1 gram of carbohydrate	4 calories
1 gram of protein	4 calories
1 gram of fat	9 calories
1 gram of alcohol	7 calories

How should you divide up your daily nutrients? The USDA suggests that 60 percent of daily calories come from carbohydrates, no more than 30 percent from fats (with a focus on unsaturated fats), and 10 percent from proteins. Fats contain 2.25 as many calories per gram as carbohydrates and proteins, so fats should be consumed in much smaller amounts than carbohydrates and proteins. The American Heart Association modifies this breakdown a bit, upping the calories from proteins and carbohydrates and decreasing the amount from fats.

The USDA MyPlate guide offers a good way to determine the amount of minerals and vitamins needed. If you follow the number of servings for each category, then you should be getting all the vitamins and minerals you need. If you're healthy and don't need to change your nutritional status, you can use the USDA's *recommended daily allowances (RDAs)* to determine your vitamin and mineral needs. RDAs are recommendations for people who are already healthy, not for people who need to make improvements or changes in their health.

The general rule of eight glasses (64 ounces or $\frac{1}{2}$ gallon) of water per day is a good rule of thumb for healthy people.

You aren't on your own when it comes to figuring out what you need to eat and drink to stay healthy. Although there are small variations in recommendations among the "establishment" theories, they all have the same general thrust. Be careful about following pop-culture nutrition recommendations or fad diets; they might sound easy and exciting, but they can have serious health consequences.

Vending-Machine Nutrition

You've learned that all carbohydrates, fats, and proteins yield the same amount of calories.

Does that mean if you eat a meal of potato chips (carbohydrates and fats) and chocolate ice cream (proteins, fats, and carbohydrates), you're getting the same nutritive value as a meal of herb-grilled salmon (proteins), potatoes au gratin (fats, proteins, and carbohydrates), and honeydew sorbet (carbohydrates)?

Not exactly. Calories are calories, and your body recognizes them as such. If you need energy right now, your body doesn't care if you give it an apple or a candy bar; it just knows you're giving it calories. However, the way your body uses the calories, and the nutrients attached to these calories, is another story.

Good nutrition is a long-term proposition, not a "quick, I need something to eat," putting-out-the-fire type of project. Although it's true that a candy bar will give you quick energy, it won't give you many nutrients, and its energy will be used up in a very short time. Your body needs a nutritional savings account of protein, vitamins, minerals, and water to function smoothly on a consistent basis.

Living on vending-machine snacks will give you fast energy, but it will damage your ability to build or repair muscles, fortify your immune system, stand up to aging, and remain mentally sharp. If you live the vending-machine lifestyle for too long, your body systems will start to break down, lacking the nutrients necessary for repair. Unfortunately, your body can't tell you specifically what it wants, and it will go a long time before it starts to slow down. You're in control of your body, and you have to make the decision between eating chips and cookies or Caesar salad and cantaloupe.

Evaluating Calories

Look at the potato chip and ice cream meal: it has a lot of calories and a lot of calories from fat. If you're like many people, you don't require all the calories you get from this meal. That means the body will store the excess calories until needed. Fat is stored all over the body in the fat cells. If too much is stored, saturated fat can lead to heart disease. Both the chips and ice cream are relatively high in sodium, another item that most people don't need in excess. Does this meal have any redeeming value? Well, the potatoes might have some calcium, phosphorus, and vitamin C, and the ice cream might have some calcium, vitamin A, and vitamin D, so it isn't a total wash.

Now look at the meal of grilled salmon, au gratin potatoes, and honeydew. The salmon has

protein and essential minerals, such as calcium and iodine. The fat in the salmon is of the omega-3 fatty acid type, the type that's supposed to help with heart health. The potatoes au gratin have some fat and sodium from the cheese. However, if made with low-fat dairy products, the au gratin adds an acceptable amount of fat to the meal and contributes calcium, phosphorus, vitamins A and D, and other nutrients. The honeydew sorbet is made with pureed fruit that has vitamin C and potassium, so it's a source of carbohydrates with no fat or sodium.

Depending on the serving sizes, these meals could have the same number of calories. One, however, gets its calories mostly from saturated fat with very few vitamins or minerals, whereas the other gets calories mostly from lean protein and carbohydrates with lots of vitamins and minerals. The second meal contains foods that dietitians call "nutrient-dense" foods.

Dense Is Best

Nutrient-dense is another way of saying "getting the most for your money with the least amount of damage." Both a fresh apple and a caramel apple have all the nutrients of an apple, but the caramel apple has a lot of extra calories without any extra nutrients.

The concept of nutrient density is important for personal health and for designing menus. For example, a three-year-old child doesn't eat very much, yet requires enormous amounts of nutrients. Parents or caregivers need to give three-year-olds food in which every mouthful counts. A baked sweet potato would be a better choice for a three-year-old than french fries. The sweet potato is packed with vitamin A, vitamin C, potassium, and protein, whereas the french fries are packed with fat. A teenager wants to have a creamy, indulgent dessert while counting calories. A soft-serve nonfat strawberry yogurt sundae with sliced bananas, chopped dates, figs, and fresh berries is relatively low in calories but packed with calcium; vitamins A, C, and D; and iron (from the figs). The idea isn't terribly difficult to grasp, but in today's world of quick foods packed with fats and artificial ingredients to enhance flavor, it can be easy to overlook.

Baked, Not Fried

You probably already know that a candy bar isn't as good a breakfast as a bowl of oatmeal. But why is that? They're both carbohydrates, with four calories per gram. However, there are

different types of carbohydrates, and they're used differently by the body. A food made almost entirely of sucrose (white table sugar), such as a candy bar, will be broken down very quickly by the body. The resulting energy will be used very quickly as well. A more complex carbohydrate, such as oatmeal, will break down slowly. This means that a slow, steady stream of energy is released for the body to use over several hours. The energy from a candy bar might last 20 minutes. The energy from a bowl of oatmeal could last three hours, depending on the type of work you're doing and the amount of energy needed to do the work.

You must also add nutrient density into the equation. The candy bar has calories, a little sodium, and that's about it. The oatmeal has dietary fiber (thought to reduce the amount of cholesterol in the body), some B vitamins, some minerals, and no sodium. As you can see, nutrition is just a matter of thinking about what you need and which foods will supply it best.



[Bowl of Pasta]

Carbohydrates, such as those found in pasta and nuts, are easily broken down and absorbed by the body.

Another way to look at nutrient density is to consider which foods your body can break down with the least amount of effort for the most reward. It takes energy to break down fat. Excess fat can force your body into unhealthy situations, taxing your liver, gallbladder, and heart. In some people, the breakdown products of fat can damage the body. Carbohydrates are easily broken down and absorbed by the body.

So, if it's between french fries and a baked potato, your body is voting for the baked potato. Mostly carbohydrate, the potato is easily digested and used with minimal effort. The baked potato would be considered the more nutrient-dense food.

What can people do to ensure good nutrition for themselves? They can learn about good nutrition to keep themselves, their families, and their clients healthy. They can equip themselves with materials and information that show how good nutrition can be a popular component of daily living.

Digestion, or Right to the Gut

As unromantic as it sounds, food is ultimately about digestion and absorption. A decadent, 12-course dinner or a bag of chips both break down to carbohydrates, fats, and proteins somewhere between your mouth, esophagus, stomach, small intestine, and large intestine, with some help from your pancreas, kidney, liver, and gallbladder.

Digestion is the breakdown of the nutrients in food, and *absorption* is the transport of the nutrients around the body to where they're needed.

Chewing food isn't enough to extract the nutrients from it. Your body needs to do a little chemistry, a little ripping and tearing, before you can turn that popcorn into usable energy.

At one level, your body is a very sophisticated and advanced machine, and on another level it's quite primitive. Digestion and absorption are a bit of both. Once you've chewed and swallowed, your body performs an intricately choreographed dance of interacting muscles, passageways, and personally autographed chemicals. Your brain tells your small intestines to start ebbing and flowing, your pancreas to start brewing the insulin, and your large intestine to prepare to synthesize some vitamins. You couldn't design machinery that worked as smoothly—especially on autopilot, because everything just described is done unconsciously, as reaction and reflex.

Your palate is a finely tuned instrument. Once that freshly squeezed blueberry-guava juice or that buttery cranberry-lemon scone has been swallowed, the “touchy-feely” part is over. Your body doesn't care how much you've spent on ingredients or how long it took to prepare a meal. It's looking for *glucose*, a breakdown product of any carbohydrate you ingest; *amino acids* from protein, whether from lobster or beans and rice; and *fatty acids* from olive oil or cheddar cheese. Vitamins, minerals, and water are broken out from food and sent to where they're needed.

Breaking Down Nutrients

While all carbohydrates are broken down to glucose, all proteins to amino acids, and all fats to fatty acids, some foods are easier for your body to tear down. This means you get more energy from foods that are easier for your body to get at. A good example is the protein from eggs versus the protein from rice and beans. Both foods are high in protein, but egg protein falls apart easily, whereas rice and beans have lots of fiber and the body has to work to get at the contained protein. When you eat an egg, you get close to 100 percent of the protein it has. When you eat rice and beans, you get closer to 75 percent. (By the way, scientists consider eggs to be the perfect protein, because they're used by the body better than protein from any other kind of food.)

Anatomy of Digestion

Before you can use the nutrients (absorption), your body has to get access to them (digestion). Through digestion, your body converts proteins into amino acids, carbohydrates into simple sugars, and fats into fatty acids and glycerol. Your body doesn't know how to use a piece of fried chicken, but it does know how to digest the protein (from the chicken), the carbohydrates (from the flour or bread crumbs used for the coating), and the fats (from the cooking oil). Your body is also able to absorb the amino acids, simple sugars, and fatty acids from that lovely piece of chicken.

Digestion is a team effort. Muscles, hormones, enzymes, beneficial bacteria, fluids, and internal organs cooperate to break food down into a usable format.

Digestion begins in the mouth. Saliva contains specific enzymes that begin to break down carbohydrates. The mechanical action of chewing breaks the food into smaller pieces, making it easier to moisten the food with saliva and exposing it to more digestive action. The smaller the pieces of food, the more efficiently digestion works throughout the entire process. There's truth to the idea that you should chew your food 20 times before swallowing; you'll wind up doing the work in one place or another.

Once the food leaves the mouth, it travels down the esophagus. The *esophagus* is no more than a conducting tube, known for its propensity to bulge out and cause heartburn and hiatal hernias. Just remember that the esophagus needs gravity to work. If you have a huge meal and then sack out on the couch, the esophagus has to get that meal down a narrow tube, working against gravitational pull, which is an almost impossible task. Think about stuffing a couple of sandwiches and a super-sized soda down a tube with the diameter of a garden

hose (at best). This is a very good reason for you to eat reasonably slowly and chew your food thoroughly.

Every once in a while, someone will arrive at an emergency room because he or she has a large piece of hotdog stuck at the bottom of the esophagus that has to be surgically removed. If you don't overcrowd your esophagus, it will be nice to you. And just in case, be sure everyone knows the Heimlich maneuver. (Technically, the Heimlich maneuver is used to dislodge substances blocking the trachea prior to reaching the esophagus.)

The esophagus empties into the *stomach*, where some real digestive action begins. This two-pint (or four-cup or one-liter) holding tank is the bus station for carbohydrates and fats. The stomach digests only proteins, through the actions of hydrochloric acid and other substances. Carbohydrates and fats are just traveling through, getting broken into smaller pieces. It takes about two to three hours for a meal to leave the stomach. At this point, the food exits into the small intestine.

Why doesn't the stomach, which is made of protein, digest itself? One reason is that specialized stomach cells produce alkaline substances that neutralize stomach acids.

The small intestine is "small" only in diameter. If you uncoiled the small intestine, it would measure anywhere from 10 to 22 feet in length.

The *small intestine* is a big deal when it comes to digestion. Fat, carbohydrates, and leftover proteins are digested along its length. Digestion is assisted by muscular contractions and enzymes and the action of *villi*, which are microscopic fronds in the intestinal wall that look like coral waving in the ocean. Villi increase the absorbing area of the intestine. Food stays in the small intestine for four to 10 hours, depending on the size of the meal and the person's physical condition.

After the small intestine comes the *large intestine*. The last part of the large intestine, called the *colon*, is about five feet long. The colon isn't a digestive organ. It helps to absorb fluids and might even assist in the production of some vitamins (with the help of beneficial bacteria and certain nutrients). Food stays in the colon for one to three days, after which it's eliminated and digestion is complete.

The colon is the area where colon cancer, a leading form of cancer, can develop.

The mouth, stomach, and small and large intestines are the organs through which food actually passes. However, even the best actor needs a supporting cast. Although the pancreas, gallbladder, kidneys, and liver never physically touch the food, they play an important role in digestion. The liver produces *bile*, necessary for digestion of fat. The pancreas produces *enzymes* and *pancreatic juices* important for digestion, as well as the hormone *insulin* to help in glucose absorption. The *kidneys* extract certain minerals and maintain proper fluid balance. The *liver* is the filtering organ for everything that you eat and drink, sending nutrients out to where they're needed and processing toxins to be eliminated from the body. Be good to your liver; you can't survive without it!

Nutrients are absorbed in various parts of the body. Different parts of the small intestine have specific cells for absorbing fats, carbohydrates, and proteins. "Good guys," such as vitamins, and "bad guys," such as cholesterol, are absorbed in the small intestine as well.

Overview of the Digestive Process

Every part of the human digestive system plays an important role in processing the food you eat. When you eat a piece of pizza, you become a seething mass of chemicals, enzymes, and muscle contractions.

Digestion and absorption are two distinct functions. *Digestion* is the breakdown of foods into nutritional components the body can use. An example of this is the breakdown of cheese in your pizza. Your body can use the cheese, but it first must break down the products of the cheese—amino acids, fatty acids, and *monosaccharides* (simple carbohydrates)—through the process of digestion. *Absorption* is the transport of the digested foods to where they're needed, and ultimately used, by the body.

Consider taking a bite of pizza. Digestion begins in the mouth. As the teeth and jaws grind and chew the pizza, saliva from the salivary glands moistens the pizza and supplies enzymes that begin to break down some of the crust (carbohydrate digestion). The saliva moistens the food, making it easy to transport. You swallow, sending the pizza down the esophagus toward the stomach.

Once the pizza hits the stomach, you'll begin protein digestion. *Pepsin* (a stomach protein enzyme) breaks down the protein. *Peristalsis* (muscle contractions that resemble the movement of clothes in a washing machine) keeps the rest of the pizza-mass moving along.

The stomach is lined with *epithelium*, a substance that contains literally millions of *gastric glands*. Cells in the gastric glands secrete the equivalent of hydrochloric acid to digest protein. In the presence of stomach acids, the pizza cheese “melts” and breaks down from its protein form into its component amino acids.

The unrecognizable mass that was your pizza flows from the stomach into the small intestine.

The small intestine is the workhorse of digestion. Chemical digestion is performed in the first part of the small intestine, the *duodenum*. Chemicals are secreted by the liver and the pancreas to help digest fat. Fat is broken down into fatty acids and glycerol, and any leftover proteins are broken down into amino acids. Carbohydrates are broken down into *monosaccharides* (very simple sugars). After digestion has been completed in the small intestine, food flows to the large intestine.

The other organs we mentioned earlier also play a role in digestion. The liver has many responsibilities, including detoxifying everything you swallow. It secretes bile, which helps to break down fat. The liver also helps to digest that extra olive oil on your pizza. No food ever reaches the *pancreas*, but the pancreas is essential for digestion and absorption. It produces enzymes and hormones that help digest fats and carbohydrates.

So, digestion begins in the mouth and ends in the small intestine. The mouth, esophagus, stomach, and small intestine actively process food with chemical assistance from the liver and pancreas. Carbohydrate digestion begins in the mouth, protein digestion begins in the stomach, and by the time food leaves the small intestine, about 90% of the nutrients have been extracted from it.

Water and minerals are extracted and stored in the large intestine, some vitamins are synthesized, and undigested food is concentrated into a form that can be eliminated by the body. The large intestine is divided into the ascending colon, the transverse colon, the sigmoid colon, the cecum, and the rectum.

Key Points and Links

READING ASSIGNMENT

Key Points

- Snack foods supply quick energy, but don't provide the nutrients needed to maintain and repair body systems.
- Excess calories taken in will be stored by the body in the fat cells.
- Nutrient-dense foods supply vitamins and minerals without a lot of excess calories. They provide a steady supply of energy.
- Digestion breaks down the nutrients in food; absorption transports the nutrients to where they are needed.
- Proteins are converted to amino acids, carbohydrates are changed into sugars, and fats become fatty acids and glycerol. Foods that are easily broken down provide more energy and a higher percentage of protein.
- Digestion begins in the mouth. From there, food passes through the stomach and small and large intestines. The liver, gallbladder and pancreas play important roles in digestion.

Links

- [Nutrient Data](https://fnic.nal.usda.gov/food-composition/usda-nutrient-data-laboratory) (fnic.nal.usda.gov/food-composition/usda-nutrient-data-laboratory)

Exercise: What Are You Eating?

Based on what you've read, answer the following questions.

1. Why is it better to get calories from nutrient-dense foods rather than from foods that lack nutrition?
2. Diagram the passage of food through the digestive system. Label the organs involved in digestion and absorption and identify the sites where carbohydrates, proteins, and fats are digested.
3. For each of the following foods, choose the one that's more nutrient-dense.
 - a. Low-fat popcorn or buttered crackers
 - b. Macaroni and cheese or plain pasta
 - c. Celery sticks or fresh fruit salad
 - d. A slice of cheese pizza or a double cheeseburger
 - e. Oatmeal with banana and raisins or cornflakes with milk
4. Calculate the number of calories in each of the following foods.
 - a. A slice of whole-wheat bread with 8 grams of carbohydrates

- b. 2 ounces of cheddar cheese with 6 grams of fat
- c. A serving of grilled chicken with 10 grams of protein

Exercise Answer Key:

Exercise: What Are You Eating?

1. Foods that are nutrient-dense give your body more than just calories; nutrient-dense foods provide the body with essential vitamins and minerals, whereas foods that aren't nutrient-dense give the body only calories.
2. The body accesses nutrients through digestion, which begins in the mouth. Saliva and chewing break down the food. The esophagus empties into the stomach where protein is digested. Fat, carbohydrates, and leftover proteins are digested in the small intestine. The colon helps to absorb fluid. The pancreas, gallbladder, kidneys, and liver are also involved in digestion.
3.
 - a. Low-fat popcorn—Crackers are high in fat.
 - b. Macaroni and cheese—The cheese does have more fat but offers protein, calcium, vitamins A and D, and other nutrients.
 - c. Fruit salad—It contains more vitamins and minerals than celery alone.
 - d. Pizza—It probably contains less fat; the sauce has a small amount of vitamins.
 - e. Oatmeal—It contains more fiber, probably less fat, and more vitamins and minerals with fruit.
4.
 - a. Carbs have 4 calories per gram, so 4 8 32 calories.
 - b. Fat has 9 calories per gram, so 9 6 54 calories.
 - c. Protein has 4 calories per gram, so 4 10 40 calories.

2.2 Evaluate carbohydrate consumption

Carbs Are King

READING ASSIGNMENT

Carbohydrates make the world go 'round. Carbohydrate crops are the most plentiful on earth. Rice, wheat, corn, beans, and potatoes are all carbohydrates. Most nutrition authorities agree that carbohydrates should be the largest part of your daily intake. The USDA Guideline for

Americans suggests that carbohydrates should make up at least 55 to 60 percent of your daily caloric intake.

All carbohydrates contain four calories per gram. Carbohydrates are divided into three categories: simple carbohydrates, also called “sugars” or “simple sugars”; complex carbohydrates, which are starches; and fiber. Scientists call simple carbohydrates *monosaccharides* and *disaccharides* and complex carbohydrates *polysaccharides*.



[Loaf of Whole Grain Bread]

Minimally processed carbohydrates, such as those in wholewheat bread, are high in fiber, vitamins, and minerals.

Just remember that *sugar*, *starch*, and *fiber* are the three main categories of carbohydrates and the terms you’ll use most often. You’ll be able to recognize the more scientific terms when you see them.

Carbohydrates are easily digested and absorbed and are a good and efficient source of fuel for the body. Most carbohydrates are very low in fat and sodium. Minimally processed carbohydrates, such as whole-wheat bread, brown rice, and dried beans, are high in fiber, vitamins, and minerals. Most people like some carbohydrates. Do you know anyone who absolutely hates potatoes, pastas, corn, rice, hot or cold cereals, breads, grains, or beans?

Gluten Intolerance

Despite all the good things about carbohydrates, some people are born without the ability to digest *gluten*, the protein found in wheat. People with *gluten intolerance* can eat rice, corn, beans, potatoes, and some other grains, such as soy and amaranth, but they have to stay away from gluten-containing products.

More people have this condition than you might think. Just search the Web or cruise the cookbook section at a bookstore and you'll get a better idea of the extent of the problem. A number of organizations and support groups are available for people who are gluten-intolerant.

Wheat-free eating takes some planning. "Wheat-free" means that no wheat flour ingredients are used in a food. These include whole-wheat flour, all-purpose flour, or any other type of flour made from wheat. Flours made from other ingredients, such as barley, rye, corn, or potatoes, usually are fine, but you can't make generalizations. Some gluten- and wheat-intolerant people can eat everything but wheat. Others have sensitivities to other grains. Wheat allergies are among the most common food allergies.

Gluten-free eating is much more restrictive than an ordinary diet. Gluten is a protein component in many grains, including wheat, barley, rye, and oats. A gluten-free food product is one in which none of the ingredients are from these grains.

People who have *celiac disease* (the old-fashioned term for this was "sprue") are born with an inability to tolerate *gliadin*, which is a protein contained in gluten. Gluten or gliadin is toxic to their small intestines, damaging the intestines in such a way that nutrients can't be absorbed. For a person with celiac disease, the smallest trace of gluten can be harmful.



[Plate of Potato Chips]

Gluten can be found in many snack foods, including potato chips.

A person with a wheat allergy can eat a gluten-free product, but a person with celiac disease or gluten intolerance might not be able to eat a wheat-free product, because other grains

contain gluten. Some common foods that contain gluten include bouillon, soy sauce, vinegar, dessert mixes, snack foods such as roasted peanuts and potato chips, and extracts that contain alcohol. Gluten is added as an ingredient to enhance the flavor or texture of these products.

How Food Calorie Amounts Are Determined

Ever wonder how food technologists figure out how many calories a food contains? One method involves burning a food item completely to ash. Special ovens called *bomb calorimeters* can measure the amount of heat the food gives off while it's burning. The amount of heat energy released can be converted to calories.

You know that you “burn” calories when you use energy. That’s one of the reasons you get so hot when you’re doing a heavy workout or running up stairs while carrying 20 pounds of books. Your body acts like an oven, burning food to release calories.

Although all carbohydrates contain four calories per gram, whether your body can access all of those calories is another story. Some food is burned more easily than others. The less fiber a food has or the less complex a food is, the more easily it can be burned for calories because less energy is required to break it apart. Simple sugars contain very little or no fiber and have no structure to speak of. If you eat a couple of spoonfuls of sugar, as in a cola or a popsicle, your body can obtain almost 100 percent of the energy. It requires hardly any energy to burn up sugar. Unfortunately, because sugar can be burned so easily, you use it up very quickly, which results in those sugar “rushes” and then corresponding lows. This uncomfortable feeling makes it very difficult to sustain a consistent energy level.

However, if you give your body some oatmeal to tackle, you won’t get exactly four calories per gram of oatmeal. Oatmeal contains starch and fiber. Both starch and fiber have a lot of structure, and it takes your body time and energy to break them down to obtain energy from them. The downside is that you have to wait awhile for the energy and you don’t get everything you paid for. The upside is that you have energy over a longer period of time, because it takes your body awhile to slowly release the energy. Eating complex, structured foods results in a consistent amount of energy available over a long period of time—probably two or three hours, depending on your activity level. Because it takes energy to get energy from oatmeal, you can eat a little more, because you’re burning a little more. In addition, oatmeal contains vitamins and minerals, whereas table sugar contains nothing but calories.

How the Body Uses Energy from Carbohydrates

Ever wonder why you can eat all the salad you want? Salad vegetables, such as lettuce, spinach, radishes, celery, onions, cucumbers, and bell peppers, are composed largely of fiber. Although fiber contains four calories per gram, the human digestive system is unable to break down most fiber. This means that you get very little energy from very high-fiber foods. The upside of this is that because you can't obtain very many calories from high-fiber foods, you can eat more of them. You'll learn more on the health benefits of fiber later in this study unit.

Sugar and Enzymes

You know something is a sugar if it ends in “-ose.” Glucose, fructose, lactose, and maltose are all sugars.

The most important simple sugar is *glucose*. The most basic sugar, glucose is what the body is looking for when it breaks down bread, potatoes, fruit—any carbohydrate-containing food. It's the body's basic fuel source, and it's the only fuel that the brain can use. Whenever you digest carbohydrates, the body is getting glucose.

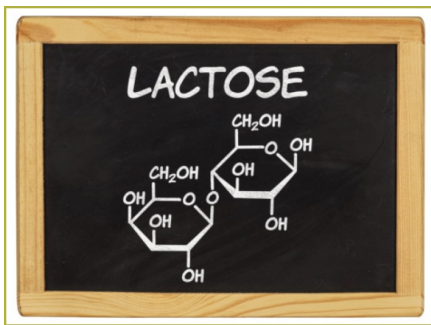
The pancreas secretes *insulin*, a hormone that enables cells to absorb glucose. This is the ultimate use of all carbohydrates. The liver releases glucose into the bloodstream as needed and also acts as the body's savings account for glucose. For efficiency, the liver changes glucose into a storage form called *glycogen*. We'll talk more about glycogen and carbohydrate loading in the next unit, when we discuss menus for fitness performance.

Lots of different enzymes are needed to digest all the different types of carbohydrates you eat. Just as anything that ends in “-ose” is a sugar, anything that ends in “-ase” is an enzyme. If you want to digest the sugar sucrose, then you need the enzyme sucrase. No problem. The brain triggers the body to produce enzymes when it figures out what you ate.

Lactose Intolerance

Dairy products include the yogurt you had for breakfast and the slice of cheese you added to your sandwich. Dairy products contain *lactose*, or milk sugar. You need the enzyme lactase to digest lactose. Perhaps you've heard of people who are *lactose-intolerant*. While many people think that means a person is allergic to milk, this isn't really the case. People with

lactose intolerant can handle the protein, fats, minerals, and vitamins in milk; they just don't have a way to break down the lactose found in milk.



[Chemical Makeup of Lactose]

People who are lactose intolerant have difficulty breaking down milk sugar.

Some people are born without the ability to produce lactase. Particular ethnic groups, especially African Americans and Asians, have a tendency to be lactose-intolerant. This is thought to be a result of evolution, because diets in Africa and Asia generally had very little dairy. The body is very efficient, so if an ability isn't needed, the body doesn't develop it.

Some people lose their ability to produce lactase over time. This is a matter of "use it or lose it." If you don't ingest any dairy products for many years, the body thinks, "Why should I keep this knowledge around? It's just cluttering up the brain." When you reintroduce dairy products back to your diet, the body says, "What's this? I don't remember this!" Sometimes lactase production returns, and sometimes it doesn't.

People who are lactose-intolerant vary in their ability to handle dairy products. Some can eat very small amounts of solid dairy products, such as cheese and sour cream. Others can't handle any type of dairy product. Some people cope with lactose intolerance by avoiding dairy products. They substitute fortified soymilk, rice milk, or grain milk and nondairy "cheese" for dairy products. They'll select sorbets (sherbet has some dairy in it), fruit ices, or soy or rice frozen desserts instead of milk-based items. Some lactoseintolerant individuals will ingest lactase in the form of pills or liquid before they eat dairy products. This adds back what the body doesn't have.

Specially modified dairy products have been developed for lactose-intolerant people.

Acidophilus is a lactose-loving good bacteria. If you put some acidophilus in milk or yogurt, the bacteria will digest all the lactose for you. This solves the problem for people who can't digest lactose on their own—the bacteria do it for them. The next time you go to the grocery store, check out the dairy section for acidophilus-containing milk or yogurt.

Selecting Sugars for Healthy Eating

Simple sugars are simple sugars. Some people believe that natural sugar, such as honey, is better for them than sugar from corn syrup or white sugar. Not so. Your body doesn't distinguish between sugar from maple syrup and sugar from granulated white sugar. Most sugars are natural, because they're processed from beets, sugar cane, corn, and dates. Remember, your body is looking to take every type of carbohydrate it can get its hands (or intestines) on and break it down into glucose. If it makes you feel better to get your sugar high from natural sugars, such as turbinado or date palm sugar, so be it. Your gut doesn't care.



[Honey]

Honey is a simple sugar.

There's a difference between sugars from syrup or honey and sugars from milk (lactose) or fruit (fructose). Maple syrup, honey, and corn syrup are nothing but simple sugars; they have no redeeming nutritional value. When you obtain sugar from an orange or from yogurt, you're also getting proteins, minerals, vitamins, fiber, and all those other good nutrients. In addition, when you obtain sugar from what nutritionists like to call "whole foods," such as fruit or juice, it takes your body a little longer to extract the sugar. This means that there's a steady, gradual release of sugar into your bloodstream, providing even amounts of energy over a longer period of time. As you know, when you get sugar from concentrated sources, such as soda or candy, you get the "soar-and-crash" effect. Lots of sugar is released into your bloodstream at one time, it's used quickly, and then it disappears. Anyone who's ever had a sugar rush and the ensuing sugar "low" knows what we mean.

Key Points and Links

READING ASSIGNMENT

Key Points

- Simple carbohydrates, or sugars, are called monosaccharides and disaccharides. Complex carbohydrates are starch, or polysaccharides. Fiber is the third category of carbohydrates.
- Many people can't tolerate gluten and must avoid foods made from wheat, barley, rye and oats. For people with celiac disease, gliadin, a protein found in gluten, damages the intestines. Many common foods contain gluten.
- Bomb calorimeters measure heat given off by food. Using energy "burns" calories. Simple sugar is burned easily; starch takes longer to burn. Most fiber can't be broken down into calories.
- Glucose is the body's basic fuel source. Glucose is stored in the liver in the form of glycogen. Words ending in -ose are sugars. Lactose, or milk sugar, can't be tolerated by some people and some people can't produce lactase. Words ending in -ase are enzymes. Enzymes are needed for digestion.
- Simple sugars contain no other nutrients; sugar from fruit or juice contains vitamins and minerals.

Links

- [Carbohydrates and Blood Sugar](http://www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/) (www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/)

Exercise: Hidden Carbs

Based on what you've read, answer the following questions.

1. Explain why a food that has more calories will give a person more energy than a food that has fewer calories.
2. Why is consuming natural sugar not necessarily any better for your body than consuming sugar from corn syrup or white sugar?

Exercise Answer Key:

Exercise: Hidden Carbs

1. The more calories a food has, the more energy it will give the body. The fewer calories a food has, the less potential it has to give the body energy.
2. The body doesn't distinguish between the types of sugars that you consume; it uses sugars in the same way because most sugars are still processed from natural ingredients.

2.3 Determine causes of and treatments for diabetes

Diabetes

READING ASSIGNMENT

The previous discussion on sugar brings up an important health condition that affects how much and what type of sugar people can ingest. Diabetes, which can be caused by a combination of genetics, lifestyle, and obesity, is becoming more and more prevalent in the United States. It's especially troubling that diabetes continues to rise among the under-30 population.

History

Diabetes, formally known as *diabetes mellitus*, isn't a modern disease. In fact, ancient Egyptian and Chinese writings dating back to 1500 BC describe diabetes in full detail.

The word *diabetes* comes from the Greek word that means "to flow through," and *mellitus* comes from the Latin word for "honey," which refers to the spilling of sugar into the urine by diabetics.

Ancient physicians could diagnose diabetes, but they had few treatments for it. Ancient diabetes treatments included withholding fluids, using various herbs believed to "absorb" sugar, and *leeching* (attaching leeches to the skin and allowing them to suck out a certain amount of blood, which was thought to remove "defective" blood).

Only in the past 200 years have the causes and treatments of diabetes been reliably researched. In 1860, a German doctor named Paul Langerhans discovered a cluster of cells

in the pancreas that produced insulin. You will learn about the “islets of Langerhans” in your biology class. After observing lab animals that had their pancreas removed, Dr. Langerhans put two and two together and postulated that insulin controlled the body’s ability to process carbohydrates. This opened the way for diabetes treatment.

In 1921, two Canadian researchers discovered the beneficial effects of injecting insulin in animals and people. This discovery greatly improved the life expectancy and quality of life for diabetics. Before the use of injectable insulin, most diabetics could expect to survive only into their twenties; they were told not to work or exercise and not to marry or have children. At that point, there was little understanding about the relationship between diabetes and diet. In fact, a high-fat, no-carbohydrate diet often was recommended to diabetics, because doctors thought that diabetics should refrain from eating any type of sugar or starch.

War is hell, but it’s good for diabetes. When looking at the number of people who had diabetes, researchers found that death from diabetes fell during wartime. This was attributed to the lack of fancy food and increased activity when food and fuel were rationed.

Researchers saw the same thing in populations used to hard work and limited food supply. Diabetes was generally low in these populations until times of affluence. Then, with decreased exercise from work and increased calories, the researchers saw a corresponding rise in the number of people diagnosed with diabetes. This pointed to the relationship between diabetes, diets, and exercise.

Type I and Type II Diabetes

As diabetes research progressed, it was found that diabetes wasn’t always caused by the absence of insulin in the body. It was found that some people with diabetes had normal, or even excessive, amounts of insulin, leading to the classifications of *Type I (or insulin-dependent) diabetes* and *Type II (or non-insulin-dependent) diabetes*. Type I diabetics require injectable insulin. The identification of Type II diabetes opened the door for research on the link between lifestyle, including diet and exercise, and diabetes treatment. Type II diabetics often can be treated without insulin, with diet and exercise being important components of successful treatment.

In the past, Type I diabetes was called *juvenile diabetes*, and Type II diabetes was called *adult-onset diabetes*. Neither type of diabetes limits itself to particular age groups, so the more appropriate terms *Type I* and *Type II* are used today.

No one is sure what causes some people, but not others, to develop diabetes. Some people are genetically predisposed for diabetes but never develop it. Others don't have a genetic predisposition for diabetes, yet they develop it anyway. However, a definite link has been found between diabetes and obesity. In the United States, obesity has become an epidemic among school-aged children. Many of these children are developing Type II diabetes as a result of their obesity.

How can people reduce their risk for diabetes? Fitness counts when attempting to prevent or control diabetes. If you treat your body well by maintaining a healthy weight, exercising, getting enough rest, staying hydrated, eating right, and avoiding drugs, alcohol, and smoking, you'll put yourself at less risk for diabetes.

How does Type II diabetes affect the body? The body's cells get their energy from glucose. As you've learned, glucose can be extracted from a variety of foods, including potatoes, fruit, breads, pasta, and so on. This glucose is then stored in the liver. When the body needs energy, the liver releases glucose into the bloodstream, and the organs that need the energy grab the glucose and use it. Insulin is a substance released by the pancreas that helps the cells to absorb glucose.

However, in Type II diabetics, this system doesn't quite work the way it's supposed to. The pancreas might not be able to release all the insulin it makes. Insulin is the "key" that opens locked cells to pave the way for glucose use. Without insulin, the body doesn't know how to use glucose. When the glucose can't get inside the cells, it accumulates in the blood. Too much glucose in the blood can lead to many medical problems. The medication that Type II diabetics take isn't insulin; it's a substance that tells the pancreas, "Wake up and make some insulin of your own!"

Type II diabetics can help their body use the glucose it needs by taking their medication, exercising, and eating properly. It has been found that just a 10-pound weight loss (in people who need to lose weight) helps insulin to work better and that regular exercise also helps the body to use insulin.

Once researchers developed a better understanding that injected insulin alone wasn't enough to control diabetes and that diet could be a powerful treatment tool, they set out to find exactly what type of diet and exercise should be recommended to diabetics.

Based on the balanced-diet theory, the American Dietetic Association began to formulate diabetic diets. From observation, it was found that avoiding certain foods did little to control diabetes, but a diet balanced in protein, fat, and carbohydrates seemed to help the condition. A variety of tools, including exchange lists, carbohydrate counting, and the glycemic index, can be used by people who are attempting to control calorie intake as well as diabetes.

Exchange List for Meal Planning

For the past four decades, many dietitians and healthcare workers have used *exchange lists* to formulate diabetic diets. The exchanges are arranged into three groups: carbohydrates, meat, and fats. The carbohydrate group includes starch, fruit, milk, and vegetable exchanges. The meat group includes very lean, lean, medium-fat, and fat meats; seafood; poultry; and meat-substitute exchanges. The fat group includes saturated and unsaturated fat exchanges.

Each exchange is assigned a calorie level; for example, one fat exchange is 45 calories. Each food within the exchange is assigned a portion amount. For example, one slice of bacon, one-eighth of an avocado, and one teaspoon of margarine are all one fat exchange, and all are worth 45 calories. People who have worked with the exchanges for a while find they can analyze a recipe or a menu in a matter of minutes.

The exchanges give patients and menu planners freedom of choice. Instead of being told that they must have grapefruit juice at breakfast time, patients are told that they're entitled to one fruit exchange in the morning. This can be translated into the correct size portion of juice, fresh fruit, dried fruit, or canned or frozen unsweetened fruit.

Diabetics are counseled as to the correct calorie level for maintenance of good health. The exchange lists allow them to select types and amounts of food while maintaining a healthy calorie level. For example, a person who is told that he or she can have one fruit exchange, two lean meat exchanges, two starch exchanges, and one fat exchange for breakfast might select cantaloupe wedges, steamed tofu, two slices of toast, and margarine one day. The next day he or she might decide on tomato juice, an egg-white omelet, and a toasted bagel. Both meals comply with the assigned exchanges.

Carbohydrate Counting

The exchange lists are one method used to calculate the daily total of calories from fat, carbohydrates, and protein. Exchange lists are used by diabetics as well as by people who want or need to keep track of fat, protein, or total calories. For example, a person attempting to lower cholesterol through proper diet can use the exchange lists to calculate how much fat is in his or her diet. A person desiring to keep daily energy intake in the 1,800-calorie range can use the exchanges to calculate total calories.

Carbohydrate counting, another method of diet control, is an effective way for diabetics to control their carbohydrate intake, thus controlling their blood sugar. Carbohydrate counting concentrates on foods containing carbohydrates, such as breads, cereals, pasta, rice, grains, potatoes, dairy products, fruit and fruit juice, table sugar, and candy and desserts. People who use carbohydrate counting for meal planning are expected to keep their protein and fat intake within acceptable limits, because protein and fat aren't counted or calculated.

Carbohydrate counting has been around since the 1920s. It allows more flexibility in menu planning, because no foods are excluded and only carbohydrates are counted. Persons using carbohydrate counting look at the "total calories" portion of food labels. They can also use printed material from restaurants that list nutritional analyses of their menus or purchase books or computer programs that detail carbohydrate information.

Carbohydrate counting operates with the knowledge that the body breaks all carbohydrates into glucose, no matter the source of the carbohydrate. One carbohydrate-counting exchange equals 15 grams of carbohydrates and is generally considered to be one serving of starch (for example, 1 slice of bread or 1/2 bagel), fruit (for example, a small piece of fruit or 1/2 cup fruit), or milk (for example, one 8-ounce glass).

Glycemic Index and Glycemic Load

Your body handles different types of carbohydrates in different ways. Your body digests a fresh apple at a leisurely rate, releasing its carbohydrates in a steady stream. In contrast, your body takes the sugar from apple juice and dumps it into the bloodstream all at one time. People with and without diabetes are concerned about having sudden spikes (and the resulting lows) in blood sugar.

It's important to know which foods can cause blood sugar spikes, because such spikes can exacerbate the symptoms of diabetes and have been implicated in the onset of heart disease

and obesity.

The glycemic index (GI) and glycemic load (GL) are ways to calculate how food affects blood sugar levels. The GI or GL shows how rapidly a food is digested, which in turn shows how quickly or slowly it drives up blood sugar. The lower the GL number, the less a serving of that food will cause blood sugar to rise quickly. On the GL scale, 10 or less is considered low; 11 to 19 is moderate; and over 20 is high (Figure 6). The following are some GL values per serving:

Food Type	GL Value per Serving
Peeled and steamed carrots	2
Pasta	18
Sushi	19
Whole bagel	25
Baked potato	26
Raisins	28
Popcorn	8
Instant oatmeal	9
Banana	13
Whole-wheat bread	6
White bread	11
Fresh apple	6
Apple juice	12
Peanuts	1

[Glycemic Load Chart]

Key Points and Links

READING ASSIGNMENT

Key Points

- Diabetes has been recognized for thousands of years. Type I diabetes (insulin dependent) was formerly known as juvenile diabetes. Type II diabetes is not controlled by insulin injections. A balanced diet can help to control diabetes.
- An exchange list grouped by carbohydrates, meat, and fats gives diabetic patients freedom of choice in their diet.
- Because the body breaks all carbohydrates into glucose, some diet plans are based on carbohydrate counting.
- The glycemic index shows how rapidly a food is digested and how quickly it drives up blood sugar.

Links

- [American Diabetes Association](http://www.diabetes.org/) (www.diabetes.org/)

Exercise: Dealing with Diabetes

Based on what you've read, answer the following questions.

1. What are the essential components for controlling Type II diabetes?
2. What are some differences between Type I diabetes and Type II diabetes?
3. Using the exchange system, if a person ate two fat exchanges with a meal, such as one-quarter of an avocado, how many calories would he or she get from the avocado?
4. How can using an exchange list help a person with diabetes maintain his or her health?
5. Using carbohydrate counting, how many grams of carbohydrates does a ham sandwich contain?
6. What is the carbohydrate counting method, and how is it used in diet control?

Exercise Answer Key:

Exercise: Dealing with Diabetes

1. A healthy lifestyle that includes adequate rest, exercise, and a balanced diet
2. Type I is insulin-dependent; Type II is non-insulin-dependent. Type I requires injectable insulin to treat; Type II can be treated without insulin with correct diet and exercise. A person is usually born with Type I diabetes, whereas Type II has been linked to obesity and poor dietary habits.
3. 90 calories; one fat exchange = 45 calories

4. Exchange lists can be used by diabetics to give freedom of choice in what they can have to eat or drink. It allows diabetics to select types and amounts of foods while maintaining a healthy calorie level.
5. 30 grams or 2 carbs, because two slices of bread 2 starch servings
6. Carbohydrate counting can help people control their carbohydrate intake, which helps control blood sugar. It allows flexibility in menu planning because no food is excluded, and only carbohydrates are counted.

2.4 Discuss the importance of proteins

The Body's Need for Protein

READING ASSIGNMENT

Protein differs from fats and carbohydrates in that it contains nitrogen, a mineral that's essential for life. Protein is necessary for keeping body systems in good repair. Too little protein can result in poor growth and healing, immune function problems, breathing difficulty, and even heart problems, such as dangerously low blood pressure or irregular heart rhythms. However, too much protein, eaten over long periods of time, can result in kidney disease, poor liver function, and vitamin deficiencies and might play a role in some forms of heart disease and cancer. What's the answer? Balance!

How the Body Uses Proteins



[Sources of Protein]

Protein comes from a variety of food sources.

Your body produces and uses thousands of proteins, each with its own job. Proteins are found in the internal organs, the muscles, the skin, and in the blood. They're also an important part of the immune system. Without protein, your body doesn't hold up very well, because it lacks the building material necessary to keep the body functioning properly. Too much protein causes problems, too, because excess protein puts a strain on the liver and kidneys.

Whole proteins aren't exactly what the body is looking for. It's the amino acids that make up the protein chains that the body can use.

Proteins are chains made from the 20 different amino acids contained in plant and animal protein.

Nine of the amino acids are *essential* amino acids. In nutrition, essential means the body has to have it, but can't produce it on its own. Essential nutrients must be obtained from the diet. You can get essential amino acids two different ways: by consuming animal products or combinations of plant products. Animal proteins, such as meat, dairy, seafood, and eggs, contain all the essential amino acids. Plant proteins have some amino acids. Beans, legumes, nuts, and soy have one group of essential amino acids. Wheat, rice, and other grains have another group of essential amino acids. When you eat one food from each group, such as rice and beans or peanut butter and bread, you get all the necessary essential amino acids from a combination of foods. You'll learn more about combining plant-based foods to obtain protein a little later in the study unit when we discuss vegetarian eating patterns.

Protein helps you in your endeavor to keep fit. Unlike the energy you get from carbohydrates and fats, some proteins take energy and turn it into physical work, such as flexing and gripping and contractions that involve muscle action. Every time you type on a computer keyboard, climb stairs, lift weights, blink, or breathe, you need protein to fire the muscles.

If you aren't eating enough protein, then you aren't doing your immune system any favors. Your white blood cells, lymph fluid, and antibodies are all necessary for a well-functioning immune system and rely on protein as their building material.

Antibodies are specific proteins found in the blood that attack and neutralize viruses, fungi, bacteria, and anything else that doesn't belong in your system.

Protein also tells your circulatory system how much fluid to keep and how much to discard. In this way, your body has the correct fluid balance, which means your tissues get nourished correctly and your heart can pump at a normal rate. If there's too little protein in the diet, then the body can't maintain correct fluid levels. If fluid levels are incorrect, fluid tends to flow out of the veins and arteries and into the surrounding tissue, causing *edema*, uncomfortable swelling and pressure. Edema can cause blood pressure to rise and can damage joints and muscles.

Protein is a real workhorse. Proteins carry lipids, vitamins, and minerals around the body in the blood. If you don't have enough protein, then the body doesn't get nourished correctly, because there are no delivery people around to take what's needed to where it's needed. Protein also helps to transport toxins from used-up nutrients away from the muscles and organs. If there's a protein deficiency, then you can have a buildup of toxins.

Your body much prefers carbohydrates and fat for energy but will use protein in a pinch. Converting protein to energy is a clunky, inefficient mechanism. The body will start to break down its own muscles for energy if no other sources of energy are available. This happens in cases of extreme starvation.

Protein Myths

For as long as people have been eating protein-containing foods, there have been myths about its "magical" qualities. Here are some of the more popular protein legends:

- *Myth:* Protein-enhanced shampoos and lotions will help to strengthen the hair and fingernails.

No way. The portion of your hair and nails that you can see is already past saving. It's basically dead tissue, waiting to be discarded. The portion of your hair and nails that you can't see, the stuff that starts right below the skin, is what needs to be nourished. That comes from a balanced diet and lots of fluids. Soak and condition to your heart's content. If you don't have a good diet, your hair and nails will never look healthy.

- *Myth:* If I want to "bulk up" my muscles, I need protein or amino acid powders.

Have you been listening? All proteins are made from amino acids. Most people eat too

much protein. One cheeseburger provides about 30 percent of a person's protein needs for the day. Throw in some grilled chicken, a cheese pizza, tuna salad, or a beef burrito and you've got all the protein the body can handle for the day. Not only are they expensive, but protein powders can cause liver and kidney overload. Have a peanut butter sandwich and save your money. This information applies to everyone, including people in weight training!

- *Myth*: Lots of people are having collagen injections to give them plumper, more kissable lips. Collagen is from an inert plant source, right?

Wrong! *Collagen* is a type of animal protein that helps keep muscles in shape. Most plastic surgeries involve animal (usually pork or beef) collagen that has been pasteurized to prevent cross-contamination. Collagen injections don't last, because the collagen is slowly absorbed into your system, just like any other kind of protein.

Popular Diet Plans

Now that we've spoken about carbohydrates and proteins, we're ready for a discussion about some popular diet fads. Everyone you speak to seems to be following some sort of diet, usually separating into disparate camps: high protein/low carb or high carbohydrate/ low fat. You've probably heard of the Atkins, Zone, and South Beach diets, which are high-protein diets, and the Ornish and DASH diets, which are high in carbohydrates.

The truth about weight-loss diets is that there's no one truth; there's more than one right answer. The discussion can't be reduced to high fat/low carb versus high carb/low fat. The complex carbohydrates in vegetables, fruits, and grains have sustained the human race since there was a human race. Unfortunately, complex carbohydrates have largely fallen out of favor, replaced by the simple carbohydrates found in white flour, sugar, and fructose.

The same thinking applies to fat. Most agree that hydrogenated fats and trans fats aren't healthy. While experts continue to debate the nutritional benefits of saturated fats from meat and dairy, most researchers agree that the polyunsaturated fats in some plants and fish are beneficial to the body and the brain. As you can see, to reduce any diet debate to fats versus proteins versus carbs is meaningless.

For the past 25 years, Americans have been getting fatter. During these 25 years, health

authorities have been recommending that people cut back on the fat in their diet.

Unfortunately, decreasing fat and increasing carbohydrate levels just seems to have made people fatter. Many other dietary changes have occurred in the past 25 years:

- The number of calories consumed per person has increased. Estimates range from an increase of 100 to 400 calories per day per person. Even if we take the lower of these two numbers, this would mean an increase of about 10 pounds per person, per year.
- Although the percentage of fat calories has decreased, the overall amount of fat consumed has stayed fairly constant because of the increase in the total number of calories consumed.
- The consumption of unhealthy trans fats and hydrogenated fats has increased.
- The consumption of simple carbohydrates (low-nutrient, high-calorie carbs) has increased.

If you listen to the two diet camps (high protein versus high carbohydrate), you might think that two vastly different diet regimens exist. Actually, they share a number of similarities:

- All diets recognize that if you're going to lose weight, you must burn more calories than you consume. Regardless of whether they count calories, all programs are designed to decrease a person's caloric intake.
- All diets acknowledge that physical activity can help people lose weight and maintain weight loss.
- All diets must include the nine essential amino acids found in protein.
- No diets suggest that you can lose weight while consuming large amounts of simple, non-nutritious, calorie-dense carbohydrates, such as sugar and soda.
- All major diets are aware of the dangers of hydrogenated fats and the benefits of omega-3 fatty acids.

In other words, every major weight-loss diet cuts calories, reduces simple carbohydrates, supports exercise, and modifies the intake of unhealthy fat. This leaves only a few variables to play around with when designing a diet:

- How many calories?
- What percentage of complex carbohydrates should the diet contain?
- How much fat and what type of fat is acceptable?
- What's the recommended proportion of proteins, complex carbohydrates, and fats?

- How much exercise is desirable, and what sort of exercise?

Keeping this in mind, here's a rundown of some of the more popular diets people are currently following.

Ornish Diet

For people with severe heart disease associated with cholesterol abnormalities who can't or don't want to take cholesterol-lowering medications, the *Ornish* program might be the best option, if they can maintain it. The Ornish diet is very demanding. It excludes all oils and animal products except for nonfat yogurt, nonfat milk, and egg whites. Saturated fats are limited as much as possible; total fat is limited to 10 percent of daily calories. The bulk of the menu is composed of carbohydrates (75 percent of calories).

The Ornish diet wasn't designed to be only a diet. In addition to following strict dietary rules, people in the program exercise at least 90 minutes three times a week and use stressreduction techniques. In addition, the diet prohibits smoking and alcohol consumption.

Many books and cookbooks explain the Ornish program and present menus and recipes. A number of ready-to-eat Ornish products are available, including health bars and shakes.

People on low-fat diets should consume a wide variety of foods and take a multivitamin, if appropriate. Low-fat diets that are high in fiber, whole grains, legumes, and fresh produce offer health advantages in addition to their effects on cholesterol. They're effective in keeping weight off, and they protect against high blood pressure and possibly against certain cancers.

DASH Diet



[Bowl of Nuts]

The DASH diet includes a daily serving of nuts, seeds, or legumes.

Dietary Approaches to Stop Hypertension, better known as *DASH*, is now considered an important step in managing blood pressure. The DASH diet is low in saturated fat (but includes calcium-rich dairy products that have no fat or low fat) and rich in whole grains, fruits, and vegetables. The diet includes a daily choice of nuts, seeds, or legumes and contains modest amounts of protein (preferably fish, poultry, or soy products). In one study, after eight weeks on the diet, subjects from a broad range of backgrounds experienced a significant reduction in blood pressure. Not only is this diet rich in important nutrients and fiber, but it also includes foods that contain two and one-half times the amounts of electrolytes (for example, potassium, calcium, and magnesium) found in the average American diet. DASH-acceptable foods include most fruits, many vegetables (especially carrots, spinach, celery, alfalfa, mushrooms, lima beans, potatoes, avocados, and broccoli), chicken, liver, and nonfat or low-fat milk. According to a recent study, a low-calorie oat or wheat diet may significantly reduce blood pressure; however, more study is needed to confirm these findings. Many of these foods also are high in fiber, which protects against many diseases.

South Beach Diet



[Eggs and Bacon]

A typical South Beach diet includes two eggs and lean bacon.

Miami cardiologist Arthur Agatston created the *South Beach diet*, and his book has spent many weeks on the *New York Times* bestseller list. The diet consists of three phases. The first phase is severe deprivation of calories—no bread, potatoes, rice, fruits, sweets, or alcohol for two weeks. In phase 2, one or two favorite foods can be reintroduced. Phase 3 is the maintenance phase.

Phase 1, which lasts 14 days, is the strictest. Normal-sized helpings of lean meats, such as chicken, turkey, fish, and shellfish, are allowed. Vegetables also are allowed, as are nuts,

cheese, and eggs. The goal is to eat three balanced meals a day and to eat enough so that you don't feel hungry all the time. A typical South Beach diet breakfast is two eggs and lean bacon.

Phase 2 lasts until the weight-loss goal has been met. During this phase, some of the foods that are banned from Phase 1, such as whole-grain breads and low-fat dairy foods, can be reintroduced.

Phase 3 focuses on weight maintenance. Dr. Agatston describes this phase as a “way of life.” Should your weight begin to climb, you repeat the diet plan. “People have been able to turn it into a lifestyle, not just a quick diet,” Agatston said about his program, noting that it can be reasonably followed for a long time.

The Zone Diet



[Plate of Protein and Vegetables]

The Zone Diet emphasizes the importance of lean protein and fiber-rich vegetables.

The idea behind the *Zone Diet* is that the digestive system operates ideally when only two groups of food are consumed: lean protein and natural carbohydrates, such as fruits and fiber-rich vegetables.

According to the Zone Diet, the ideal ratio of carbohydrates, proteins, and fats is 40-30-30, respectively. The five fingers of your hand should remind you to eat at least five times a day—three meals and two snacks.

The Zone Diet was created by Dr. Barry Sears and has attracted many followers. You can find the Zone restaurants, spa vacations designed around the Zone menus, the Zone books, and the Zone ready-to-eat foods.

The Atkins Diet

The foundation of the *Atkins diet* is a four-phase eating plan, combined with vitamin and mineral supplementation and regular exercise.

1. Phase 1 is referred to as *Induction*. This first step involves restricting daily carbohydrate consumption to 20 grams and obtaining carbohydrates primarily from salad and other nonstarchy vegetables.
2. In Phase 2, the *Ongoing Weight Loss (OWL)* phase, Atkins dieters add carbohydrates, in the form of nutrient-dense and fiber-rich foods, by increasing to 25 grams daily the first week, 30 grams daily the next week, and so on, until weight loss stops. Then the Atkins dieter subtracts 5 grams of carbohydrate from his or her daily intake so that sustained, moderate weight loss continues.
3. In Phase 3, *Pre-Maintenance*, the dieter transitions from weight loss to weight maintenance by increasing the daily carbohydrate intake in 10-gram increments each week.
4. Phase 4 involves *Lifetime Maintenance*. During this phase, a wide variety of foods can be incorporated into the menu while controlling carbohydrate intake to ensure weight maintenance.

All of these contradictory diets can be confusing, but don't worry; you aren't alone. Not even the experts can agree on what causes people to put on weight or the best way to lose it.

Which diet is better: high-protein or high-carbohydrate? Which is healthier? Most experts agree that more studies are needed to evaluate the long-term effectiveness of these diets. Until then, several recipes from each camp are provided in Appendix B. Remember to keep it healthy and balanced!

Vegetarianism

A discussion of proteins inevitably brings up the topic of vegetarianism, because vegetarians exclude some or all types of animal products. Many non-vegetarians can't imagine how one can get sufficient amounts of protein without animal products. Nowadays, more and more people are becoming vegetarian, semi-vegetarian, or just cutting back on animal protein consumption.



[Different Types of Cheese]

Lacto-ovo vegetarians include animal products, such as cheese, in their diets.

What foods are acceptable to most types of vegetarians? The word *vegetarian* has several meanings. It can be an umbrella term for anyone who excludes some or all animal products from the diet (for example, vegans, fruitarians). For many years, people, when asked what type of vegetarian they were, would respond “lacto-ovo.” *Lacto-* means dairy, and *-ovo* means eggs. Thus, *lacto-ovo* vegetarians exclude animals from their diet but include animal products, such as cheese, sour cream, and yogurt made from cow, goat, or any other kind of animal milk. Lacto-ovo vegetarians will accept animal products that they perceive don’t harm or make an animal suffer.

In the past several years, the “lacto-ovo” has been dropped, and vegetarians formerly known as lacto-ovo vegetarians are now known simply as *vegetarians*. When devising a vegetarian menu, it’s important to determine whether or not dairy products are permitted.

Vegan diets are stricter than simple vegetarian diets. *Vegans* are vegetarians who exclude meat, fish, poultry, eggs, dairy, and honey from their diets. They also don’t use fur, wool, leather, and animal-tested products. Most vegans are dedicated to animal rights, which would include forcing animals to produce food and be “shackled” in miserable conditions.

When people speak about “vegan nutrition issues,” they’re usually referring to the amount of protein found in a vegan diet. Some people believe that it isn’t possible to get enough protein from a vegan diet to do extensive workouts. Until several years ago, it was thought that vegans had to do extensive protein planning or protein combining because animal proteins contain all the essential amino acids, whereas plant proteins each contain some of them. It was thought that consumption of various plant-based foods, such as rice and beans or lentils and pasta, had to be planned to guarantee sufficient intake of complete proteins.



[Types of Breakfasts]

Typical Breakfast for a Lacto-Ovo Vegetarian (A) and a Vegan (B).

Now we know that as long as you eat lots of different foods each day, by hook or by crook, you'll have the proper protein intake. Just as *omnivores* (people who include every type of food in their diet) can follow the [MyPlate Guide](http://www.choosemyplate.gov/) (www.choosemyplate.gov/) without eating specifically calculated foods, so can vegans, as long as they eat a varied, well-balanced diet. So, vegans shouldn't live just on apples and broccoli—throw in some soymilk, hummus, or a bean burrito, too. By the way, soy is an almost-complete protein food. Soymilk, *edamame* (fresh soybeans), tofu, or soy burgers can add a lot of fast protein to the diet.

Remember that there are different levels of each type of vegetarian. Some lacto-ovo vegetarians might eat dairy and eggs but not wear leather or use animal-tested products. Some lacto-ovo vegetarians might eat dairy but no eggs, and others might eat eggs but no dairy.

Key Points and Links

READING ASSIGNMENT

Key Points

- Thousands of proteins, each with its own purpose, are produced by the body. Of the 20 different amino acids that make up protein chains, nine are essential and must be obtained from the diet. Proteins help maintain the immune system and regulate fluid balance.
- In the past 25 years, overall calorie consumption has increased, as has the consumption of unhealthy fats and low-nutrient carbohydrates. To lose weight, a dieter must take in fewer calories than he or she burns.
- The Ornish diet is a strict program that limits saturated fats and attempts to control cholesterol.

- The DASH diet was created to manage high blood pressure.
- Weight maintenance is one of the three phases of the South Beach diet.
- On the Zone Diet, carbs, proteins and fats are consumed according to a ratio.
- The Atkins diet is a four-phase eating plan.
- Vegetarians exclude some or all animal products from their diet.
- Vegans usually support animal rights and neither use nor consume animal products.
- Plant-based foods provide sufficient protein in a well-balanced vegan diet.

Links

- [Dietary Guidelines for Americans](http://health.gov/dietaryguidelines/2015/default.asp) (health.gov/dietaryguidelines/2015/default.asp)
- [MyPlate Guide](http://www.choosemyplate.gov/) (www.choosemyplate.gov/)
- [USDA Protein Requirements](http://healthyating.sfgate.com/usda-protein-requirements-grams-8619.html) (healthyating.sfgate.com/usda-protein-requirements-grams-8619.html)

Exercise: How the Body Uses Proteins

Based on what you've read, answer the following questions.

1. Why are essential proteins so important to a healthy diet?
2. How does the body use protein?
3. List at least three features shared by the various popular diet plans discussed in this section.
4. Name and describe a category of vegetarianism.

Exercise Answer Key:

Exercise: How the Body Uses Proteins

1. These proteins can be obtained only from food sources. They can't be manufactured by the body.
2. The body uses protein to help build and repair muscles, as well as help keep nails and hair follicles healthy. Protein helps transport toxins out of the body, away from the muscles and the organs.
3. Any three of the following: (a) They all recognize that if you're going to lose weight you must burn more calories than you consume; (b) they all acknowledge that physical activity can help people lose weight and maintain weight loss; (c) they all include the

nine essential amino acids found in protein; (d) none of them suggest that you can lose weight while consuming large amounts of simple, non-nutritious, calorie-dense carbohydrates, such as sugar and soda; (e) they're all aware of the dangers of hydrogenated fats and the benefits of omega-3 fatty acids.

4. Lacto-ovo: Excludes meat but includes animal products, such as eggs and dairy
Eats nothing derived from an animal source

2.5 Distinguish how fats positively or negatively affect the body

Fats

READING ASSIGNMENT

Are all fats created equal? We should all be so lucky! Fats differ in chemical structure, appearance, taste, and use. What all fats have in common is that they have nine calories per gram and are very dense in calories. Four ounces of baked or steamed potatoes have about 90 calories, while the same amount of fried potatoes has about 200 calories.



[Baked Potato with Sour Cream]

Loading a baked potato with butter and sour cream significantly increases the amount of calories it contains.

A medium-sized fresh apple is about 60 calories, with no fat, whereas a medium-sized avocado can be as much as 360 calories, all from fat. The exchange lists for meal planning state that a baked potato has about 80 calories of starch, and 3 cups of popped (not

buttered) popcorn have about 80 starchy calories, but one-eighth of an avocado or one slice of bacon is 45 calories, all from fat. A whole egg, including the yolk, is about 75 calories; the same amount of egg whites is only about 40 calories, with no fat. You have to know a little bit about nutrition to understand why all of those salads (heaped with grated cheese, bacon bits, and salad dressing) aren't a good food for weight loss.

All fat contains the same amount of calories. A teaspoon of olive oil and a teaspoon of butter both contain about 45 calories. But that's where the similarity ends. Some types of fat can cause damage and disease to the body, whereas other types of fat can actually contribute to health.

Triglycerides

Triglycerides are a form of fat; when found in the bloodstream, they can be an indicator of heart disease. Diabetics and people who are obese tend to have high triglyceride levels, as well as heart disease. The good news is that triglycerides and that other nuisance fat, cholesterol, can be lowered by eating the right foods, maintaining a desirable weight, stopping smoking, and exercising.

Some people actually are physically unable to handle high-fat diets. Both the pancreas and the gallbladder contribute enzymes and emulsifiers that help the body to break down and absorb fat. If either organ isn't functioning properly, then the body lacks the chemicals necessary to digest fats easily. People who have undergone radiation therapy or who have cystic fibrosis or *Crohn's disease* (a chronic and debilitating inflammation of the colon) can develop a malabsorption syndrome or the inability to tolerate fat in the diet. Such people will appreciate lower-fat menu items, so they can enjoy eating without feeling ill afterward.

Saturated Fats

Dietary fats are either saturated or unsaturated. *Saturated fats* are strong substances and are fairly solid at room temperature. *Saturation* refers to the amount of hydrogen that a molecule of fat is holding on to. If a molecule of fat is holding on to the most hydrogen it can, then it's saturated. Imagine a glass of iced tea. Then imagine adding teaspoon after teaspoon of sugar, until you can't stir the tea. That tea is "saturated" with sugar. When you use a paper towel to wipe up some spilled water, the towel becomes saturated with water, meaning it can't hold any more water. Saturated fat molecules do the same thing with

hydrogen, holding on to as much hydrogen as possible.

Saturation makes for a very strong molecule that's difficult to break apart. For this reason, saturated fats give very good texture and mouthfeel to food. Chefs often prefer to use saturated fats, such as butter or bacon fat, in their cooking. Saturated fats contribute texture and taste to many menu items. For example, butter or hydrogenated vegetable oil is responsible for the texture and taste of cookie dough.

Unfortunately, the body has difficulty in breaking down saturated fats. Excess saturated fats are stored in the walls of veins and arteries, narrowing them and causing a decrease in elasticity and volume. This ultimately leads to various disease states.



[Breakfast of Eggs, Bacon, and Potatoes]

This breakfast is high in saturated fat.

Examples of saturated fats include the marbling in steak, butter, egg yolks, and bacon grease. Most saturated fats are found in animal products, with several exceptions. Palm oils, tropical oils, and coconut products are plant products that contain saturated fat.

So you can't feel virtuous if you stop adding whole cream to your coffee and switch to a coffee lightener made from coconut oil. Both cream and coconut oil are saturated fat and will produce the same damage in your body as saturated fats from animal products.

Hydrogenation

Ever wonder how corn oil is miraculously changed into solid oil? It's done through a process called *hydrogenation*. Hydrogen is introduced to vegetable oil molecules to make them saturated. Nature made corn oil to be liquid. Humans fooled around with nature and added some chemical bonds where there weren't any before. When you make mayonnaise and

whip lots of air into the oil, you're creating a type of hydrogenation.

For years it was thought that hydrogenated vegetable oils, such as those in margarines or solid vegetable shortenings, were healthier than animal fats, such as butter or lard. It's now thought that the bonds made from adding hydrogen to vegetable oil, called *trans fatty acid bonds*, might do just as much damage to the veins and arteries as animal fat.

If you have to use margarine, select the healthiest one. Read the label. Be sure the margarine is low in saturated fat; usually, the softer the margarine, the lower the saturation. Some tub and squeezable margarines don't have trans fatty acids at all.



[Nutritional Label with Measuring Tape]

It's important to read nutrition labels to determine the fat content of food.

Certain manufacturers have created margarines from plant sterols that are almost medicinal. These natural plant sterols, isolated from pinesap or soy, don't allow the body to absorb cholesterol. This type of margarine shouldn't be used for cooking, but rather used in small amounts by people who need to reduce their cholesterol. Other margarines aren't as concerned about reducing cholesterol as they are in helping with weight loss. They're reduced in calories. These, too, shouldn't be used in cooking, because they contain too little fat to yield an acceptable product.

Cholesterol

Saturated fat from plant products is simply called saturated fat. Saturated fat from animal products is called *cholesterol*. It's important to understand the distinction. A manufacturer can produce a sandwich cookie with a filling that contains coconut oil. Coconut oil has a smooth texture and a silky mouthfeel. It's also extremely saturated. It will clog up your arteries as fast

as a double bacon cheeseburger. However, the cookie manufacturer can put “contains no cholesterol” on the label, because cholesterol is found only in animal products.

Knowledgeable consumers will read the ingredient line, see the coconut oil, and then make a decision whether the cookie tastes good enough to risk heart disease.

While the body can synthesize the cholesterol it needs to create hormones and other body chemicals, some people inherit a gene that tells their body to create more cholesterol than is needed. Such people have to be very careful to limit the cholesterol in their diet, because their body already overproduces cholesterol. Even with healthy diet and exercise, cholesterol-lowering medications are sometimes necessary to help keep cholesterol at the proper level.

There are different types of cholesterol. When you go for a blood test, the doctor measures total cholesterol as well as the different types of cholesterol. A total cholesterol value of 200 or below is thought to decrease the possibility of heart disease and high blood pressure. People with a total cholesterol value over 240 have twice the risk of heart attack; those with a total cholesterol value of over 300 have three times the risk, and so on.

HDL (high-density lipoprotein) and *LDL (low-density lipoprotein)* are the two cholesterol subtypes. of the two, HDL cholesterol is thought to be the less harmful. LDL cholesterol can do more harm to the arteries; the higher the HDL and the lower the LDL, the better.



[Bottle and Dish of Olive Oil]

Olive oil is a monounsaturated fat.

Unsaturated Fats

Unsaturated fats are found only in plant products. A *monounsaturated fat*, such as olive oil,

has one area on its molecule that's unsaturated. Put another way, a monounsaturated fat has a hole where a hydrogen used to be. In a *polyunsaturated* fat, many areas on the molecule are unsaturated. Unsaturated fats, such as corn, soy, safflower, canola, sesame, hazelnut, and cottonseed oils, are all liquid at room temperature. Unsaturated fats aren't holding on to as much hydrogen as they can and therefore are structurally weaker than saturated fat. Think of saturated fats as having a double chain-link fence surrounding them and unsaturated fats as having a single fence with lots of holes in it.

Breakdown and Storage of Dietary Fats

Saturated fats are big molecules that require a lot of energy to be broken down. Unsaturated fats are less formidable and require less energy to be taken apart. For this reason, the body will store any saturated fat it doesn't absolutely need. The storage repository for saturated fat in the body is in fat cells. Dietary fat is stored within each fat cell in a part of the cell called the *vacuole*. When you cut down calories to lose weight, the vacuoles in the fat cells empty, but the fat cells are still there. When you begin to eat more calories and have excess calories, the fat cells suck up the excess calories and store them as fat.

Unsaturated fats are more readily broken down by the body, because their "fence" has lots of holes in it. It's obvious if someone is storing a lot of unsaturated fat, because unsaturated fats are carried in the "fatty pads" of the body, or places where fat accumulation is abundant and evident.

Any extra weight on the body strains the heart. The heart has to work harder to supply blood to the extra areas' bulk. A person with an ideal weight of 120 but who actually weighs 180 pounds has to take care of 60 extra pounds, day and night, all the time. The extra weight forces the body's engine, the heart, to overwork on a constant basis. If this happens over a long period of time, the "engine" will start to show signs of wear and tear.

Extra saturated and unsaturated fat can damage the body. Fat is easily deposited but very hard to eliminate from the body. Excess fat adds excess weight, clogs passageways, and creates extra work for the heart, lungs, organs, and muscles and joints.

Use of Fat in the Body

It's important to not go overboard; let's talk about fat's good points. Fat is an essential nutrient. Your body can produce some of the fat it needs, but some must be obtained from

diet. Cholesterol is an important part of many natural body compounds, such as certain hormones, and it also helps the body to absorb vitamins and other nutrients. Vitamin D can be synthesized by your body from dietary cholesterol. Even if you don't eat any foods that contain cholesterol, you'll still have some cholesterol circulating in your blood, because the body produces the cholesterol it needs.

Fat is an efficient source of calories, meaning that it's a good source of energy. Foods that are high in fat are high in energy. During certain times of life, this is very important. For example, an infant needs a lot of energy to grow but has a very small stomach and a limited ability to store energy. Breast milk and infant formulas have a high fat content that meets infants' needs. An infant put on a low-fat diet won't grow or develop properly. A person hiking Mount Everest will need an enormous amount of energy but won't want to carry a lot of heavy food packages. Special hiking foods are very high in unsaturated fats, supplying lots of energy in a small package.



[Man Bottle-Feeding Baby]

Infants require a high fat content in their diet.

Both fats and carbohydrates are protein-sparing nutrients. This means that the body uses fats and carbohydrates to do the day-to-day tasks and leaves protein for the more important jobs, such as building and maintaining muscle and keeping the immune system strong. Different parts of the body work more efficiently with different types of fuel. For example, the brain works *only* with glucose, whereas muscle prefers fat. During exercise, the body uses a combination of carbohydrates and fat for energy.

Some portions of certain fat molecules might contribute to health. Omega-3 fatty acids, found in fish and some plants, are said to contribute to heart health. Other fatty acids help to

regulate blood clotting and the opening and closing of blood vessels.

Just a Little Every Day

Fat is a very efficient source of energy and is an essential part of the diet. Because it's so efficient, only very small amounts are required on a daily basis. About 60 to 70 percent of the energy you need at rest comes from fat calories. Resting energy needs include things like breathing, blinking, swallowing, muscle contractions, and so on. Saved or stored energy is in the form of fat, to be used when needed. What are we trying to say? Don't fill up your shopping cart on the fat-free aisle and think you're doing your body a favor. Plan a balanced diet that contains no more than 30 percent of calories from fat every day, and enjoy a vinaigrette here, a little feta cheese there.

Visceral fat is the fat that surrounds the internal organs. Visceral fat shields the organs from bruising and acts as an insulator and cushion. Don't see the reason for this extra insulation? Just check out someone jogging down the street. All the internal organs are getting bounced around. Without visceral fat, you'd have bruised kidneys every time you ran.

Ever wonder why it sometimes seems that men can lose weight more easily than women? Part of the reason is the way fat is distributed in the body. Fat stored in different parts of the body has different characteristics. Fat stored above the waist is called *yellow fat* and is more metabolically active. Fat stored below the waist is called *brown fat* and isn't very metabolically active. This means that when your body needs extra energy and goes into its stores, it will use all the yellow fat before it begins to use brown fat.

Women have more brown fat than men. The yellow fat/brown fat ratio is the reason that it's harder for women to change a pants size than a shirt size. The body needs to use up all the yellow fat on top before it will begin to touch the brown fat on the bottom. You might notice, in both men and women, that when people diet to lose weight, you notice the weight loss first in their faces. This is the yellow fat/brown fat ratio working again.

The American Heart Association (AHA) is dedicated to improving cardiac health and therefore is very concerned with fat intake. The AHA guidelines recommend more fiber and less sugar in the daily diet and reducing the amount of salt. The Heart Association guidelines emphasize increasing exercise and reducing weight as being important for heart health. Perhaps most important, the AHA acknowledges that genes play a role in heart disease.

People with family histories of heart disease should be even more vigilant about their diet and lifestyle.

Omega-3 Fatty Acids

Fat isn't all bad. As you've learned, the body uses fat to insulate organs. Fat helps regulate body temperature and is the preferred source of energy for muscles at rest. In fact, some fat has a protective effect for the heart.

Omega-3 fatty acids, which are fats found in fish, soybean and canola oil, walnuts, and flaxseed might actually contribute to heart health.



[Fish on Ice]

Fish are rich in omega-3 fatty acids.

Researchers wondered how it was possible that native populations in Alaska, Norway, and Greenland could eat very high-fat diets and have very low incidences of heart disease and high blood pressure.

The answer was found in their diet—specifically, in the type of fat in the diet. All of the dietary fat came from fish, other seafood, and fish oil. These foods are naturally high in omega-3 fatty acids. Upon closer examination, it was found that omega-3s reduce the amount of hardened material (*plaques*) that form on artery walls. Cholesterol and saturated fats tend to attach themselves to the walls of the arteries. If this extra fat isn't eliminated, calcium attaches itself to the fatty deposits. This creates a *calcification*, or hardening, of the arteries. If there are a lot of plaques, the arteries lose their elasticity and narrow. When the arteries narrow, blood can't flow normally, and the heart must work harder. This can lead to high blood pressure and damage to the heart muscle.

This leads us back to omega-3s. Populations that have diets high in fish and seafood tend to

have fewer arterial plaques. The conclusion is that a diet high in fish and seafood will reduce the risk of heart disease, because omega-3s found in the fish reduce the possibility of hardened arteries. It's recommended that a healthy diet should include two to three fish meals per week, with a small amount of vegetable oils as well.

Fish oil supplements, in liquid and capsule form, have been available for many years. Current research suggests that fish oil supplement might not be the way to go. Because nutritional supplements aren't regulated by government agencies, consumers can't be sure of the source of the fish oil or how much omega-3s the supplement contains. Also, there's the risk of contamination with impurities during processing. It's possible to consume toxic levels of fish oils that can lead to cerebral strokes or liver damage. To keep the whole body healthy, stick to food when trying to get your omega-3s.

In addition to heart health, omega-3 fatty acids have also been linked to decreases in certain types of cancer. Once again, populations that consume large amounts of fish and seafood tend to have lower incidences of colon and breast cancer.

Omega-3s are an essential nutrient for brain development, growth, and function. That's why some people call fish "brain food." The brain is made largely of lipid (fat), and it depends heavily on omega-3 fatty acids to work properly. Pregnant women who include seafood in their diet are ensuring that their child's brain develops properly. However, note that pregnant women shouldn't eat fish with high mercury content (like swordfish) or take fish oil supplements.

Olive Oil

There's no such thing as a miracle oil, one you can use as much as you want as often as you want. There are no oils that you can pour on foods and use like a medicine to chase away heart disease. However, in recent decades, sales of olive oil have risen sharply. The Mediterranean diet was popularized by the fact that there's a much lower incidence of heart disease among populations that use olive oil as their main source of fat. It didn't hurt that the promotions stressed the cholesterol-lowering properties of a diet high in olive oil.

Olive oil has a wonderful taste and aroma. It's monounsaturated, which many healthcare professionals think might actually help heart health. Olive oil is a great ingredient for the culinary professional. Just beware—too much olive oil can cause excess weight to amass

just as much as its less glamorous polyunsaturated cousins.

Cardiovascular Diseases

As you've learned, fat is an essential part of the diet. However, on a regular basis, many people consume much more fat than they need. The body likes to hold on to as much fat as it can, because it has no way of knowing where its next meal is coming from. Holding on to extra fat doesn't provide an unlimited amount of energy or lots and lots of fat-soluble vitamins. Unfortunately, that double order of fries can lead to all kinds of nasty conditions, including obesity, diabetes, cancer, and heart disease.

Hypertension (HTN), or high blood pressure, can be a contributing factor to heart disease, heart attack, and stroke. A high-fat diet can be a contributing factor to hypertension. In fact, millions of Americans have HTN. HTN causes the heart to work harder than usual and can accelerate atherosclerosis, or hardening of the arteries. HTN raises the risk of heart disease by three and the risk of a stroke by seven. It's like letting all the hoses in a car's engine get 80 or 90 percent clogged up and still expecting the engine to run consistently at 60 miles per hour. Eventually the engine will either wear out from having to run harder just to keep up ordinary performance, or it will blow a hose. Just about the same thing happens with a heart that's depending on fat-clogged arteries. A heart attack can occur when the heart has just been trying to compensate too long with clogged arteries. A stroke can occur when some of the clog (a combination of dead blood cells and cholesterol, or plaque) breaks off and blocks the blood flow to an artery supplying blood to the brain.

Key Points and Links

READING ASSIGNMENT

Key Points

- All fat contains the same amount of calories. Some fats are healthy; others are not.
- Triglycerides are a form of fat that can indicate heart disease when found in the blood.
- Saturated fats are found in tropical oils as well as meat, butter, and eggs. Saturated fat from animal products is called cholesterol. HDL (high-density lipoprotein) is thought to be less harmful than LDL (low-density lipoprotein).
- Hydrogenation changes vegetable oils into solids. Plant sterols don't allow the body to absorb cholesterol.

- Saturated fats require more energy to be broken down than unsaturated fats.
- Fat is an efficient source of calories, important for infants and hikers, but needed in small amounts on a daily basis. Visceral fat cushions internal organs. Omega-3 fatty acids are thought to be heart-healthy, as is olive oil, when used in moderation.
- A high-fat diet can contribute to hypertension, which makes the heart work harder.

Links

- [Good Fats, Bad Fats: How to Choose](http://www.health.com/health/gallery/0,,20477647,00.html) (www.health.com/health/gallery/0,,20477647,00.html)
- [The Truth about Fats](http://www.health.harvard.edu/staying-healthy/the-truth-about-fats-bad-and-good) (www.health.harvard.edu/staying-healthy/the-truth-about-fats-bad-and-good)

Exercise: Fats and Your Body

Based on what you've read, answer the following questions.

1. What are the main concerns for someone who has high triglyceride levels in the blood?
2. When shopping for margarine, what information should you look for on the label?
3. Describe the process of hydrogenation. Why is this a concern in regard to nutrition?
4. What are the risks of consuming high amounts of saturated fats?
5. Why is fish considered to be a heart-healthy food?
6. Is it OK to prepare a lot of fried foods as long as you use healthy oil, such as olive oil? Why or why not?
7. Indicate whether the reading signifies an increased or decreased risk of heart disease and high blood pressure.
 - a. 300
 - b. 200
 - c. 180
 - d. 267
8. Which cholesterol subtype is more dangerous, HDL or LDL?

Exercise Answer Key:

Exercise: Fats and Your Body

1. High triglyceride levels can be an indicator of heart disease; diabetics and people who are obese usually have high triglyceride levels.
2. Amount of saturated fat, cholesterol, or trans fatty acids
3. Hydrogenation is the introduction of hydrogen to vegetable oil molecules to make them saturated. It's a concern for nutrition because although some hydrogenated vegetable oils were considered to be a healthy alternative to animal fats, it's now believed that this type of hydrogenated oils might do as much damage to the veins and arteries as animal fat.
4. Excess saturated fats are unable to be broken down by the body, so they're stored in the walls of the veins and arteries; this causes the veins and arteries to narrow, as well as become hard. This makes it very difficult for blood to pass through and ultimately leads to various disease states.
5. Fish is low in cholesterol and saturated fats. Fish contains omega-3 fatty acids, which are thought to help protect against heart disease.
6. No, all fat has calories, and even "healthy" calories may exceed daily calorie needs
7.
 - a. Increased
 - b. Decreased
 - c. Decreased
 - d. Increased
8. LDL

2.6 Apply vitamin, mineral, and nutrition guidelines

Vitamins, Minerals, and Water

READING ASSIGNMENT

People have always known that food is essential for life, but it wasn't known what particular substances in foods made them important. The need for vitamin C was discovered in the early 1700s. The British navy at that time was powerful and very large. British sailing ships were constantly setting out to discover new lands that could be sources of wealth. Although ships could carry fresh food stores for no more than 10 or 15 days, voyages often lasted for months. After the fresh food ran out, sailors lived on salted meat (you know it as beef jerky),

hard tack (a very dry biscuit that had the texture of a three-month-old bagel), rum, water, and any fish or birds they could catch. Although high in protein and carbohydrates, this diet was totally devoid of vitamin C.



[Citrus Fruits]

The vitamin C in citrus fruit helps ward off diseases, such as scurvy.

After several months without vitamin C, the sailors would develop a “sea sickness” known as *scurvy*. Because no one knew anything about vitamins, this disease was attributed to the idea that man wasn’t meant to live on the water, away from dry land for long periods of time. Scurvy was considered incurable. Symptoms included bleeding gums, wounds that never healed, bruising, loss of teeth (caused by gum disease), muscle soreness, and, ultimately, dementia. During one especially long voyage to the West Indies, a group of sailors with scurvy was put ashore with several officers. The ship was to return in several weeks. If any men were still alive, they’d be picked up and brought home. The group wasn’t issued any stores, because stores couldn’t be wasted on “hopeless cases.”

The group was able to scrounge food on the tropical island, including fresh fruit. The small citrus fruits they ate were probably oranges, but, being unfamiliar with most citrus, they called them limes. Miraculously, after several days of eating citrus fruit, the symptoms of scurvy disappeared! The group was picked up and returned to England, being sure to take a large stash of “limes” with them shown in the following figure. From that time on, limes were added to all British sailors’ rations. Perhaps you’ve heard the slang term for a British sailor: “limey.”

Vitamins are either *water-soluble* or *fat-soluble*. The eight water-soluble vitamins include the B vitamins and vitamin C. The four fat-soluble vitamins are vitamins A, D, E, and K.

Water-Soluble Vitamins

Vitamin C was discovered but not identified or isolated until at least 150 years later. Thiamin was the first vitamin isolated, in 1911. To make matters more interesting, vitamins don't exist in just one chemical form. Many vitamins exist as a group of similar compounds. For example, folic acid is also known as folacin and folate, because it can exist as an acid, a protein, and a carbohydrate. For all intents and purposes, all the different forms do the same thing in the body.

The *B vitamins*, which include thiamin, riboflavin, niacin, B₁₂, B₆, and folic acid, aid a large number of functions in the body, including muscle control, nerve function, healthy skin and eyes, and the manufacture of red blood cells. Folic acid has been found to prevent certain kinds of birth defects, and B₁₂ can prevent certain kinds of anemia. B₁₂ is best absorbed from animal sources, so vegans might need to think about special B₁₂ supplementation.

Vitamin C is essential for a healthy immune system. It also helps to build *collagen* (the “glue” that helps joints to function correctly) and aids in healing. However, too much vitamin C can cause gastric upset, diarrhea, and kidney stones.

Because water-soluble vitamins aren't stored in the body, there's very little chance of vitamin toxicity. However, because water-soluble vitamins aren't stored, they need to be consumed on a daily basis. Therefore, it's important to consume dietary sources of water-soluble vitamins.

Fat-Soluble Vitamins

Fat-soluble vitamins are stored in the fatty tissues of the body, so some are left over from day to day. This isn't to give you permission to eat healthy one day and live on chips and ice cream the next. You just have a bit of an insurance policy with vitamins A, D, E, and K.

Although the possibility of *toxicity* exists with fat-soluble vitamins because the body can store them, vitamin toxicities come from megadoses. Vitamin toxicity is almost impossible from food consumption, unless you eat 30 pounds of carrots a day. A varied diet allows you to consume an adequate amount of fat-soluble vitamins without worrying about an overdose. Most vitamin toxicities come from taking too many vitamin supplements over long periods of time. The diet should include sources of vitamins A, D, E, and K at least every other day.

Obtaining Vitamins and Minerals from Food

Some people think that a complete breakfast is a vitamin and a cup of coffee. Others prefer to slurp their vitamins, stopping at the smoothie stand for a cranberry-apricot-apple-bee-pollen shake. Over \$6 billion is spent in the United States each year on vitamins. Do people need to purchase vitamin supplements? Or should they just get their vitamins from foods? The answer depends on a person's diet.

According to dietitians and nutrition professionals, most people can get all of their vitamins and minerals from their diet. Certainly, food contains all the vitamins and minerals that a person could ever need. The challenge, however, is in eating five or more servings of fruits and vegetables per day, lots of whole grains and fiber-containing foods, and a variety of protein foods, such as seafood, poultry, red meat, beans, legumes, and soy foods.

Most foods have several vitamins and minerals, so you don't have to eat 40 different foods every day. Milk, for example, contains calcium, magnesium, phosphorus, vitamin A, and vitamin D, among other nutrients. So a cup of yogurt has a lot of things going for it. Combine that yogurt with an orange, and you've got some vitamin C, zinc, and phosphorus. Add some whole-wheat toast, and you've got most of the B vitamins, such as folic acid, niacin, thiamin, and riboflavin, and the mineral iron.

Vitamins don't provide energy directly, because they don't contain carbohydrates, proteins, or fats, which are the only sources of energy. Even though you can't get energy, or calories, directly from vitamins, vitamins help the body to use energy. Vitamins guide the way for the body to use energy in an effective way. A vitamin deficiency makes it difficult for the body to use the energy in food.

Vitamins help with lots of different activities in the body. Without vitamins, you couldn't grow, metabolize nutrients, use energy, or maintain health. The FDA has established *RDAs (recommended dietary allowances)* for 14 vitamins. This is changing all the time as new functions for vitamins are discovered.

All the vitamins you need can be found in animal and plant sources. All dairy milk and some soy milks are enriched with vitamins A and D. A balanced diet includes enough of vitamins E and K. Vitamins E and K are needed in small amounts and are conveniently found in small amounts in lots of foods, such as green vegetables, nuts, plant oils, beans, whole grains, and some meat and seafood. Enriched grains and cereals supply many of the B vitamins, and salsa, sliced kiwi, and strawberries join oranges to provide lots of vitamin C.

Some people know that they eat a healthy diet all the time and don't worry about supplementing their diet with vitamin and mineral pills. Some people know that they eat healthy some of the time and worry about those times when they don't have time to eat well. And other people think that the tomato sauce and onions on their pizza constitute a healthy serving of vegetables. These people should consider using vitamin supplements to make up what they're missing.



[Fruits and Smoothies]

Whole foods tend to have more health-promoting properties than vitamin supplements.

However, there's no substitute for the real thing. A glass of orange juice is more beneficial to the body than a vitamin C pill. It's more enjoyable and healthy to get calcium from stir-fried tofu or strawberry yogurt than from a calcium tablet. Experts agree that whole foods have more health-promoting properties than supplements. Eating whole foods delivers the nutrients to you in the original package which is shown in the following figure. An orange isn't just a packet of vitamin C but a whole carton of vitamins, minerals, fiber, water, and other natural substances meant to function together.

However, sometimes it just isn't possible to grab those five daily servings of fruits and vegetables. If you decide you need some help from a bottle in the vitamin and mineral department, you should start by consulting a healthcare professional. He or she can give your body and your blood a once-over to ascertain what you need.

It can't be emphasized enough that vitamin supplements are just that—supplements. Supplements aren't meant to replace a good diet. Something else to remember, before you

purchase that 1,000-count bottle of 500 percent of your RDAs, is that the body needs only 100 percent of any given nutrient. With regards to water-soluble vitamins, the Bs and C, the body will keep what it needs, and the rest will wash away. With fat-soluble vitamins, the body will attempt to store what it can't use right away. This can lead to toxicities and ultimately to organ failure. Minerals are water-soluble, so your body uses only what it requires and discards the rest.

If the gasoline tank of your car holds 15 gallons of gas, you don't try to force 20 gallons into it. You know that it runs most efficiently when it's almost full. You also know that trying to add extra fuel won't help its performance. The same is true with your body and vitamins and minerals. Your body needs 100 percent of the RDAs for vitamins and minerals. More than that won't help you and could possibly harm you. It's a waste of money and potentially damaging to take megadoses of vitamins and minerals.

Remember that almost all foods contain some vitamins and minerals. For example, a piece of toast is probably made from flour enriched with B vitamins and iron. A cup of yogurt has some calcium, magnesium, phosphorus, and vitamins A and D. Unless you eat a diet totally devoid of real ingredients, you're getting at least some nutrients. Check out the label on a bag of cheese puffs or corn chips. Along with the outrageously high fat and sodium content, it probably has some vitamins and minerals. The point is that people who take vitamin supplements and eat a reasonable diet are getting far more than 100 percent of their daily vitamin and mineral needs. When you add megadoses of vitamins and minerals, you go way off the scale of what's required. If you aren't careful, your heart and liver could go on strike to protest having to handle such a heavy load.

Using Supplements

If you do use vitamin and mineral supplements, remember that they need to go through the digestive system before they can be absorbed. Taking vitamins with food, even a slice of toast or a slurp of milk, will help you get everything you need from them. If you take vitamins on an empty stomach, you probably won't absorb 100 percent of the vitamins. In addition, some vitamins might stimulate your stomach to secrete digestive acids, which can result in stomach upset.

When it comes to vitamins, you don't have to go for the most expensive brands. Vitamin C is vitamin C. It doesn't make any difference to your body if the vitamin C was extracted from

citrus or synthesized in a test tube. Once it's in pill form, vitamin C is just another beneficial chemical. Do select vitamins that come in opaque glass or plastic. Light can break down vitamins, so you don't want them in glass or see-through plastic. Heat can also break down vitamins, so store them in cool places and not over the stove or in the bathroom. Vitamins have expiration dates. Discard them after they've expired, because expired vitamins won't do anything for you. Also, keep all vitamins away from children. An excess of fat-soluble vitamins can build up in the liver to toxic levels, causing damage.

Hopefully, your idea of a healthy breakfast isn't a fruit-filled doughnut and a multivitamin. But, you say, I don't have the time for a real breakfast! Consider the following before deciding to take supplements:

1. Most water-soluble vitamins produce only very expensive urine. Your body doesn't store water-soluble vitamins well, so excess just gets washed out.
2. If you take a calcium pill instead of a cup of yogurt, you miss out on the magnesium, phosphorus, and vitamins A and D, not to mention the fluid. If you take vitamin C instead of eating an orange, you miss out on beta-carotene, calcium, fiber, and fluid. We really aren't sure if the whole package of an orange helps you to use vitamin C more efficiently, but we're pretty sure it works a lot better than just a pill with a single substance.
3. Research the maximum doses. Even water-soluble vitamins can cause problems. Fat-soluble vitamins can become toxic.
4. In the following situations, vitamin supplements can be helpful, but only after discussing their use with a healthcare professional:
 - People with iron-deficiency anemia are sometimes prescribed iron supplements. Don't take iron supplements without a physician's approval. Too much iron can result in *hemochromatosis* (iron overload), which can cause heart arrhythmias.
 - Pregnant or breastfeeding women are sometimes prescribed vitamin supplements because of their increased nutrient needs.
 - People prone to osteoporosis because of family history, the use of certain medications, or chronic disease might be prescribed calcium supplements.
 - Tentative research shows that people with family histories of colon cancer, heart disease, and prostate cancer might benefit from vitamin E.
 - Strict vegans who don't vary their diets or have small daily intakes might benefit from

supplements.

- People who are *chronic dieters* (under 1,200 calories per day) might require supplements.
- People undergoing cancer therapy might require supplements.

Major and Trace Minerals

Minerals make up only about 5 percent of our body weight, but they're essential for life.

Minerals are present naturally in foods, in the environment, and in our bodies.

The two classifications of minerals are major and trace minerals. *Major minerals* are found in greater amounts in the body and are needed in larger amounts in the diet. Major minerals include calcium, potassium, chloride, sulfur, magnesium, and sodium. *Trace minerals* are needed in smaller amounts and include iron, iodine, zinc, fluoride, and cobalt. If you eat a balanced diet, then you should be able to get all the minerals you need from the food you eat and the beverages you drink, such as water, dairy drinks, and juices.

Taking high doses of single mineral supplements can be dangerous, unless a physician has identified a specific need for a particular mineral. Too much of a good thing, such as iron or calcium, can be toxic. Don't self-prescribe or swallow all the advertising you see and hear. If you think you have a need for more minerals or vitamins, check with a doctor. Also, the resources in the following box can provide useful information about vitamins and minerals.

Calcium 101

Orange juice fortified with calcium, soymilk with extra calcium, fruit-flavored calcium supplements—you can't escape the calcium explosion. Why the sudden interest in this super-white mineral that gives pearls their luster?

Well, pearls, those opaque gems of calcium, are nice to wear around your neck, but it's even nicer to be able to stand up straight and smile. Without calcium, you'd have very few pearly whites in your smile and you'd have a decided slouch from a telltale gray bone structure. Scientists have known for years that calcium is very important in the growth and maintenance of bones and teeth. Calcium also is a big contributor to a healthy nervous system. Calcium might even play a role in helping to prevent certain kinds of cancers and reducing some of the symptoms of *premenstrual syndrome (PMS)*. Calcium has always been important for health. Every day fitness professionals find even more reasons to maintain adequate calcium

stores in the body. Also, some researchers suggest that the trace mineral boron might help the body to absorb calcium.

The majority of the body's calcium is in the skeleton and the teeth. A small, but important, amount of calcium is found in the blood and is necessary for nerve conduction. Calcium is found in the membrane of every cell in the body. It also is essential in the absorption of vitamin B₁₂. Among its many jobs, vitamin B₁₂ helps the body use iron, thus helping to prevent certain types of anemia. Insufficient calcium equals insufficient B₁₂ absorption; insufficient B₁₂ absorption results in a lack of energy and complications from anemia.

The skeleton is the body's "savings account" when it comes to calcium. The bones are in a constant state of thinning and repair due to the day-to-day demands of exercise, stress, and normal functioning. Bone is being built up all the time if the body has sufficient building materials, such as calcium, vitamin D, and sufficient fluid.

Your body knows how to keep the correct amount of calcium. The brain, kidneys, and liver communicate with blood, muscles, and internal organs to assess calcium needs. A set of checks and balances changes the amount of calcium that's absorbed from food and released in the urine.

Your body knows it needs calcium and will actually change its ability to absorb calcium from food, depending on the body's needs. For example, consider a person with a broken foot whose diet is minimally adequate in calcium. The body will attempt to absorb every milligram of calcium it can from the food and water taken in. Of course, the diet must contain some calcium, because the body can't perform alchemy and create calcium where there isn't any.

The body can be in positive or negative calcium balance depending on a person's lifestyle and diet. A positive calcium balance is necessary during periods of growth, as in childhood, during pregnancy, or when the body is repairing itself, as when recovering from a broken ankle or resting up after a marathon. There's an interesting natural phenomenon related to calcium balance. People who need the most calcium seem to absorb the most. Children absorb almost 75 percent of all the calcium they ingest, whereas people in their thirties absorb only 20 to 40 percent.

The body's need for calcium doesn't decrease proportionately as the ability to absorb

decreases. Therefore, adults need to be careful to select foods that are high in calcium so they don't go into a negative calcium balance.

If the body goes into a negative calcium balance, it has to dip into the "savings account" in the skeleton to get the calcium it needs for muscle contraction, healthy blood formation, and other necessary functions. If this continues for any length of time without sufficient replacement of calcium, the bones begin to thin. This is the mechanism that causes *osteoporosis*.

Osteoporosis is a medical condition in which the bones become brittle and fragile from loss of tissue.

If a person doesn't ingest enough calcium, the body removes it from the bones. If the person still doesn't ingest enough calcium, the body continues to withdraw it from the skeleton. Pretty soon, the calcium savings account is overdrawn, resulting in thinned-out bones that break easily and repair very slowly.

When you hit your mid-30s, nature tells you, unfortunately, to go into a negative calcium balance. How can you meet this challenge? You can eat a calcium-rich diet, stay well hydrated, and exercise. In addition to diet, it's been found that weight-bearing exercise, such as walking, running, tennis, weightlifting, and aerobics, can increase the density of bone. So grab a cup of yogurt or a soy milk smoothie and go for a walk!

Who is most at risk for osteoporosis? Just about everybody. Both men and women can develop osteoporosis. Ten to 15 percent of men over age 50 might have osteoporosis, and it can develop in men or women, depending on genetics and lifestyle. Excess caffeine and alcohol and smoking leech calcium from the bones on a daily basis.

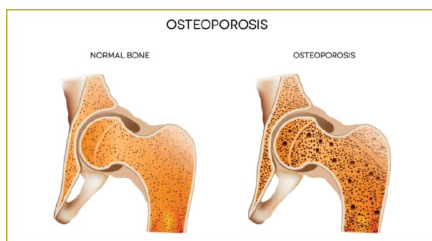
What helps? Vitamin D helps your body to absorb calcium; it's no accident that many foods naturally have both calcium and vitamin D. Manufacturers have gotten nutrition savvy and enrich products with both calcium and vitamin D. Read the label on yogurt, low-fat cheeses, soy and rice milk, and cold cereals and you'll find both these nutrients. Boron, found in many fruits, veggies, nuts, and beans, helps in calcium absorption as well.

Some researchers think that the hormone *estrogen* helps the body to maintain calcium levels. After menopause, when estrogen levels decrease, many women opt for estrogen replacement therapy, taking daily doses of estrogen combined with other hormones to

prevent the onset of osteoporosis. Others opt for estrogen from plant sources. Soy is high in phytoestrogens, or plant estrogens. Populations of women having diets high in soy, such as found in traditional Japanese diets, don't display bone-thinning during menopause. However, neither synthetic estrogens nor plant estrogens are recommended for women with a history of breast, cervical, or ovarian cancers. It's thought that estrogen stimulates these types of cancer cells to grow in some people.

Of course, eating lots of calcium-rich foods is the first line of defense against a negative calcium balance. Exercise is very important in helping the body to build bone, but it has to have something with which to build! Many dairy and nondairy foods are good sources of calcium. We'll talk about dietary selection a little later.

What puts the body at risk for a negative calcium balance? Too much protein, salt, alcohol, and caffeine can increase the risk, as can smoking and lack of exercise. Lack of exercise will guarantee tissue-thin bones later in life shown in the following figure. Protein, salt, alcohol, and caffeine send an incorrect message to your blood and kidneys to vacuum calcium out of the blood. This calcium is lost from the body in the urine. In developing countries, although you see many nutrition deficiencies, you don't see many bone fractures or osteoporosis. This is because the population performs lots of weight-bearing work, walks, doesn't get very much protein, and has less access to tobacco, alcohol, and caffeine.



[Normal Bone and Osteoporosis]

*A poor diet, lack of exercise,
and genetic predisposition can
all lead to osteoporosis.*

Believe it or not, some foods aren't your friends when it comes to building up calcium. Some foods have lots of calcium but also contain *oxalates*, natural substances that inhibit the absorption of calcium. Spinach, which is a great source of iron, has some calcium. But its oxalate content doesn't let you get at it. So have your spinach salad at one meal and your

frozen yogurt at another meal. Beans, legumes, and other green vegetables contain oxalates. This doesn't mean they should be excluded from your diet, because, as you've learned, they have other important nutrients.

How can you determine if you're in a calcium deficit? This is still a fairly new science, with a lot of disagreement among healthcare professionals. *Bone scans* and *bone density tests* can be used to estimate calcium levels. The issue with bone scans is that they measure total bone, which has other minerals. At this point, though, bone scans are the gold standard for assessing bone, or calcium, health. Blood tests aren't helpful, because the body tends to keep blood calcium at a constant level. A person's blood calcium could be within a normal range and his or her bone calcium in a negative range.

So how much calcium does a person need on a daily basis? Just as it's difficult to assess calcium stores in the body, it's difficult to give an exact amount for calcium needs. At this time, healthcare professionals will tell you to check your RDA for calcium and attempt to derive as much as possible from the foods you eat. The current theory is that postmenopausal women and men who might need it should consume 1,200 milligrams of calcium per day.

What about calcium supplements? Some people might be unable to include enough calcium in their diet. Remember, supplements aren't meant to take the place of balanced meals. Calcium supplements might be of some use, but it's important not to take too much. It's possible to have too much calcium. Excess calcium, taken over extended periods, will begin to bind zinc, preventing it from doing everything it's supposed to do in the body. If a decision is made to take calcium supplements, find some with added vitamin D and boron, which will help calcium absorption.

What about people who avoid dairy products and fish? Is it possible to get enough calcium from a dairy- and fish-free diet? Yes. A diet rich in greens, such as kale, collards, mustard, romaine lettuce, and Swiss chard; calcium-enriched soy products and other calcium-enriched foods; and lots of beans, legumes, nuts, and seeds can supply enough dietary calcium. Cutting back or getting rid of caffeine, alcohol, and tobacco can also help. See Appendix C for more information on dietary sources of calcium.

Other Minerals



[Faucet]

Many municipal water supplies contain fluoride.

Zinc helps in wound healing and immune response and is part of many hormones and enzymes. Humans tend to absorb zinc more easily from animal than plant sources. Red meat, whole eggs, mollusks (such as oysters), poultry, dairy products, and dried beans are good sources of zinc.

When you purchase toothpaste, you may select a brand that has fluoride. *Fluoride* is important for the health of the bones and teeth and helps to prevent cavity formation. Many municipal water supplies have fluoride added for this purpose. The use of fluoride to help dental health was discovered in the early 1950s and fluoridated water was a really hot topic. It was also during the Cold War. Many citizens thought that fluoridation of city water was a Communist plot and that the government was trying to control people's minds by adding chemicals to the water. It took many years before most US municipalities voted to allow fluoride to be added to their water shown in the figure. Nutrition has always been controversial!

The *thyroid gland* is the body's "alternator," controlling metabolism rates, and *iodine* is the fuel that the thyroid needs. Iodine can be found in iodized salt; sea products, such as ocean fish, nori, and sea vegetables that are popular in Asian cuisine; and some dairy products. Salt companies were instructed to add iodine to salt by an act of Congress during World War I. During the draft, it was discovered that *goiter*, an enlargement of the thyroid due to lack of iodine, was rampant among the US population. Because most people didn't live near the ocean with ready access to seafood, they had no easy way to obtain iodine. In those days,

salt was considered a staple, something that everyone used every day. Therefore, it was the logical item to iodize. Salt is iodized to this day. You have to read the label, though, because salt is available in both iodized and noniodized forms. Kosher salt and popcorn salt usually aren't iodized. Sea salt doesn't need to be iodized, because it naturally contains iodine. Some chefs say they can taste the iodine in salt and choose to use noniodized salt in their dishes.

Sodium is a good-guy, bad-guy kind of mineral. Sodium is an essential nutrient. It helps to maintain fluid balance in the body and is a participant in many reactions, including the beating of the heart. Unfortunately, too much sodium in the body can cause elevated blood pressure (hypertension), strain the kidneys, and can even cause an irregular heartbeat. The USDA recommends that Americans eat no more than 2,400 milligrams of sodium per day. This translates into about 2 teaspoons. Most people would be pretty hard-pressed to limit their sodium intake to this amount. In addition to being a common preservative, salt is a taste that most people enjoy. Good chefs cut back on salt by using fresh and dried herbs, spices, citrus (your taste buds react the same way to lemon juice as they do to salt), wine and vinegar reductions, and vegetable purees, to name just a few techniques. A skillful chef doesn't need salt to make food taste good.

The importance of *iron* has been known for a long time. Ancient Greek medical writings point out the importance of iron. In medieval France and England, iron, in the form of fine filings dissolved in wine, was prescribed to treat anemia.

Iron is one of the few minerals necessary at every stage of life, from infancy to old age. Iron is needed to ensure that all the cells of the body are nourished with oxygen. Infants, children, adolescents, pregnant women, athletes, vegetarians, frequent blood donors, and senior citizens are all at risk for iron-deficiency anemia. In other words, just about everybody.

Iron deficiency is usually caused in healthy people by poor dietary intake. It can also be caused by excess blood loss and some illnesses. Iron needs can range from 10 to 30 milligrams per day. The typical American diet has only about 6 milligrams of iron for every 1,000 calories eaten. In addition to food, it's thought that using cast-iron cookware can add iron to the diet.

Of course, nature had to have its joke with humans and iron. Many types of dietary iron are poorly absorbed. Foods containing the highest amount of iron are the least desirable. Organ

meats, such as liver and kidneys, are high in iron but are despised by a large number of people. Oysters and clams also are good sources of iron, but, again, they aren't likely to be a regular part of most people's diets shown in the following figure. Lean beef, pork, veal, and poultry do have some iron. Iron from animal sources is better absorbed than that from plant sources.



[Oysters and Clams]

Oysters and clams are good sources of iron, although they aren't usually a regular part of most diets.

However, this isn't to say you shouldn't eat your spinach. You'll just need to increase your intake of dark green leafy vegetables, such as kale, collards, mustards, beet greens, and spinach. Dried fruit, dried peas, nuts, enriched breads and cereals, and blackstrap molasses also contain iron. Iron does have some friends. Vitamin C helps in iron absorption, so sprinkle some tangerine sections on that spinach salad.

A number of foods prevent the body from absorbing iron: egg yolks, calcium-containing foods, tea, and soy. Zinc found in multivitamins and in sore-throat lozenges also can inhibit iron absorption. So, have a spinach salad for lunch and wait a couple of hours before having that frozen yogurt or tofu smoothie. Order a glass of some sparkling water instead of iced tea with that spinach salad as well.

Herbs and Botanicals

Vitamin C; herbal preparations, such as *echinacea* (a purple daisy originally used by Native Americans in a medicinal tea); or massive amounts of orange juice won't cure the common cold. Washing your hands will. The more frequently you wash your hands, the more you lower your chances of exposure to cold viruses. Getting enough rest helps replenish your

immune system, as does drinking lots of noncaffeinated, nonalcoholic beverages. Fluids help nurture the cells of the body and also help to flush out foreign invaders.

Antibiotics don't work against colds. Colds are caused by viruses, and antibiotics work only on bacteria. Antibiotics are prescribed only when a secondary bacterial infection sets in. Take your vitamin C if you like, but wash your hands and get enough sleep before you do.

But what about all these herbal preparations sold to prevent or cure colds and a thousand other ailments? Many people take echinacea during flu season. Some research has found that echinacea might boost the immune system. Rather than using pharmaceuticals, some people turn to St. John's wort to help with depression or kava-kava to relieve anxiety. Some beverages and meal-replacement bars have ginseng added as an "energy" enhancer. Consumers have accepted herbs, or botanicals, as an alternate method of handling aches and pains and improving well-being.

It's important to educate yourself about herbs, because some might help, some might cause harm, and some might not do anything but waste your money. Remember that just because something is "natural" doesn't mean that it's better or even harmless. Ephedra can elevate blood pressure, cause irregular heartbeats, and lead to liver and kidney damage. Willow bark extract, which herbalists might recommend for headaches and muscle pain, contains the same chemicals as aspirin. If you're allergic to aspirin, you'll have the same allergic reaction to willow bark. Many pharmaceuticals are merely chemical interpretations of substances isolated from nature.

Something else to remember about herbs is that they don't act quickly but must be taken over a period of time to show an effect. St. John's wort, which is sometimes used for depression, takes four to six weeks to change how someone feels. The moral of this story is to not self-diagnose. If you don't feel well, discuss your issues with a healthcare professional. If you want to use herbs or botanicals as part of your plan, be sure to mention it. Herbs can interact with some medications or cause unwanted symptoms or side effects. For example, goldenseal, an herb sometimes taken for colds or sore throats, can cause blood thinning. You wouldn't want to take goldenseal right before or after surgery or if you have problems healing. *Ephedra* is an herbal preparation included in many "natural" diet pills.

Water

Water is an essential nutrient. It doesn't supply energy, ramp up the immune system, or build better bones. However, the body is about 60 to 70 percent water. Muscle tissue has about 70 percent water, and fat tissue has about 20 percent water. A well-nourished person could theoretically go about six weeks without food. It wouldn't be pretty, but it would be possible. However, a person can go only about three days without water. The body can conserve and store energy, but it can't store or conserve water.

Most people take water for granted; it isn't interesting, and it doesn't seem to do very much. In reality, water participates in just about every chemical reaction and function in your body and is a large part of each and every cell.

Water helps to regulate body temperature. If you ever go swimming in a lake or the ocean, you'll notice that the water temperature changes much more slowly than the temperature on land. The same thing happens in your body. Water holds on to heat and changes temperature very slowly. By holding on to heat, the water in your body helps you to stay warm; when you need to cool down, your body releases water, in the form of perspiration. The perspiration comes to the surface of the skin, where it evaporates. As perspiration evaporates, heat energy is taken from the skin, cooling it. Just to give you a perspective, it takes about 600 calories to evaporate 1 quart of perspiration. That's why people who have had high fevers lose a couple of pounds over several days. Maintaining a fever is no way to lose weight!



[Woman Drinking Water
During Workout]

*It's important to keep
yourself hydrated when*

you work out.

Water is a large portion of your blood supply and other body fluids, such as lymph. Water in these systems, as well as in your muscles and internal organs, helps the body to rid itself of waste products. Water is used and waste products are produced as a result of digestion, exercise, breathing, and all those other things bodies do to stay alive. Water helps dilute the waste products so that the kidneys aren't damaged and helps to move the waste products out of the body.

Because the body loses water every day, and because the body is 60 to 70 percent water, it's important to replenish your supply. You even lose water when you breathe! The old rule of thumb was that everyone needed eight glasses ($\frac{1}{2}$ gallon) of water per day. Technically, 1 milliliter of water is needed for every calorie burned. If a person burns 1,200 calories per day, then he or she needs about 1,200 milliliters of water, which is 1.2 liters or about 5 cups of water per day, minimum.

You don't have to get all your daily water from drinking straight water. Most fruits and vegetables (and their juices) contain water; many other foods are mostly water or ice, such as soups, gelatin, and sorbets. In addition, water can be obtained by drinking herbal teas, decaffeinated beverages, or sparkling or flavored waters. Of course, plain water is still the best source of water.

Caffeine and alcohol are the enemies of water. Beverages containing caffeine, such as coffee, green and black tea, colas, sodas to which caffeine is added, chocolate, and other products that have been "fortified" with caffeine, as well as alcohol-containing products, act as diuretics. *Diuretics* tell the body to get rid of water even though water is needed. So, theoretically, you could drink caffeinated iced tea all day and wind up becoming dehydrated! In addition to having a diuretic effect, researchers think that caffeine might have a negative effect on calcium absorption, resulting in osteoporosis.

Dehydration can be an important concern for people who work out, especially if they're working out in hot conditions, have extended workouts, or are out of shape shown in the figure. Dehydration can have mild to severe symptoms, which can range from headaches and thirst to muscle aches, flulike symptoms, fever, irregular heartbeat, and even mental confusion. Heat makes the body lose water at a faster rate, and remember that you need to

replace everything you lose. Dehydration strains the body's organs and can cause physical and mental damage if it becomes a chronic condition.

The Importance of Good Nutrition

Some nutrient needs remain consistent throughout the lifespan, whereas others change. However, everyone needs sufficient calories and water over the entire lifespan. Iron is very important in every stage of life. Calcium needs might be higher in very young and very old people, first to create a healthy skeleton and then, later on, to prevent loss of bone density. The moral of this story is that if you eat a healthy diet throughout your life and maintain hydration levels, you'll be giving your body what it needs when it needs it.

Good nutrition is a wonderful thing and can lead to many happy outcomes. Poor nutrition can lead to infant mortality, physical and mental developmental delays in children, illness and pain of every type for every age group, adult disability and lack of productivity, lack of independence and physical ability for seniors, and increased healthcare costs for everyone. Well-nourished populations are productive and successful and have lifestyles that are the envy of their neighbors. Many businesses have recognized the benefits of having healthy employees and have incorporated "wellness" programs as part of their employee benefits. Many companies expect their food service providers to offer "healthy" menus and cooking classes.

Good nutrition can help ensure the following:

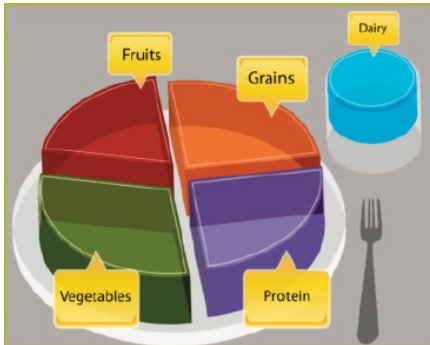
- Healthy babies born without birth defects
- Improved dental health
- Increased productivity at work
- Better learning ability and success in school

It can also reduce risk for

- Hypertension and heart disease
- Childhood and adult obesity
- Diabetes
- Anemia
- Certain types of cancers

- Osteoporosis

Tools of the Trade



[USDA Guidelines]

The USDA guidelines can help you make healthy choices in your diet.

The [USDA MyPlate Guide](http://www.choosemyplate.gov/) (www.choosemyplate.gov/) is a useful tool for nutrition education shown in the figure. You might already be familiar with it, because it appears on many food labels, is taught in many school systems, and appears, in poster form, in many community health centers and medical clinics.

The guide can be understood and used by almost everyone, regardless of reading or math ability. The shape of the guide and the graphics make it ideal for teaching a varied audience. You'll have to look closely to fine-tune your interpretation of the guide, because at first glance it doesn't seem to distinguish between high-fat meat and beans or sugary cereals and a bowl of oatmeal. Use the graphics already in place or develop your own to explain how to use the guide most effectively for good health and nutrition.

For example, many ethnic groups tend to use whole grains and lots of vegetables and fruit in their diets and use meat more for flavoring than for a main course. Go with that! Remember, many dietary patterns developed based on the types of ingredients available, the cost of particular ingredients, and even the cost and/or availability of cooking fuel. Asian hot-pot dishes enable the cook to prepare an entire meal in one pot, maximizing fuel use. However, many ethnic groups traditionally use animal fat for cooking oil and tend to fry all the foods for an entire meal. How did this unhealthy process develop?

In many cases, animal fat was more readily available and more easily obtained than vegetable oils. If a pig or chicken is slaughtered for its meat, other parts remain, including the rendered fat. Growing a seed crop and pressing the oil takes much more time and technology. Once you've got the fat heated, you'll want to cook all your ingredients in it, to save on fuel use.

In many countries, meat, eggs, and dairy are very expensive and considered ingredients to be used for festivities. Refrigeration might not be widely available, so a minimum amount of ingredients is purchased and used quickly. A side effect of America's bounty is the relative affordability and storability of ingredients. The good news is that consumers can take advantage of sale prices or the lower prices of large packages. The bad news is that many items that were formerly eaten sparingly can now be daily delights.

All diets have their good and bad sides. Think about how to continue healthy ethnic eating patterns, minimize less healthy traditions, and moderate the "temptation" foods and cooking styles of both ethnic and American cuisines.

The USDA MyPlate guide can be easily modified for vegetarians and vegans. Legumes, nuts, nut butters, and soy products, such as tofu, seitan, and tempeh, can be incorporated into the diet instead of meat and eggs. "Fake" meats and meat alternatives, such as veggie burgers and soy-based "roasts" and deli slices, can be used as well. For vegetarians, select soymilk and rice milk that are fortified with vitamins A and D and calcium. Vitamin B₁₂ is a nutritional concern for vegans. Some cereals and specialty products, such as some nutritional yeasts, are enriched with this important nutrient. You may want to write to manufacturers and obtain tasting samples of these products; be sure to request recipes and consumer information as well.

Here's a rundown of each profile, with an accent on the healthy aspects and some hints about the unhealthy aspects.

North American Profile

- 6 to 11 servings of bread, cereal, rice, and pasta. Encourage selection of whole grains, enriched breads, corn, bagels, rice, unsweetened cereal, and tortillas.
- 3 to 5 servings of vegetables. Encourage selection of dark green, leafy vegetables, raw vegetables, vegetable juices, squashes, tomatoes, sweet potatoes, cruciferous

vegetables, and legumes.

- 2 to 4 servings of fruit. Encourage selection of citrus fruits and juices, raw fruit of all types, melons, tree fruits, berries, and bananas.
- 2 to 3 servings of meat, poultry, fish, dry beans, eggs, and nuts. Select lean beef, pork, lamb, veal, egg whites, fish, poultry, assorted beans, and soy foods.
- 2 to 3 servings of milk, yogurt, and cheese. Encourage selection of nonfat and 1% milk, yogurt, buttermilk, and cottage cheese.

Here's a sample dinner menu based on the North American food profile:

- Salad of baby greens with sliced nectarines and seasonal berries (1 serving fruit, 1 serving vegetables)
- Pecan-crust oven-roasted halibut with a ragout of white beans and tomatoes, served with tricolored rotini in a pesto sauce (2 to 3 servings meat, 1 serving vegetables, 1 serving bread, 1 serving fat)
- Caramelized apples with raisins, dried apricots, and ginger served over cinnamon-apple sorbet (2 servings fruit)

Asian Profile

For the *Asian profile*, add the following to the North American profile:

- Millet, rice, and rice noodles to the bread group
- Tofu and nuts to the meat group

In Asian culture, deep frying and stir-frying are popular food-preparation methods. Ginger, garlic, rice wine, and vinegar are low-sodium condiments; soy sauce, plum sauce, oyster sauce, and hoisin are high-sodium condiments. Dairy products aren't frequently used; soy or rice milk can be used as a beverage in place of dairy milk.

Here's a sample dinner menu based on the Asian food profile:

- Vegetable hot and sour soup (2 servings vegetables)
- Wok-prepared baby bok choy with steamed tofu, fresh chilies, and rice noodles (1 serving vegetables, 1 serving meat, 1 serving bread, 1 serving fat)
- Sticky rice with sliced mango, coconut, and kumquats (1 serving bread, 2 servings fruit, 1 serving fat)

Mediterranean Profile

For the *Mediterranean profile*, add the following to the North American profile:

- Eggplant, lentils, onions, peppers, olives, and tomatoes to the vegetable group
- Low-fat yogurt, feta cheese, and goat cheese to the milk group; omit fluid milk (used infrequently)
- Dates, figs, grapes, lemons, and raisins to the fruit group

In Mediterranean cuisine, olive oil often is the fat of choice. Encourage nondairy, calcium-rich foods, such as green leafy vegetables and seafood (with bones, such as canned salmon or sardines).

Latin Profile

For the *Latin profile*, add the following to the North American profile:

- Corn and flour tortilla and rice to the bread group
- Cactus (*nopales*) and olives to the vegetable group
- Avocado, papaya, mango, guava, and pineapple to the fruit group
- Canned evaporated and condensed milk, soft white cheeses, and sour cream to the milk group

In Latin cuisine, frying is a popular preparation method. Lard and butter are traditionally used for cooking. Cheese and sausage are used as flavorings and garnishes. In some areas, herbal teas and beverages are popular. Encourage the use of lower-fat dairy products.

Vegetarian Profile

For the *vegetarian profile*, add the following to the North American profile:

- Dark green, leafy vegetables daily to the vegetable group
- Soy milk, rice milk, tofu, and milk alternatives to the milk group
- Legumes, beans, nuts, nut butters, and seeds to the meat group

Remove meat and dairy from the appropriate groups.

RDA Every Day

On food labels, the *RDA* table gives recommendations for proteins, 11 vitamins, and 7 minerals. Other RDA tables feature nutrition needs for various ages and tentative recommendations for 2 more vitamins and 8 minerals. Before you use the RDAs, understand the following:

- RDAs aren't minimum requirements but *recommended amounts*. The RDAs aren't mandatory or required, but they're based on the most recent scientific evidence. The RDAs are reviewed and revised periodically by scientists selected by the National Academy of Science.
- The RDAs are estimates of the needs for healthy people. The allowances are generous (except for energy, or calorie, needs), but they still might not cover every person for every nutrient. For example, the RDA for iron might not be enough for a person with anemia.

Understand that the RDAs are a flexible approximation. The RDAs generally are used with a combination of other nutrition tools, such as a diet history and the USDA Guidelines for Americans. The RDA can be used to assess, in a small range, the adequacy of an individual's diet. Remember that the RDA can direct an individual to an adequate intake, but excess intake of energy or nutrients is more difficult to assess.

The RDAs don't address the issues of undernutrition and overnutrition. *Undernutrition* can result from consuming inadequate calories or a lack of certain vitamins or minerals. Undernutrition can lead to depressed immunity, anemia, decreased healing, and retardation of growth and development. *Overnutrition*, which results from consuming too much energy, can lead to heart disease, diabetes, cancer, and liver disease, as well as circulatory and physical problems.

Dietary Guidelines

The *USDA Dietary Guidelines for Americans* were introduced in the 1980s and revised periodically several times since then. The initial guidelines stressed eating a variety of foods, cutting back on fat, especially saturated fat and cholesterol, limiting salt, sodium and sugar, including lots of fiber from fruits, vegetables, and grain products, and, if using alcohol, to do so in moderation. The revisions included new information on the need for exercise and the tie-in between diet and exercise: "Balance the food you eat with physical activity and maintain or improve your weight." The USDA later organized the guidelines into the "ABCs"

of healthy eating and attempted to emphasize that diet was just a part of a healthy lifestyle. The guidelines attempt to help answer the question, “What should Americans do to stay healthy?” Food-service professionals find the guideline a useful tool for menu design.

The “eat a variety of foods” portion of the guidelines is an easy way to ensure balanced nutrition. If you eat a couple of servings of different types of fruit, vegetables, grains, and low-fat dairy products every day, just by accident you’ll be getting some good nutrition.

Conversely, if you eat a lot of different foods, you can “stray” every once in a while and eat some things that aren’t so great for you. If you do this only occasionally, then your body has time to filter out the bad stuff and recuperate.

Food Compositions Tables

Many different *food composition tables* are available. They all list an ingredient or food item, such as bread or cheddar cheese. They then list various nutrition values for the particular ingredient, which can include calories, carbohydrates, protein, fats (including saturated and unsaturated fats), vitamins, minerals, and fiber, to name a few. Simply locate the food on the table and read across the line.

How is drinking orange juice going to make my bones stronger? If I smoke, why should I increase the amount of vitamin C in my diet? Why should a woman who is just thinking about getting pregnant in the future maintain an adequate intake of folic acid? Why is nutrition so much like a puzzle? Devising good nutrition plans is like fitting together the pieces of a huge jigsaw puzzle. Nutrients don’t act alone. The body can use iron only if many supporting cast members are present. Vitamin C helps your body to absorb iron, as does vitamin B₁₂.

Calcium blocks the body’s ability to absorb iron. So, if you’re planning a fresh spinach salad for your menu, you’d be affecting your customers’ nutrition options by offering a mandarin orange vinaigrette full of vitamin C. The citrus dressing would increase iron absorption much more than a plain vinaigrette. A buttermilk-based ranch dressing might taste good, but the calcium in the buttermilk will actually decrease the body’s ability to absorb iron.

Key Points and Links

READING ASSIGNMENT

Key Points

- Vitamin C and the B vitamins are water soluble and need to be consumed daily.
- Vitamins A, D, E, and K are fat-soluble and stored in the body. Megadoses can cause vitamin toxicity.
- Vitamins don't provide energy, but they help the body to use food energy effectively.
- Vitamins aren't a replacement for a good diet.
- Both major and trace minerals are essential.
- High doses of mineral supplements can be toxic.
- Calcium is important for bones and teeth and also for the nervous system. The body changes its ability to absorb calcium from food, according to the body's needs. If the body has a negative calcium balance, it will take calcium from the skeleton.
- Zinc and fluoride are other important minerals. Iodine fuels the thyroid. Sodium is essential, but too much can cause health problems. Sufficient iron is needed at every stage of life.
- It's important to know the side effects of herbal remedies and how they interact with pharmaceuticals.
- Water regulates body temperature, is a large part of the blood and other fluids, and aids in digestion and excretion. For each calorie burned, a person needs a milliliter of water.
- Poor nutrition can lead to pain and illness, developmental delays, and increased healthcare costs.
- The USDA MyPlate guide is a useful tool that can be modified for vegetarian and ethnic diets.
- RDAs are recommended daily allowances based on the needs of healthy people.
- Dietary Guidelines established by the USDA recommend eating a variety of foods and getting exercise.
- Food composition tables list calories and nutrition values of foods or food ingredients.

Links

- [USDA Food Data](http://www.usda.gov/cnpp) (www.usda.gov/cnpp)
- [Berkeley Wellness Letter](http://www.berkeleywellness.com) (www.berkeleywellness.com)
- [Tufts University Nutrition Navigator](http://navigator.tufts.edu) (navigator.tufts.edu)
- [Harvard University health information](http://www.health.harvard.edu/) (www.health.harvard.edu/)
- [National Cancer Institute](http://www.cancer.gov) (www.cancer.gov)
- [American Cancer Society](http://www.cancer.org) (www.cancer.org)

- [Academy of Nutrition and Dietetics](http://www.eatright.org) (www.eatright.org)
- [American Heart Association](http://www.americanheart.org) (www.americanheart.org)
- [Government Healthfinder](http://www.healthfinder.gov) (www.healthfinder.gov)
- [Mayo Clinic](http://www.mayohealth.org) (www.mayohealth.org)
- [Quackwatch](http://www.quackwatch.com) (www.quackwatch.com)
- [Food and Health Communication](http://www.foodandhealth.com) (www.foodandhealth.com)

Exercise: Supplements, Vitamins, and Minerals

Based on what you've read, answer the following questions.

1. Name some situations in which taking a vitamin supplement might be beneficial or necessary for a person.
2. Why is taking a high dose of a single mineral dangerous?
3. List some potential problems for a person who is deficient in calcium.
4. If you're burning 1,500 calories a day, how much water should you consume?
5. Which mineral is essential to maintaining healthy bones and teeth?
6. List whether each of the following vitamins is water-soluble or fat-soluble: A, B, C, D, E, and K.
7. List the benefits of Vitamin C and Vitamin B.
8. Why is overnutrition just as dangerous to a person's health as undernutrition?
9. For the vegetarian profile, what food group should soymilk, rice milk, tofu, and milk alternatives be placed in?
10. For the Asian profile, what food group should tofu and nuts be placed in?
11. List at least three negative effects of undernutrition.

Exercise Answer Key:

Exercise: Supplements, Vitamins, and Minerals

1. When a person's diet doesn't provide him or her with the necessary amount of vitamins; people who are prone to certain illnesses or diseases; pregnant or breastfeeding women; people who are anemic; individuals who are undergoing cancer therapy
2. Too much of a single mineral can be toxic to the body
3. Low calcium levels will trigger the body to take the missing calcium from the skeleton; this causes the bones in the skeleton to become brittle and break more easily.

4. 1,500 milliliters, or 1.5 liters
5. Calcium
6. Water-Soluble: B, C; Fat-Soluble: A, D, E, K
7. Vitamin C: Essential for a healthy immune system; builds collagen; aids in healing
Vitamin B: Aids in muscle control, nerve function, healthy skin and eyes, and production of red blood cells
8. Overnutrition can lead to heart disease, diabetes, cancer, and liver disease, as well as circulatory and physical problems
9. Milk and dairy
10. Meat
11. Depressed immunity, anemia, decreased healing, and retardation of growth and development

Lesson 2 Review

Self-Check

1. Which one of the following are carbohydrates, proteins, and fats?
 - a. Non-Energy-giving Nutrients
 - b. Energy-giving Nutrients
 - c. Calories
 - d. Protiens
2. Which one of the following is the transport of the nutrients around the body to where they're needed?
 - a. Absorption
 - b. Metabolism
 - c. Nutrients
 - d. Digestion
3. Which one of the following produces *bile*, necessary for digestion of fat?
 - a. Kidneys
 - b. Colon
 - c. Stomach

- d. Liver
4. Complex carbohydrates are also called?
- a. Carbohydrates
 - b. Monosaccharides
 - c. Polysaccharides
 - d. Disaccharides
5. Which one of the following is the most important simple sugar?
- a. Lactose
 - b. Maltose
 - c. Glucose
 - d. Fructose
6. Which one of the following comes from the latin word for “*honey*,” which refers to the spilling of sugar into the urine by diabetics?
- a. Diabetes
 - b. Glucose
 - c. Insulin
 - d. Mellitus
7. Which *Type* of diabetics require injectable insulin?
- a. Type I
 - b. Type II
 - c. Type III
 - d. Type IV
8. Which one of the following is a way to calculate how food affects blood sugar levels?
- a. Glycemic Endorphines
 - b. Glycemic Load
 - c. Glycemic Level
 - d. Glycemic Calories
9. Which one of the following are chains made from the 20 different amino acids contained in plant and animal protein?
- a. Amino Acids
 - b. Antibodies
 - c. Carbohydrates
 - d. Proteins
10. Which one of the following diets is a low in saturated fat (but includes calcium-rich dairy

products that have no fat or low fat) and rich in whole grains, fruits, and vegetables?

- a. Ornish diet
- b. Dash diet
- c. Zone diet
- d. South Beach diet

11. Which one of the following are a form of fat; when found in the bloodstream, they can be an indicator of heart disease?

- a. Antibodies
- b. Glycemic
- c. Triglycerides
- d. Amino Acids

12. Which one of the following is the fat that surrounds the internal organs?

- a. Vacuole
- b. Cholesterol
- c. Fatty Acids
- d. Visceral fat

13. Which one of the following is important for the health of the bones and teeth and helps to prevent cavity formation?

- a. Iodine
- b. Fluoride
- c. Goiter
- d. Trace Minerals

14. Which one of the following is a purple daisy originally used by Native Americans in a medicinal tea?

- a. Fluoride
- b. Zinc
- c. Iodine
- d. Echinacea

Self-Check Answer Key

1. Energy-giving Nutrients

Explanation: The energy-giving (or calorie-containing) nutrients are carbohydrates, proteins, and fats. The non-energy-giving (or no-calorie) nutrients are vitamins,

minerals, and water.

Reference: Section 2.1

2. Absorption

Explanation: Absorption is the transport of the nutrients around the body to where they're needed.

Reference: Section 2.1

3. Liver

Explanation: The liver produces bile, necessary for digestion of fat.

Reference: Section 2.1

4. Polysaccharides

Explanation: Scientists call simple carbohydrates monosaccharides and disaccharides and complex carbohydrates polysaccharides.

Reference: Section 2.2

5. Glucose

Explanation: The most important simple sugar is glucose. The most basic sugar, glucose is what the body is looking for when it breaks down bread, potatoes, fruit—any carbohydrate-containing food. It's the body's basic fuel source, and it's the only fuel that the brain can use. Whenever you digest carbohydrates, the body is getting glucose.

Reference: Section 2.2

6. Mellitus

Explanation: Mellitus comes from the latin word for "honey," which refers to the spilling of sugar into the urine by diabetics.

Reference: Section 2.3

7. Type I

Explanation: Type I diabetics require injectable insulin.

Reference: Section 2.3

8. Glycemic Load

Explanation: The glycemic index (GI) and glycemic load (GL) are ways to calculate how food affects blood sugar levels. The GI or GL shows how rapidly a food is digested, which in turn shows how quickly or slowly it drives up blood sugar

Reference: Section 2.3

9. Proteins

Explanation: Proteins are chains made from the 20 different amino acids contained in plant and animal protein.

Reference: Section 2.4

10. Dash diet

Explanation: The DASH diet is low in saturated fat (but includes calcium-rich dairy products that have no fat or low fat) and rich in whole grains, fruits, and vegetables. The diet includes a daily choice of nuts, seeds, or legumes and contains modest amounts of protein (preferably fish, poultry, or soy products). In one study, after eight weeks on the diet, subjects from a broad range of backgrounds experienced a significant reduction in blood pressure. Not only is this diet rich in important nutrients and fiber, but it also includes foods that contain two and one-half times the amounts of electrolytes (for example, potassium, calcium, and magnesium) found in the average American diet.

Reference: Section 2.4

11. Triglycerides

Explanation: Triglycerides are a form of fat; when found in the bloodstream, they can be an indicator of heart disease.

Reference: Section 2.5

12. Visceral fat

Explanation: Visceral fat is the fat that surrounds the internal organs. Visceral fat shields the organs from bruising and acts as an insulator and cushion.

Reference: Section 2.5

13. Fluoride

Explanation: Fluoride is important for the health of the bones and teeth and helps to prevent cavity formation.

Reference: Section 2.6

14. Echinacea

Explanation: Echinacea is a purple daisy originally used by Native Americans in a medicinal tea.

Reference: Section 2.6

Flash Cards

1. Term: Digestion

Definition: The breakdown of the nutrients in food, and absorption is the transport of the nutrients around the body to where they're needed

2. Term: Diabetes

Definition: A disease in which a person's body cannot process sugar as it should

3. Term: Protein

Definition: Chains made from the 20 different amino acids contained in plant and animal food sources

4. Term: Antibodies

Definition: Specific proteins found in the blood that attack and neutralize viruses, fungi, bacteria, and anything else that doesn't belong in your system

5. Term: HDL (high-density lipoprotein) and LDL (low-density lipoprotein)

Definition: The two cholesterol subtypes. Of the two, HDL cholesterol is thought to be the less harmful. LDL cholesterol can do more harm to the arteries; the higher the HDL and the lower the LDL, the better.

6. Term: Osteoporosis

Definition: A medical condition in which the bones become brittle and fragile from loss of tissue

7. Term: Nutrients

Definition: Those parts of food that the body needs for it to grow, replenish, move, and feel good

8. Term: Energy-Giving Nutrients

Definition: Calorie-containing nutrients, such as carbohydrates, proteins, and fats

9. Term: Nonenergy-Giving Nutrients

Definition: No-calorie nutrients, such as are vitamins, minerals, and water

10. Term: Recommended Daily Allowances (RDAs)

Definition: Recommendations for people who are already healthy, not for people who need to make improvements or changes in their health

11. Term: Nutrient Dense

Definition: Another way of saying “getting the most for your money with the least amount of damage”

12. Term: Glucose

Definition: A breakdown product of any carbohydrate you ingest

13. Term: Villi

Definition: Microscopic fronds in the intestinal wall that look like coral waving in the ocean

14. Term: Kidneys

Definition: Organs that extract certain minerals and maintain proper fluid balance

15. Term: Liver

Definition: The filtering organ for everything that you eat and drink, sending nutrients out to where they're needed and processing toxins to be eliminated from the body

16. Term: Absorption

Definition: The transport of the digested foods to where they're needed, and ultimately used, by the body

17. Term: Pepsin

Definition: A stomach protein enzyme

18. Term: Peristalsis

Definition: Muscle contractions that resemble the movement of clothes in a washing machine

19. Term: Epithelium

Definition: A substance that contains literally millions of gastric glands

20. Term: Duodenum

Definition: When a chemical digestion is performed in the first part of the small intestine

21. Term: Monosaccharides

Definition: A type of simple carbohydrate

22. Term: Disaccharides

Definition: A type of simple carbohydrate

23. Term: Polysaccharides

Definition: Complex carbohydrates

24. Term: Gluten

Definition: The protein found in wheat

25. Term: Bomb Calorimeters

Definition: Special oven that can measure the amount of heat the food gives off while it's burning

26. Term: Insulin

Definition: A hormone that enables cells to absorb glucose

27. Term: Lactose

Definition: Milk sugar

28. Term: Type I Diabetes

Definition: People with diabetes that had normal, or even excessive, amounts of insulin and are insulin-dependent

29. Term: Type II Diabetes

Definition: People with diabetes that had normal, or even excessive, amounts of insulin and are not insulin-dependent

30. Term: Exchange Lists

Definition: Used to formulate diabetic diets

31. Term: Glycemic Index (GI) and Glycemic Load (GL)

Definition: Ways to calculate how food affects blood sugar levels

32. Term: Essential

Definition: The body has to have it, but can't produce it on its own

33. Term: Edema

Definition: An uncomfortable swelling and pressure of the body

34. Term: Ornish Diet

Definition: Excludes all oils and animal products except for nonfat yogurt, nonfat milk, and egg whites; saturated fats are limited as much as possible; total fat is limited to 10 percent of daily calories and the bulk of the menu is composed of carbohydrates (75 percent of calories)

35. Term: DASH Diet

Definition: Low in saturated fat (but includes calcium-rich dairy products that have no fat or low fat) and rich in whole grains, fruits, and vegetables; includes a daily choice of nuts, seeds, or legumes and contains modest amounts of protein (preferably fish, poultry, or soy products)

36. Term: South Beach Diet

Definition: Consists of three phases: (1) the first phase is severe deprivation of calories—no bread, potatoes, rice, fruits, sweets, or alcohol for two weeks; (2) the second phase, one or two favorite foods can be reintroduced; and (3) the third phase is the maintenance phase

37. Term: Zone Diet

Definition: The digestive system operates ideally when only two groups of food are consumed: lean protein and natural carbohydrates, such as fruits and fiber-rich vegetables

38. Term: Atkins Diet

Definition: A four-phase eating plan, combined with vitamin and mineral supplementation and regular exercise: (1) the first phase is referred to as Induction, (2) the second phase is the Ongoing Weight Loss (OWL), (3) the third phase is the Pre-Maintenance, and (4) the fourth phase involves Lifetime Maintenance

39. Term: Vegetarians

Definition: Exclude animals from their diet but include animal products, such as cheese, sour cream, and yogurt made from cow, goat, or any other kind of animal milk

40. Term: Omnivores

Definition: Include every type of food in their diet

41. Term: Triglycerides

Definition: A form of fat; when found in the bloodstream, they can be an indicator of heart disease

42. Term: Saturation

Definition: Refers to the amount of hydrogen that a molecule of fat is holding on to

43. Term: Saturated Fats

Definition: Strong substances and are fairly solid at room temperature

44. Term: Hydrogen

Definition: Introduced to vegetable oil molecules to make them saturated

45. Term: Trans-Fatty Acid Bonds

Definition: Created from adding hydrogen to vegetable oil

46. Term: Saturated Fat

Definition: Simply saturated fat from plant products

47. Term: Cholesterol

Definition: Saturated fat from animal products

48. Term: Visceral Fat

Definition: The fat that surrounds the internal organs

49. Term: Scurvy

Definition: A “sea sickness” sailors developed after several months without vitamin C

50. Term: Fat-Soluble Vitamins

Definition: Stored in the fatty tissues of the body, so some are left over from day to day

51. Term: Collagen

Definition: The “glue” that helps joints to function correctly

52. Term: Water-Soluble Vitamins

Definition: Aren't stored in the body, there's very little chance of vitamin toxicity

53. Term: Minerals

Definition: Make up only about 5 percent of our body weight, but are essential for life

54. Term: Major Minerals

Definition: Found in greater amounts in the body and are needed in larger amounts in the diet and include calcium, potassium, chloride, sulfur, magnesium, and sodium

55. Term: Trace Minerals

Definition: Needed in smaller amounts and include iron, iodine, zinc, fluoride, and cobalt

56. Term: Fluoride

Definition: Important for the health of the bones and teeth and helps to prevent cavity formation

57. Term: Echinacea

Definition: A purple daisy originally used in a medicinal tea

58. Term: Food Composition Tables

Definition: List ingredient or food item and various nutrition values for the particular ingredient, which can include calories, carbohydrates, protein, fats (including saturated and unsaturated fats), vitamins, minerals, and fiber