CHAPTER **19**

Coronary Heart Disease and Hypertension

KEY CONCEPTS

- Cardiovascular disease is the leading cause of death in the United States.
- Several risk factors contribute to the development of coronary heart disease and hypertension, many of which are preventable by improved food habits and lifestyle behaviors.
- Other risk factors are nonmodifiable, such as age, gender, family history, and race.

- Hypertension (i.e., chronically elevated blood pressure) may be classified as primary or secondary hypertension.
- Hypertension damages the endothelium of the blood vessels.
- Early education is critical for the prevention of cardiovascular disease.

Cardiovascular disease (CVD) is the leading cause of death in the United States, and it accounts for more than 615,000 deaths each year (Figure 19-1).[1] A similar situation exists in most other developed Western societies. Every day, thousands of people have heart attacks and strokes, and more than 1 million others continue to live with various forms of rheumatic and congestive heart disease.

This chapter discusses the primary underlying disease processes of atherosclerosis and hypertension as well as the various risk factors involved, and it explores ways to use nutrition therapy to reduce risk factors and to help prevent disease.

CORONARY HEART DISEASE

Atherosclerosis

Disease Process

The major cause of CVD and the underlying pathologic process in coronary heart disease is atherosclerosis. This process is characterized by fatty fibrous plaques that may begin as early as childhood and that develop into fatty streaks, which are largely composed of cholesterol, on the inside lining of major blood vessels. When tissue is examined, cholesterol can be seen with the unaided eye in the debris of advanced lesions. This fatty, fibrous plaque gradually thickens over time and narrows the interior part of the blood vessel. The thickening of the vessel or the

development of a blood clot may eventually cut off blood flow (Figure 19-2).

Cells die when they are deprived of their normal blood supply. The local area of dying or dead tissue is called an *infarct*. If the affected blood vessel is a major artery that supplies vital nutrients and oxygen to the heart muscle (i.e., the myocardium), then the event is called a *myocardial infarction* (MI) or *heart attack*. If the affected vessel is a major artery that goes to the brain, then the event is called a *cerebrovascular accident* or *stroke*. The major arteries and their many branches that serve the heart are called *coronary arteries,* because they lie across the brow of the heart and resemble a crown. Thus, the overall disease process is identified as *coronary heart disease*. A common symptom of its presence is angina pectoris or
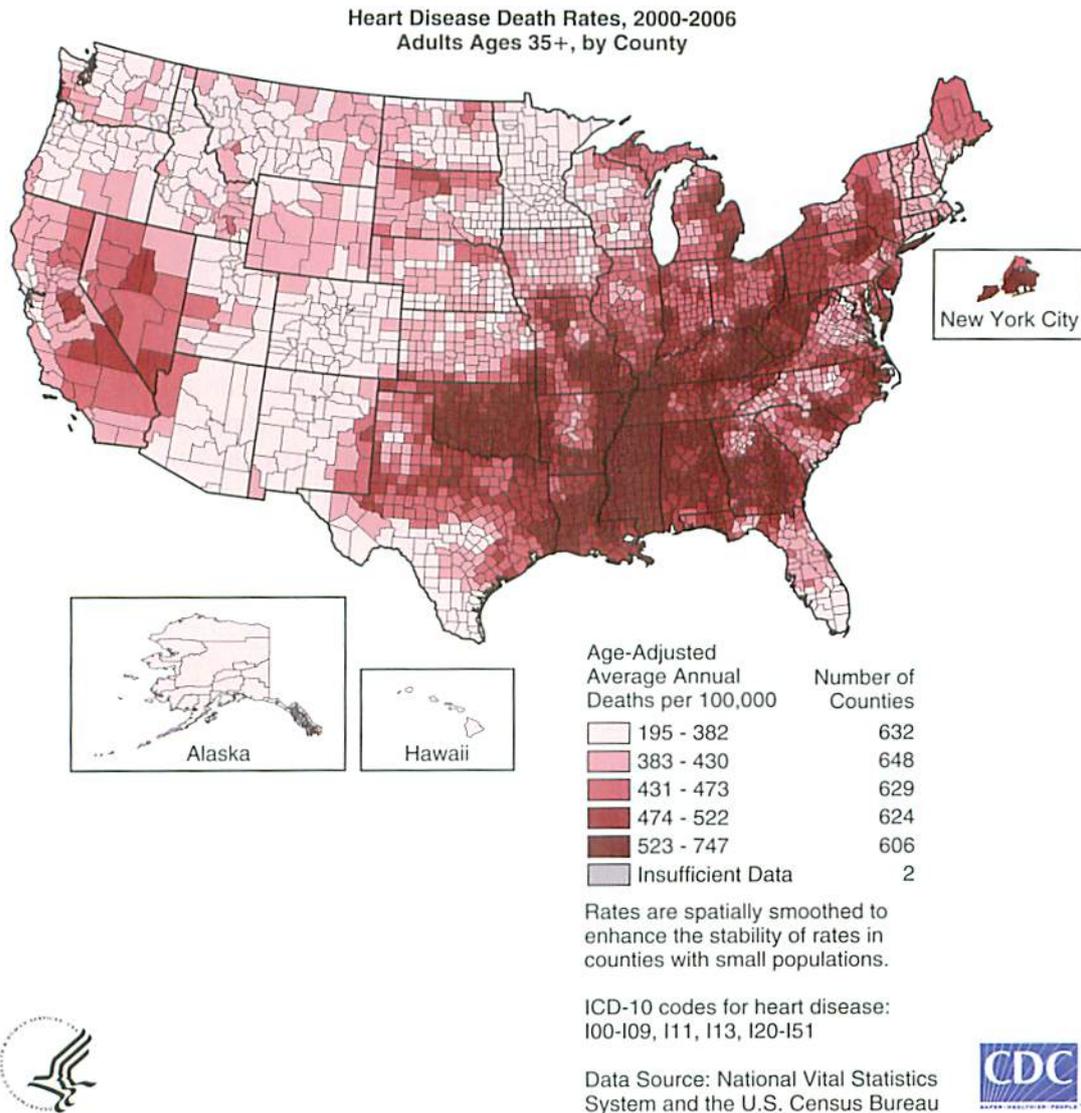
Heart Disease Death Rates, 2000-2006
Adults Ages 35+, by County

New York City

Alaska

Hawaii

Age-Adjusted Average Annual Deaths per 100,000	Number of Counties
195 - 382	632
383 - 430	648
431 - 473	629
474 - 522	624
523 - 747	606
Insufficient Data	2

Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

ICD-10 codes for heart disease: I00-I09, I11, I13, I20-I51

Data Source: National Vital Statistics System and the U.S. Census Bureau

CDC

Figure 19-1 Heart disease death rates for 2000 to 2006 among adults 35 years old and older, by county. (From the Centers for Disease Control and Prevention. *Heart disease death rates, 2000-2006, adults ages 35+, by county* (website): www.cdc.gov/DHDSP/maps/pdfs/hd_all.pdf. Accessed March 2011.)

atherosclerosis the underlying pathology of coronary heart disease; a common form of arteriosclerosis that is characterized by the formation of fatty streaks that contain cholesterol and that develop into hardened plaques in the inner lining of major blood vessels such as the coronary arteries.

myocardial infarction (MI) a heart attack; a myocardial infarction is caused by the failure of the heart muscle to maintain normal blood circulation as a result of the blockage of the coronary arteries with fatty cholesterol plaques that cut off the delivery of oxygen to the affected part of the heart muscle.

cerebrovascular accident a stroke; a stroke is caused by arteriosclerosis within the blood vessels of the brain that cuts off oxygen supply to the affected portion of brain tissue, thereby paralyzing the actions that are controlled by the affected area.

coronary heart disease the overall medical problem that results from the underlying disease of atherosclerosis in the coronary arteries, which serve the heart muscle with blood, oxygen, and nutrients.

angina pectoris a spasmodic, choking chest pain caused by a lack of oxygen to the heart; this is a symptom of a heart attack, and it also may be caused by severe effort or excitement.
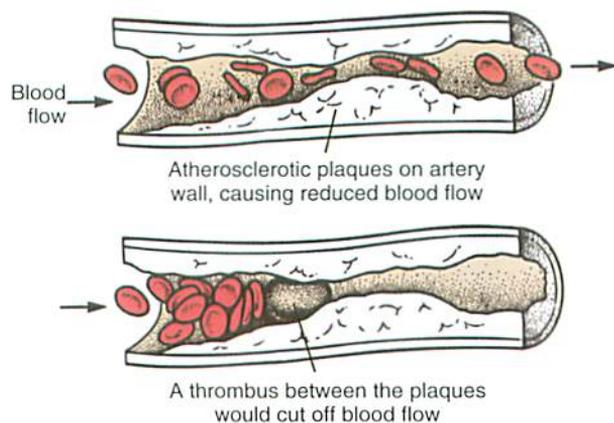
Atherosclerotic plaques on artery wall, causing reduced blood flow

A thrombus between the plaques would cut off blood flow

Figure 19-2 An atherosclerotic plaque in an artery.

chest pain that usually radiates down the left arm and that is sometimes brought on by excitement or physical effort.

Relation to Fat Metabolism

Elevated blood **lipids** are associated with CVD. Lipid substances involved in the disease process are described in detail in Chapter 3, and three of these substances are discussed again in this chapter.

Triglycerides. The chemical name for fat that describes its basic structure is *triglyceride.* All simple fats, whether in the body or in food, are triglycerides (see Chapter 3). The blood test for total triglycerides measures circulating levels in the blood. Studies that assesses the effect of dietary fat on blood lipid profiles show adverse results from diets that are high in saturated and trans fats.[2] Conversely, diets that are low in overall fat and diets that replace saturated fats with monounsaturated fats produce more desirable profiles and lower inflammatory markers.[3,4] In addition, supplementing with omega-3 fatty acids (i.e., eicosapentaenoic acid and docosahexaenoic acid) effectively reduces circulating levels of triglycerides in individuals with hypertriglyceridmia.[5]

Body fat assessment and the measurement of fat distribution with methods such as the body mass index, **waist circumference**, waist-hip circumference ratio, **dual-energy x-ray absorptiometry**, and **ultrasonography** help to identify people who are more likely to have CVD risk factors and elevated triglyceride levels.[6-8]

Cholesterol. Cholesterol is a fat-related compound that is both consumed in the diet and produced in the liver. It is an important part of normal cell functioning. Dietary cholesterol is found in foods of animal origin only (e.g., meat, dairy, butter). Although cholesterol is an essential compound in the body, excess total blood levels increase the risk of heart disease in predisposed individuals. High blood cholesterol levels increase the risk for the deposition of cholesterol, fats, fibrous tissue, and

macrophages in arteries throughout the body, which is the beginning of atherosclerosis. The Centers for Disease Control and Prevention reports that 14.9% of American adults 20 years old and older have high total blood cholesterol levels of more than 240 mg/dL.[1] Many patients with **hypercholesterolemia** have the related problems of obesity and hypertension; these require medical counseling and intervention, with diet as the primary treatment. A total blood cholesterol level of less than 200 mg/dL is desirable.[9]

Lipoproteins. Because fat is not soluble in water, it is carried in the bloodstream in small packages wrapped with protein called *lipoproteins.* These compounds are produced in the intestinal mucosal cells after a meal that contains fat and in the liver as part of the ongoing process of fat metabolism. Lipoproteins carry fat and cholesterol to tissues for cell metabolism and then back to the liver for breakdown and excretion as needed. Lipoproteins are grouped and named in accordance with their protein, fat, and cholesterol content (i.e., their density) (Figure 19-3). Those with the highest protein content have the highest density and vice versa. Five lipoproteins are significant in relation to heart disease risk as follows:

1. *Chylomicrons:* These are made predominantly (≈85%) from dietary triglycerides after absorption from the gastrointestinal tract. Chylomicrons are lipoprotein particles that transport absorbed dietary (i.e., exogenous) triglycerides to plasma and tissues (Figure 19-3, *A*).
2. *Very low-density lipoproteins (VLDLs):* These are formed in the liver from endogenous fat. VLDLs carry a relatively large load of triglycerides to cells, and they also contain approximately 12% cholesterol (Figure 19-3, *B*).

lipids the chemical group name for fats and fat-related compounds such as cholesterol and lipoproteins.

waist circumference the measurement of the waist at its narrowest point width-wise, just above the navel; waist circumference is a rough measurement of abdominal fat and a predictor of risk factors for cardiovascular disease; this risk factor increases with a waist measurement of more than 40 inches in men and of more than 35 inches in women.

dual-energy x-ray absorptiometry radiography that makes use of two beams (i.e., dual) that measure bone density and body composition.

ultrasonography an ultrasound-based diagnostic imaging technique that is used to visualize the muscles and internal organs; also referred to as *sonography.*

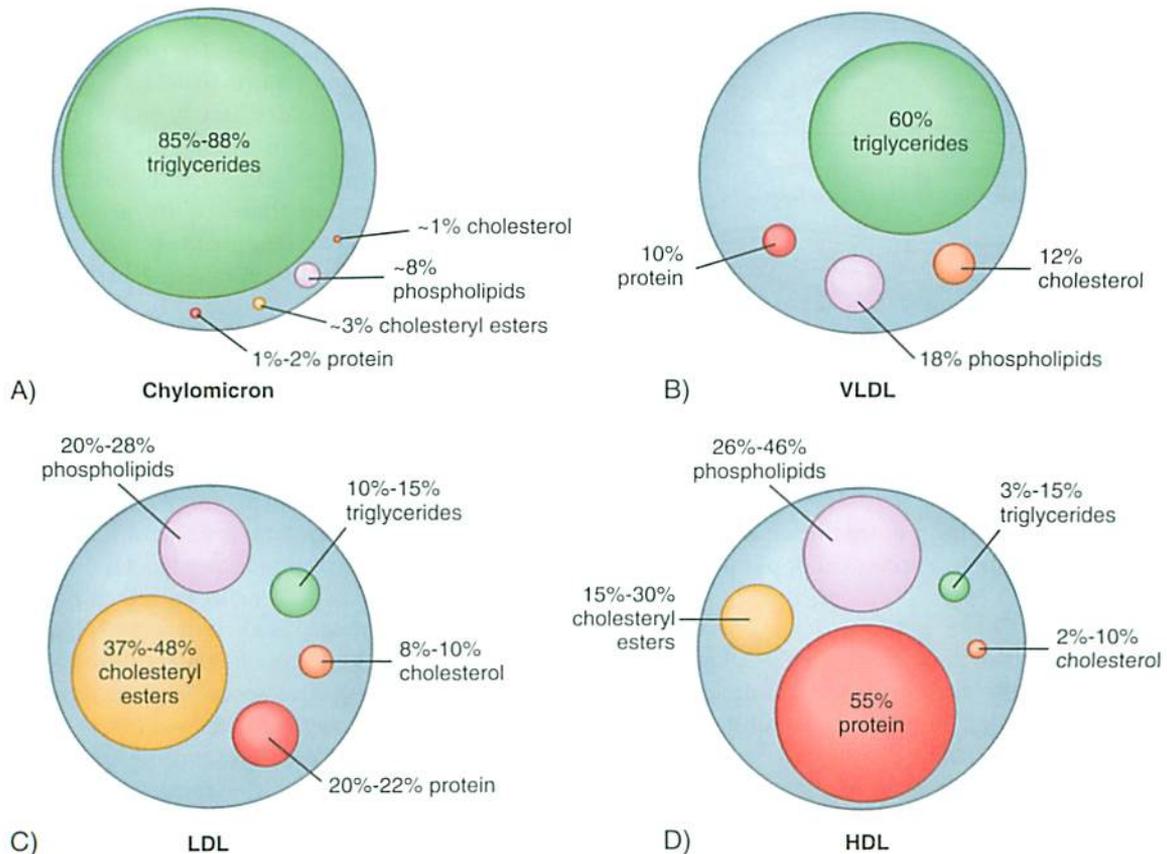**hypercholesterolemia** elevated blood cholesterol levels.

Figure 19-3 Serum lipoprotein factions showing lipid composition. A, Chylomicron. B, Very low-density lipoprotein. C, Low-density lipoprotein. D, High-density lipoprotein.

3. *Intermediate-density lipoproteins (IDLs):* Like VLDLs, IDLs deposit triglycerides throughout the body; degradation leaves IDLs in the circulation. IDLs continue delivering endogenous triglycerides to cells and tissue.

4. *Low-density lipoproteins (LDLs):* LDLs carry, in addition to other lipids, at least two thirds of the total plasma cholesterol to body tissues. LDLs are formed endogenously in the liver and in serum from the catabolism of VLDLs and IDLs. Because LDLs constantly send cholesterol to tissues, they can be considered "the source of bad cholesterol." With regard to cardiovascular health, LDL cholesterol is the major lipoprotein of concern[10] (Figure 19-3, *C*).

5. *High-density lipoproteins (HDLs):* HDLs carry less total fat and more protein (Figure 19-3, *D*). They transport cholesterol from the tissues to the liver for catabolism, and they are endogenously produced in the liver. Compared with LDL cholesterol, HDL often is considered "good cholesterol," and higher serum levels are protective against CVD. Values of

less than 40 mg/dL imply increased risk for CVD, and a value of 60 mg/dL or more contributes protection and decreased risk. Unlike other lipoproteins, HDL cholesterol is more closely associated with regular exercise and lean body mass than diet, which is one of the reasons that the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults recommends regular physical activity.[2,9]

Table 19-1 outlines the recommended blood levels of each lipid component.

Risk Factors

The underlying disease process of atherosclerosis is caused by multiple risk factors (Box 19-1). Note the modifiable risk factors over which people have some control compared with those that individuals cannot control (i.e., nonmodifiable):

- *Gender:* CVD occurs more often among men than women until women reach menopause, at which time the relative risks are the same for both genders. Researchers have not concluded whether the

TABLE 19-1 CHOLESTEROL AND LIPOPROTEIN PROFILE CLASSIFICATION

Cholesterol Reading	Classification
Total Cholesterol (mg/dL)	
< 200	Desirable
200 to 239	Borderline high
≥ 240	High
Low-Density Lipoprotein Cholesterol (mg/dL)	
< 100	Optimal
100 to 129	Near optimal
130 to 159	Borderline high
160 to 189	High
≥ 190	Very high
High-Density Lipoprotein Cholesterol (mg/dL)	
≥ 60	Optimal
< 40	Low (elevated risk)
Triglycerides (mg/dL)	
< 150	Optimal
150 to 199	Borderline high
200 to 499	High
≥ 500	Very high

Data from National Cholesterol Education Program. *Third report of the NCEP Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)*. Washington, DC: National Institutes of Health; 2002.

increased risk for women is solely the result of menopause, because separating risks associated with age from those associated with menopause is difficult.[11,12]

- *Age:* General risk for CVD increases with the aging process. It is greater for men who are older than 45 years old and for women who are older than 55 years old.
- *Family history:* A positive family history is defined as a history of premature CVD (i.e., before the age of 55 years in a male first-degree relative or before the age of 65 years in a female first-degree relative). Early screening for children and adolescents with a high-risk family history is important so that appropriate diet and lifestyle modifications may begin before fatty streaks develop in the coronary arteries.
- *Heredity:* Certain ethnic groups (i.e., African Americans, Mexican Americans, Native Americans, Native Hawaiians, and some Asian Americans) have a higher incidence of risk factors and CVD. Genetic defects that result in abnormally high serum lipid levels include familial hypercholesterolemia and familial hypertriglyceridemia.

Both conditions require diet and drug therapy to begin during the second or third decade of life.

- *Compounding diseases:* Comorbidities associated with obesity such as type 2 diabetes, hypertension, and metabolic syndrome (Table 19-2) increase the risk for the development of CVD.[9,13]
- *Blood cholesterol profile:* High total and LDL cholesterol and low HDL cholesterol are major risk factors for the disease process, which is worsened by obesity, physical inactivity, diets that are high in trans fat and saturated fat, stress, and smoking. The National Cholesterol Education Program recommends cholesterol screening every 5 years for adults without existing risk factors and more often for those with higher risks.

Dietary Recommendations for Reduced Risk

Dietary Guidelines. Because the control of dietary fat and cholesterol is important to reduce risks for heart disease, the Dietary Guidelines for Americans (see Chapter 1) and the American Heart Association (Box 19-2) recommend the dietary restriction of both fat and cholesterol.

Adult Treatment Panel III Guidelines. The National Heart, Lung, and Blood Association's National Cholesterol Education Program (NCEP) began a campaign against high blood cholesterol in 1988 with the release of its "Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, Adult Treatment Panel (ATP)." The NCEP designed the Step I and Step II diets, which were also endorsed by the American Heart Association, to lessen the risk of CVD by reducing high blood cholesterol levels. Since the inception of the Step I and Step II diets, the NCEP has released two follow-up reports. In the most recent report (ATP

familial hypercholesterolemia a genetic disorder that results in elevated blood cholesterol levels despite lifestyle modifications; this condition is caused by absent or nonfunctional low-density lipoprotein receptors, and it requires drug therapy.

familial hypertriglyceridemia a genetic disorder that results in elevated blood triglyceride levels despite lifestyle modifications; it requires drug therapy.

metabolic syndrome a combination of disorders that, when they occur together, increases the risk of cardiovascular disease and diabetes; it is also known as *syndrome X* and *insulin resistance syndrome*.

BOX 19-1 RISK FACTORS FOR CARDIOVASCULAR DISEASE

Lipid Risk Factors
- Low-density lipoprotein cholesterol > 130 mg/dL
- High-density lipoprotein cholesterol < 40 mg/dL*
- Total cholesterol > 200 mg/dL
- Triglycerides > 150 mg/dL
- Atherogenic dyslipidemia[†]

Nonlipid Risk Factors
Nonmodifiable
- Male gender
- Age (men ≥ 45 years, women ≥ 55 years)
- Heredity (including race)
- Family history of premature cardiovascular disease (i.e., myocardial infarction or sudden death at 55 years of age or less in a male first-degree relative or at 65 years of age or less in a female first-degree relative)
- Estimated glomerular filtration rate of < 60 mL/min or microalbuminuria
- Type 1 diabetes mellitus

Modifiable
- Cigarette smoking
- Hypertension (blood pressure > 140/90 mm Hg or taking antihypertensive medication)

- Physical inactivity
- Obesity (body mass index of > 30 kg/m²) and overweight (body mass index of 25 to 29.9 kg/m²)
- Type 2 diabetes mellitus
- Atherogenic diet (i.e., a high intake of saturated fat and cholesterol)

Emerging Risk Factors
Emerging Lipid Risk Factors
- Elevated lipoprotein remnants
- Elevated lipoprotein(a)
- Small low-density lipoprotein particles
- Elevated apolipoprotein B
- Low apolipoprotein A-I
- High total cholesterol/high-density lipoprotein cholesterol ratio

Emerging Nonlipid Risk Factors
- Hyperhomocysteinemia
- Thrombogenic or hemostatic factors
- Inflammatory markers (e.g., C-reactive protein)
- Impaired fasting glucose level

*High-density lipoprotein level of > 60 mg/dL counts as a "negative" risk factor; its presence removes one risk factor
†Atherogenic dyslipidemia is a disorder with four components: borderline high-risk low-density lipoprotein cholesterol level (i.e., 130 to 159 mg/dL), moderately raised (often high normal) triglyceride level, small low-density lipoprotein particles, and low high-density lipoprotein cholesterol level.
Modified from the National Cholesterol Education Program. *Third report of the NCEP Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)*, Washington, DC: National Institutes of Health; 2002.

BOX 19-2 AMERICAN HEART ASSOCIATION DIETARY GUIDELINES

Weight and Physical Activity
- Burn at least as many calories as consumed.
- Aim for at least 30 minutes of physical activity on most if not all days. To lose weight, do enough activity to burn more calories than eaten every day.

Foods to Focus On
- Eat a variety of nutritious foods from all food groups.
- Choose foods like vegetables, fruits, whole-grain products, and fat-free or low-fat dairy products most often.
- Choose lean meats and poultry without skin, and prepare them without added saturated and trans fats.
- Eat fish at least twice a week.
- Select fat-free, 1% fat, and low-fat dairy products.

Foods to Limit or Consume in Moderation
- Cut back on foods that contain partially hydrogenated vegetable oils to reduce trans fats in the diet.

- Cut back on foods that are high in dietary cholesterol. Aim to eat less than 300 mg of cholesterol each day.
- Eat less of the nutrient-poor foods.
- Cut back on beverages and foods with added sugars.
- Choose and prepare foods with little or no salt. Aim to eat less than 1500 mg of sodium per day.
- Drink alcohol in moderation, if at all. That means one drink per day for women and two drinks per day for men.

General Recommendations
- Follow the American Heart Association recommendations when eating out, and keep an eye on portion sizes.
- Don't smoke tobacco, and stay away from tobacco smoke.

Source: American Heart Association, Inc. Modified from the American Heart Association. *Diet and lifestyle recommendations* (website): www. heart.org/HEARTORG/GettingHealthy/Diet-and-Lifestyle-Recommendations_UCM_305855_Article.jsp. Accessed March 2011.

TABLE 19-2 DIAGNOSTIC CRITERIA FOR METABOLIC SYNDROME

Measure*	Categoric Cut points
Increased waist circumference[†‡]	≥ 102 cm (≥ 40 in) in men ≥ 88 cm (≥ 35 in) in women
Elevated triglycerides	≥ 150 mg/dL (1.7 mmol/L) or drug treatment for elevated triglycerides[§]
Reduced HDL cholesterol	< 40 mg/dL (1.03 mmol/L) in men < 50 mg/dL (1.3 mmol/L) in women or drug treatment for reduced high-density lipoprotein cholesterol[§]
Elevated blood pressure	≥ 130 mm Hg systolic or ≥ 85 mm Hg diastolic or drug treatment for hypertension
Elevated fasting glucose	≥ 100 mg/dL or drug treatment for elevated glucose

*Any three of these five criteria constitute a diagnosis of metabolic syndrome.

†To measure waist circumference, locate the top of the right iliac crest. Place a measuring tape in a horizontal plane around the abdomen at the level of the iliac crest. Before reading the tape measure, ensure that the tape is snug but that it does not compress the skin, and be sure that it is parallel to the floor. The measurement is made at the end of a normal expiration.

‡Some U.S. adults of non-Asian origin (e.g., Caucasian, African American, Hispanic) with marginally increased waist circumferences (e.g., 94 to 101 cm [37 to 39 in] in men and 80 to 87 cm [31 to 34 in] in women) may have a strong genetic contribution to insulin resistance and should benefit from changes in lifestyle habits; this is similar for men with categoric increases in waist circumference. A lower waist circumference cut point (e.g., 90 cm [35 in] in men and 80 cm [31 in] in women) appears to be appropriate for Asian Americans.

§Fibrates and nicotinic acid are the most commonly used drugs for elevated triglycerides and reduced high-density lipoprotein cholesterol. Patients who are taking one of these drugs are presumed to have a high triglyceride level and a low high-density lipoprotein cholesterol level.

From Grundy SM, Cleeman JI, Daniels SR, et al; American Heart Association; National Heart, Lung, and Blood Institute. Diagnosis and management of metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation.* 2005;112:2735-2752.

III), the organization moved toward an intensive lifestyle habit intervention that was focused on appropriate weight, diet, physical activity, and other controllable risk factors.[9] This comprehensive approach is referred to as the **Therapeutic Lifestyle Changes** (TLC) diet. Table 19-3 outlines the recommendations for the TLC diet. Essential components of the approach are as follows[9]:

- Total energy intake should reflect energy expenditure to maintain a desirable body weight and to prevent weight gain.
- Include enough exercise to expend at least 200 kcal/day.

TABLE 19-3 AMERICAN HEART ASSOCIATION AND NATIONAL CHOLESTEROL EDUCATION PROGRAM RECOMMENDATIONS FOR LOWERING CHOLESTEROL

Nutrient*	Recommended Intake as Percent of Total Calories
Total fat	25% to 35%
Saturated	< 7%
Polyunsaturated	Up to 10%
Monounsaturated	Up to 20%
Carbohydrate	50% to 60%
Protein	≈ 15%
Cholesterol	< 200 mg/day
Total fiber	25 to 30 g
Soluble fiber	10 to 25 g
Total calories	Balance energy intake and expenditure to maintain a desirable body weight and to prevent weight gain

*Calories from alcohol not included.
Modified from the National Cholesterol Education Program. *Third report of the NCEP Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III).* Washington, DC: National Institutes of Health; 2002.

- Total fat intake should not exceed 25% to 35% of total kilocalories, with saturated fats contributing no more than 7%, polyunsaturated fats contributing up to 10%, and monounsaturated fats contributing up to 20%. Individuals with metabolic syndrome or diabetes can increase their intake of monounsaturated and polyunsaturated fats in place of carbohydrates.
- Avoid trans fatty acids.
- Carbohydrates—mainly from complex carbohydrates such as whole grains, fruits, and vegetables—should make up 50% to 60% of the total energy intake per day. The diet should allow for a total of 25 to 30 g of fiber (of which 10 to 25 g should be from soluble fiber) and 2 g of plant-derived sterols or stanols per day.
- Total protein intake should account for approximately 15% of the total energy intake. Soy protein is encouraged as a low-fat alternative to other animal products (see the For Further Focus box, "Soy Protein and Heart Disease").

Therapeutic Lifestyle Changes (TLC) an intensive lifestyle intervention that is focused on appropriate weight, diet, physical activity, and other controllable risk factors to reduce cholesterol levels and to prevent other complications of heart disease.

FOR FURTHER FOCUS

SOY PROTEIN AND HEART DISEASE

In recent years, soy protein has been linked to a reduced risk for coronary heart disease. The ingestion of soy protein has led to a reduction in low-density lipoprotein cholesterol levels, an increase in high-density lipoprotein cholesterol levels, and a reduction in triglyceride levels. The findings are so significant that the U.S. Food and Drug Administration (FDA) has approved an official health claim to link soy protein consumption with a reduced risk of coronary heart disease.[1]

One of the main focuses of research in this area is to narrow the recommendations for the amount and type of phytosterols and phytostanols needed on a daily basis to receive the most beneficial results. Phytosterols and phytostanols are the molecules that are found in plant foods that have the cholesterol-lowering effects. One way in which they work is by preventing the absorption of cholesterol in the digestive tract. Previous research had found a huge range (i.e., 18 to 124 g/day) in the amount of soy protein needed to achieve the desired results. One reason for this large difference is the low water solubility of the compounds. Because the compound requires fat as a carrier, consuming that amount of soy protein could drastically increase total fat consumption. (Even if it is the heart-healthy fat, it still carries the potential for causing weight gain.) The FDA recommends consuming four servings per day of soy protein, with each serving containing a minimum of 6.25 g for a total of 25 g/day.

Researchers are exploring alternative methods for introducing the protein without drastically changing diet or fat intake. One study found that a soy protein supplement of soybean β-conglycinin (a component of soy protein isolate) in the form of candy produced a significant reduction in triglyceride concentrations and may be an effective alternative or addition to soy-protein foods.[2] A similar study combined soy protein with small amounts of lecithin, dried it, and added it to otherwise fat-free foods as an alternative source of phytosterols and phytostanols.[3] β-Sitosterol and lecithin increased the water solubility of the compound and allowed for better absorption without the fat. In both cases, the beneficial effects of soy protein were seen in the form of lowered cholesterol levels and improved lipid profiles.

Incorporating soy protein into a low-fat, high-fiber diet with plenty of fruits and vegetables is a sound start to reducing the risk for coronary heart disease.[4] Soy protein can be found in the following foods:

- Soy-based meat alternatives
- Miso
- Nondairy frozen desserts
- Okara (not okra)
- Soy beverages
- Soy cheese
- Soy nut butter
- Soy yogurt
- Soybeans
- Soybean oil
- Soy milk
- Soy nuts
- Tempeh
- Textured vegetable protein
- Tofu

1. U.S. Food and Drug Administration. *Health claims: soy protein and risk of coronary heart disease (CHD), Electronic Code of Federal Regulations.* Washington, DC: U.S. Food and Drug Administration; 2011.
2. Kohno M, Hirotsuka M, Kito M, et al. Decreases in serum triacylglycerol and visceral fat mediated by dietary soybean beta-conglycinin. *J Atheroscler Thromb.* 2006;13(5):247-255.
3. Spilburg CA, Goldberg AC, McGill JB, et al. Fat-free foods supplemented with soy stanol-lecithin powder reduce cholesterol absorption and LDL cholesterol. *J Am Diet Assoc.* 2003;103(5):577-581.
4. Sacks FM, Lichtenstein A, Van Horn L, et al. Soy protein, isoflavones, and cardiovascular health: an American Heart Association Science Advisory for professionals from the Nutrition Committee. *Circulation.* 2006;113(7):1034-1044.

- Total cholesterol intake should be less than 200 mg/day.

A diet that is rich in vegetables, fruits, and whole grains; low in saturated and trans fatty acids; and that includes the moderate use of polyunsaturated and monounsaturated food fats (i.e., mostly olive oil, corn oil, and other vegetable oils and products) is the basic guideline. Low-fat and fat-free dairy products as well as lean meat, fish, and poultry are used instead of their high-fat alternatives.

When the risk factor of obesity is present, weight loss via negative energy balance is encouraged. Interestingly, studies show that weight loss attempts are largely unsuccessful among patients with CVD; however, when a physician officially diagnoses a patient as overweight, weight loss attempts are more successful.[14] Negative energy balance should be achieved through reduced energy intake and increased energy expenditure as a result of regular physical activity (see Chapter 15). A treadmill exercise tolerance test is ideal to determine the exercise limit for individuals who are older, who are obese, or who have a history of CVD or hypertension before they start an exercise program (Figure 19-4).

Drug Therapy

In the event that the LDL cholesterol level is above the goal range, the NCEP ATP III guidelines recommend cut points for the TLC diet and drug therapy, depending on

Figure 19-4 A patient with a history of cardiac disease is evaluated for exercise tolerance with a treadmill test. (Copyright PhotoDisc.)

the level of risk. As the number and severity of risk factors increase, the point at which TLC and drug therapy should begin declines. For example, a person with few or no risk factors associated with CVD may wait to initiate drug therapy until LDL levels exceed 190 mg/dL, whereas an individual with significant risk for CVD should consider drug therapy when LDL levels rise to more than 100 mg/dL. At any level of drug therapy, the TLC dietary guidelines should be continued as adjunct therapy.

Acute Cardiovascular Disease

When CVD progresses to the point of cutting off the blood supply to major coronary arteries, a critical vascular event (i.e., MI) may occur. During the initial acute phase of the attack, additional diet modifications are necessary for healing.

Objective: Cardiac Rest

The term *infarction* means tissue death from a lack of oxygen. Blood tests reveal enzymes and proteins that are released from the damaged heart muscle after infarction; these cardiac markers are one of the tests used for diagnosis. During the care immediately after an MI, patients are treated with the MONA protocol and given analgesics (e.g., *M*orphine), supplemental *O*xygen, intravenous *N*itroglycerine, and *A*spirin. All care, including the diet, is directed toward ensuring cardiac rest so that the damaged heart may be restored to normal functioning.

Principles of Medical Nutrition Therapy

Medical nutrition therapy goals for patients after MI are as follows: (1) promote recovery and strength; and (2) lower LDL cholesterol and other known risk factors to prevent the progression of CVD.[15] Patients who have experienced an MI are encouraged to follow the TLC diet (if they are not already doing so) to reduce further risk factors for CVD.

Initially, the diet is modified with regard to energy value and texture as well as for fat and sodium content (see the Clinical Applications box, "Case Study: The Patient With a Myocardial Infarction").

Energy. A brief period of reduced energy intake during the first day after the heart attack reduces the metabolic workload on the damaged heart. The metabolic demands for the digestion, absorption, and metabolism of food require a generous cardiac output. Thus, to decrease the level of metabolic activity that the weakened heart can handle, small feedings are spread over the day when an oral diet is started. The patient progresses to eating more as healing occurs. During the recovery period, caloric intake is adjusted to meet the energy needs of the person's ideal body weight.

Texture. Early feedings may include foods that are relatively soft in texture or easily digested to avoid excess effort during eating or the discomfort of gas formation. Some patients benefit from assistance during the feeding process for a short period, especially those with poor appetite or weakness or who become short of breath from the exertion of eating. Smaller and more frequent meals may provide needed nourishment without undue strain or pressure. Depending on the patient's condition, gas-forming foods, caffeine-containing beverages, and hot or cold temperature extremes in foods in both solids and liquids should be avoided.

Fat. The TLC diet controls the amounts and types of fat and cholesterol consumed (see Table 19-3). Research supports the adoption of a Mediterranean-type diet (see Figure 14-8) for patients who have had an MI. Adherence to the Mediterranean diet reduces risk factors for CVD, reduces inflammatory markers after an MI, and increases the life span.[16-18] The basic components of a Mediterranean diet are plant-based foods; fish and poultry, with limited red meat; up to 4 eggs per week; moderate amounts of dairy products; olive oil as the primary source of fat; the use of herbs and spices in place of salt; moderate red wine intake with meals; fresh fruit as dessert; and minimal intake of processed foods.[19]

Sodium. General attention to reduced sodium content in food selection is important as well (Box 19-3). If the patient has hypertension, sodium restriction to

CLINICAL APPLICATIONS

CASE STUDY: THE PATIENT WITH A MYOCARDIAL INFARCTION

Charles Carter is a young businessman who works long hours and who carries the major responsibilities of his struggling small business. At his last physical checkup, the physician cautioned him about his pace, because he was already showing mild hypertension. His blood cholesterol was elevated, and he was overweight, with a body mass index of 28.5. At his desk job, he gets little exercise, and he finds himself smoking more and eating irregularly as a result of the stress of his increasing financial pressures.

One day while commuting in heavy freeway traffic, Charles felt a pain in his chest, and he became increasingly apprehensive. When he arrived home, the pain increased. He broke out into a cold sweat, and he felt nauseated. When he became more ill after trying to eat dinner, his wife called their physician, and Charles was admitted to the hospital.

After emergency care and tests, the physician placed Charles in the coronary care unit at the hospital. His test results showed elevated total cholesterol, low-density lipoprotein cholesterol, and triglyceride levels and a low high-density lipoprotein cholesterol level. The electrocardiogram revealed an infarction of the posterior myocardium wall.

When Charles was first able to take oral nourishment, he could only consume a liquid diet. As his condition stabilized, his diet was increased to 1200 kcal (soft diet) with low cholesterol and low fat. By the end of the first week, his diet was increased to 1600 kcal (full diet), with low cholesterol,

only 25% of the total kilocalories from fat, and a polyunsaturated fat to saturated fat ratio of 1:1.

Charles gradually improved over the next few days and was able to go home. The physician, the nurse, and the dietitian discussed with Charles and his wife the need for care at home during a period of convalescence. They explained that Charles had an underlying lipid disorder and that he needed to continue his weight loss and follow the TLC diet.

Questions for Analysis

1. Identify factors in this patient's personal and medical history that place him at high risk for coronary heart disease. Give reasons why each factor contributes to heart disease.
2. Why did Charles receive only a liquid diet at first? What is the reason for each modification in his first diet of solid food?
3. What occurs during the underlying disease process that causes a heart attack? What relationship do fat and cholesterol have to this underlying process?
4. What needs might Charles have when he goes home? How would you help him to prepare to go home? Name some community resources that you might use to help him understand his illness and plan self-care.

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approximately 2400 mg/day may be indicated to control edema.[15] This restriction can be achieved by using little or no salt in cooking, adding no salt when eating, and avoiding salty processed foods. Appendix C provides a salt-free seasoning guide. Nutrition Facts labels provide specific information about the sodium content per serving of any food (see Chapter 13).

Heart Failure

Congestive heart failure is a form of chronic heart disease. The progressively weakened heart muscle is unable to maintain an adequate cardiac output to sustain normal blood circulation. The resulting fluid imbalances make basic functions of living (e.g., breathing, eating, walking, sleeping) difficult to perform. The most common causes of heart failure are coronary heart disease, MI, and chronic hypertension.

Control of Pulmonary Edema

The basic objective of diet therapy for a patient with congestive heart failure is to control the fluid imbalance that results in pulmonary edema. The primary causes of fluid

accumulation are altered fluid shift mechanisms and inappropriate hormonal responses.

Fluid Shift Mechanism. With decreased heart function, blood accumulates in the vascular system. This buildup offsets the delicate balance of filtration pressures and causes fluid to collect within intracellular spaces instead of flowing among fluid compartments.

Hormonal Alterations. Kidney nephrons sense decreased renal blood flow, which is normally an indication of dehydration, and they respond by triggering the vasopressin and renin-angiotensin-aldosterone systems to increase blood pressure (see Chapter 9). Unlike

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congestive heart failure a chronic condition of gradually weakening heart muscle; the muscle is unable to pump normal blood through the heart–lung circulation, which results in the congestion of fluids in the lungs.

pulmonary edema an accumulation of fluid in the lung tissues.

dehydration, reduced blood flow is caused by the inadequate pumping of the heart rather than by low blood volume. Vasopressin from the pituitary gland, which is also known as *antidiuretic hormone,* stimulates the resorption of water in the kidneys. In addition, aldosterone, which is secreted by the adrenal glands, causes the resorption of sodium (and thus water) in the kidneys. Consequently, fluid retention is increased, and edema is exacerbated.

Principles of Medical Nutrition Therapy

Medical nutrition therapy focuses on achieving nutritional adequacy of the diet while limiting sodium and fluid intake to control edema.[15]

The main source of dietary sodium is common table salt or sodium chloride. The taste for salt is acquired. Some people heavily salt their food out of habit without tasting it first, thereby habituating their taste to high salt levels. Others acquire a taste for less salt by gradually using smaller and smaller amounts. The Adequate Intake for sodium is 1500 mg per day for adults up to the age of 50 years, and then it declines slightly.[20] Daily adult intakes

of sodium range widely in the typical American diet; men consume an average of 4043 mg/day, and women consume an average of 2884 mg/day.[21] Other than the salt that is used in cooking or added at the table, a large amount is used as a preservative in processed food. Remaining sources of sodium include that found as a naturally occurring mineral in certain foods.

Nutrition therapy focuses the following[15]:

- *Sodium restriction (2 g per day):* No salt is served with meals. Fresh foods are encouraged and should include sodium-free flavorings such as herbs. Salty processed foods are avoided (e.g., pickles, olives, bacon, ham, corn chips, potato chips). Some processed foods with low sodium are available in food markets.
- *Fluid restriction:* Fluid is limited to 2 L per day for patients with mild symptoms of heart failure. For advanced stages of heart failure, fluid is restricted to 1000 to 1500 mL per day as indicated.
- *Texture and timing:* Patients may tolerate soft foods better if eating is laborious or uncomfortable. Frequent small meals (e.g., five to six per day) are better suited than large meals to prevent fatigue from eating.
- *Nutritional adequacy:* Care should be taken to ensure that diet restrictions do not result in nutrient inadequacies in the diet.
- *Alcohol:* Alcohol intake is limited or avoided if it contributes to heart disease.

ESSENTIAL HYPERTENSION

The Problem of Hypertension

Incidence and Nature

Hypertension or high blood pressure is one of the most common vascular diseases worldwide. The Centers for Disease Control and Prevention reports that 31% of American adults who are older than 20 years old have hypertension, with an additional 18% of the population at risk with elevated blood pressure. The incidence is highest among African-American women, with a 44.4% prevalence rate.[1] When speaking of the chronic condition of elevated blood pressure, the term *hypertension* is more appropriate than *high blood pressure,* because blood pressure may occasionally be elevated during situations that involve overexertion or stress. With **essential (or primary) hypertension**, the specific cause is unknown, although injury to the inner lining of the blood vessel wall appears to be an underlying link. More than 90% of cases are considered to be essential hypertension. **Secondary**

TABLE 19-4 CLASSIFICATION OF BLOOD PRESSURE FOR ADULTS

Blood Pressure Classification	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)	Lifestyle Modification	INITIAL DRUG THERAPY	
				Without Compelling Indication	With Compelling Indication
Normal	< 120	and < 80	Encourage		
Prehypertension	120 to 139	or 80 to 89	Yes	No antihypertensive drug indicated	Drugs for compelling indications*
Stage 1 hypertension	140 to 159	or 90 to 99	Yes	Thiazide-type diuretics for most; may consider ACEI, ARB, BB, CCB, or combination	Drugs for compelling indications,* other antihypertensive drugs as needed (diuretics, ACEI, ARB, BB, or CCB)
Stage 2 hypertension	≥ 160	or ≥ 100	Yes	Two-drug combination for most† (usually thiazide-type diuretic and ACEI, ARB, BB, or CCB)	Drugs for compelling indications and other antihypertensive drugs as needed (diuretics, ACEI, ARB, BB, or CCB)

Information for adults 18 years old and older. Treatment is determined by the highest blood pressure category.
ACEI, Angiotensin-converting enzyme inhibitor; *ARB,* angiotensin receptor blocker; *BB,* β-blocker; *CCB,* calcium channel blocker.
*Patients with chronic kidney disease or diabetes should be treated with a blood pressure goal of < 130/80 mm Hg.
†Initial combined therapy should be used cautiously for individuals who are at risk for orthostatic hypotension.
Modified from the National Institutes of Health; National Heart, Lung, and Blood Institute. *Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) express, NIH publication No.03-5233.* Bethesda, Md: National Institutes of Health; 2003.

hypertension is the result of a known cause; it is a symptom or side effect of another primary condition. For example, individuals with kidney disease often have secondary hypertension.

Hypertension has been called "the silent killer," because no signs indicate its presence. It can have serious effects if it is not detected, treated, and controlled. Hypertension is a highly inherited disorder; children of hypertensive parents may develop the condition at an early age, often during their adolescent years. Obesity worsens the condition by forcing the heart to work harder to circulate blood through excess tissue, thereby maintaining higher pressure. Smoking also increases blood pressure, because nicotine constricts the small blood vessels. Other risk factors include increasing age, ethnicity, physical inactivity, chronic stress, alcohol abuse, a diet that is high in saturated fat and sodium, and a low potassium intake.

Hypertensive Blood Pressure Levels

Common blood pressure measurements indicate the pressure of the blood surge in the arteries of the upper arm with each heartbeat. The power of each surge is measured in millimeters of mercury (mm Hg). Two forces are counted and represented by separate numbers. The numerator of the fraction (i.e., the top value) measures the force of the blood surge when the heart contracts, which is known as the *systolic pressure.* The denominator of the fraction (i.e., the bottom value) measures the pressure that remains in the arteries when the heart relaxes between beats; this is known as the *diastolic pressure.* Adult blood pressure is considered normal if it is less than 120/80 mm Hg. Current hypertension screening and treatment programs identify people with hypertension according to the degree of severity of these pressures (Table 19-4).[22] Specific care is then outlined, depending on the severity.

Prehypertension. The initial focus of hypertension treatment is on lifestyle modifications. Lifestyle choices

essential (or primary) hypertension an inherent form of high blood pressure with no specific identifiable cause; it is considered to be familial.

secondary hypertension an elevated blood pressure for which the cause can be identified and which is a symptom or side effect of another primary condition.

TABLE 19-5 **LIFESTYLE MODIFICATIONS TO PREVENT AND MANAGE HYPERTENSION**

Modification	Recommendation	Approximate Systolic Blood Pressure Reduction (Range)*
Weight reduction	Maintain a healthy body weight (i.e., body mass index of 18.5 to 24.9 kg/m^2)	5 to 20 mm Hg/10 kg
Adopt the DASH eating plan#	Consume a diet that is rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat	8 to 14 mm Hg
Dietary sodium reduction	Reduce dietary sodium intake to no more than 2.4 g of sodium or 6 g of salt per day	2 to 8 mm Hg
Physical activity	Engage in regular aerobic physical activity such as brisk walking at least 30 minutes per day most days of the week	4 to 9 mm Hg
Moderation of alcohol consumption	Limit alcohol consumption to no more than two drinks per day (e.g., 24 oz of beer, 10 oz of wine, 3 oz of 80-proof whiskey) for most men and to no more than one drink per day for women and lighter-weight men	2 to 4 mm Hg

For overall cardiovascular risk reduction, stop smoking.
*The effects of implementing these modifications are dependent on dose and time and could be greater for some individuals.
#DASH eating plan is discussed later in this chapter.
Modified from the National Institutes of Health; National Heart, Lung, and Blood Institute National High Blood Pressure Education Program. *The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, NIH Publication No. 04-5230.* Bethesda, Md: National Institutes of Health; 2004.

that are encouraged include the following: (1) weight loss, if indicated; (2) increased fruit, vegetable, and low-fat dairy consumption; (3) reduced salt and increased potassium and calcium intake; (4) reduced total fat, saturated fat, and cholesterol intake; (5) moderation of alcohol use; (6) regular aerobic physical fitness; and (7) quitting smoking, if indicated.[22] Such lifestyle changes are able to reduce the risk of chronic disease and improve the blood pressure (Table 19-5).[23-25]

Stage 1 Hypertension. In addition to the diet therapy for prehypertension, drugs are used according to need and usually include a diuretic. The continuous use of some—although not all—diuretic drugs causes a loss of potassium along with the increased loss of water from the body. Because potassium is necessary for maintaining normal heart muscle action, depletion could become dangerous. Potassium replacement is sometimes necessary. Dietary replacement with the increased use of potassium-rich foods (e.g., fruits, especially bananas and orange juice; vegetables; legumes; nuts; whole grains) is an important part of therapy. The sodium and potassium values of various foods can be found on Evolve.

Stage 2 Hypertension. In addition to the diet for stage 1 hypertension, vigorous drug therapy is necessary for stage 2 hypertension. See the Drug-Nutrient Interaction box entitled "Grapefruit Juice and Drug Metabolism" for more information about potential interactions with the medications that are often used for hypertension.

Nutrition therapy is important for all types of hypertension, along with other nondrug therapies such as physical activity and stress reduction.

Principles of Medical Nutrition Therapy

Weight Management. In accordance with individual need, weight management requires losing excess weight and maintaining a healthy weight for one's height. A sound approach to managing weight loss is discussed in Chapter 15, and guidance for increasing physical activity is given in Chapter 16. Because excess weight is closely associated with hypertension risk factors, a wisely planned personal program of weight reduction and physical activity is a cornerstone of therapy.

Sodium Control. About half of the American population with hypertension is salt sensitive, which means that their blood pressure is significantly affected by dietary sodium intake. Substantial evidence exists to support a direct correlation with decreasing sodium intake and decreasing blood pressure, even in patients with **resistant hypertension**.[26,27] However, achieving a palatable diet with sodium restrictions set at less than

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resistant hypertension the presence of high blood pressure despite treatment with three antihypertensive medications

DRUG-NUTRIENT INTERACTION

GRAPEFRUIT JUICE AND DRUG METABOLISM

A common pathway for drug metabolism makes use of the enzyme CYP3A. This enzyme oxidizes lipid-soluble drugs, thereby making them more water soluble in preparation for urinary excretion. As more of the drug is oxidized, less is absorbed. This system is anticipated when standard dosages of drugs are determined. It is expected that only a percentage of the therapeutic agent will actually reach the circulation.

Compounds in grapefruit juice known as *furanocoumarins* inhibit CYP3A, thereby increasing the amount of the associated drug that enters the circulation. As little as 8 oz of grapefruit juice can increase the absorption of certain drugs for up to 72 hours after consumption. The increased absorption of these medications may cause adverse events and can, in some cases, be fatal.[1] Patients essentially experience drug toxicity from their prescribed dose as a result of the drastic increase in absorption of the active ingredient.

Several cardiovascular drugs make use of the CYP3A pathway for metabolism. The table below shows some of the cardiovascular agents that are influenced by grapefruit's inhibition of CYP3A and their side effects. Hospitals and inpatient facilities do not serve grapefruit juice, and patients who are taking drugs that use the CYP3A pathway for metabolism should avoid drinking it at home.

DRUG NAME	DRUG CLASS	DRUG ACTION	SIDE EFFECTS	ADDITIONAL COMMENTS
Amiodarone (Cordarone)	Antiarrhythmic	Broad-spectrum antiarrhythmic, vasodilator	Anorexia, nausea, vomiting, constipation	High levels may cause fatal pulmonary toxicity
Amlodipine (Norvasc) Nifedipine (Procardia) Nisoldipine	Calcium channel blockers	Antihypertensive	Nausea, dyspepsia, constipation, peripheral edema, muscle cramps, flushing	Alternative calcium channel blockers (e.g., Verapamil) are available that do not interact with grapefruit juice
Atorvastatin (Lipitor) Lovastatin (Mevacor) Simvastatin (Zocor)	3-hydroxy-3methylglutaryl coenzyme A inhibitors/statins	Antihyperlipidemic	Nausea, dyspepsia, abdominal pain, constipation, diarrhea, possible myopathy	Alternative medications in this class are available that do not have significant interactions with grapefruit juice (e.g., fluvastatin, pravastatin, rosuvastatin)

Kelli Boi

1. Seden K, Dickinson L, Khoo S, Back D. Grapefruit-drug interactions. *Drugs.* 2010;70(18):2373-2407.

2 g/day may be difficult for some patients with the current food supply, which is rich in processed foods. A dietary restriction of sodium of between 1500 mg/day and 2400 mg/day is advised.[15] Keep in mind that 2.4 g of sodium is equivalent to approximately 6 g of sodium chloride (i.e., table salt). See Box 19-3 for ideas on ways to limit sodium intake.

Other Nutrients. In addition to sodium control, other nutrients have been discussed in relation to hypertension. Evidence suggests that the increased intake of the minerals calcium, potassium, and magnesium is beneficial for everyone, especially those with hypertension. The *Dietary Guidelines for Americans* and the American Heart Association encourage a diet that includes a wide variety of fruits, vegetables, and low-fat dairy products to ensure the adequate intake of these nutrients. Other nutrients that appear to have a link with blood pressure are vitamin D, polyunsaturated fatty acids, protein, and fiber intake.

However, studies are controversial with regard to the efficacy of these recommendations and their results on lowering blood pressure.[28-30]

The DASH Diet. The DASH diet is the result of the successful Dietary Approaches to Stop Hypertension landmark study, which was able to lower blood pressure significantly by diet alone within a 2-week period.[31] The diet recommends eating four to six servings of fruits, four to six servings of vegetables, and two to three servings of low-fat dairy foods per day in addition to lean meats and high-fiber grains. Studies have found that individuals who follow the diet have an average decrease in systolic blood pressure of 6 to 11 mm Hg.[31] When combining the DASH diet with a low-sodium diet, the blood-pressure-lowering effects are even greater.[32] Combining the DASH diet with exercise and weight loss also produces a significant reduction in total and LDL cholesterol, a reduced risk for coronary heart disease and heart failure, and improvements

in insulin sensitivity.[33-36] Giving patients dietary supplements of potassium, magnesium, and fiber to match the amount provided by the DASH diet does not produce the same blood–pressure-lowering as actually following the diet and getting those nutrients through food.[37]

The DASH diet is recommended for individuals with high blood pressure, blood pressure in the prehypertension range, and a family history of high blood pressure; it is also recommended for those who are trying to eliminate the use of blood–pressure-lowering medications. The first step in following the DASH diet is to determine the appropriate energy level (in kilocalories) on the basis of the desired weight and activity level (see Chapter 6). The appropriate number of servings per day of each food group should then be based on the total energy need. Table 19-6 outlines the DASH diet and its associated serving sizes; Box 19-4 provides a 1-day sample menu that is based on a 2000-calorie diet.

Additional Lifestyle Factors

The National High Blood Pressure Education Program recommends limiting alcohol intake to 1 oz per day of ethanol for men and 0.5 oz per day of ethanol for most women and smaller men. One ounce of ethanol is equal to 24 oz of regular beer, 10 oz of wine, or 2 oz of 100-proof whiskey. Additional recommendations to prevent or treat hypertension include stopping smoking, replacing saturated fats with polyunsaturated fats (e.g., eicosapentaenoic acid, docosahexaenoic acid), and increasing aerobic physical activity to a minimum of 30 to 45 minutes per day on most days of the week.[22,38]

EDUCATION AND PREVENTION

Practical Food Guides

Food Planning and Purchasing

The *Dietary Guidelines for Americans, 2010* (see Chapter 1), provides a basic outline to guide sound food habits.[39] The food exchange list, which is described in Chapter 20, demonstrates the food groups and includes the fat and sodium modifications discussed in this chapter. These lists also provide a guide for controlling energy intake to help with weight-management planning.

An important part of purchasing food is carefully reading labels. The Nutrition Facts labels provide basic nutrition information in a standard format that is easily *recognized* and clearly expressed (see Chapter 13). All food products that make health claims must follow the strict guidelines provided by the U.S. Food and Drug Administration. A good general guide is to primarily use fresh, whole foods, with an informed selection of

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BOX 19-4 SAMPLE 1-DAY MENU ON THE DASH DIET, 2000 CALORIES

Breakfast
- ¾ cup bran flakes cereal
- 1 medium banana
- 1 cup low-fat milk
- 1 slice whole-wheat bread
- 1 tsp unsalted soft (tub) margarine
- 1 cup orange juice

Lunch
- ¾ cup chicken salad
- 2 slices whole-wheat bread
- 1 Tbsp Dijon mustard
- Salad with the following:
  - ½ cup fresh cucumber slices
  - ½ cup tomato wedges
  - 1 Tbsp sunflower seeds
  - 1 tsp Italian dressing, low calorie
- ½ cup fruit cocktail, juice packed

Dinner
- 3 oz beef, eye of round
- 2 Tbsp beef gravy, fat free
- 1 cup green beans, sautéed with ½ tsp canola oil
- 1 small baked potato with the following:
  - 1 Tbsp sour cream, fat free
  - 1 Tbsp grated natural cheddar cheese, reduced fat
  - 1 Tbsp chopped scallions
- 1 small whole-wheat roll
- 1 tsp unsalted soft (tub) margarine
- 1 small apple
- 1 cup low-fat milk

Snacks
- ⅓ cup almonds, unsalted
- ¼ cup raisins
- ½ cup fruit yogurt, fat free, no sugar added

Modified from the National Institutes of Health; National Heart, Lung, and Blood Institute. *Your guide to lowering your blood pressure with DASH, NIH Publication No. 06-4082*, Washington, DC: U.S. Department of Health and Human Services; 2006.

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processed foods used as necessary. Refer to Chapter 13 for background material regarding food supply and health.

Food Preparation

The public is more aware than ever before of the need to prepare foods with less fat and salt. Consequently, the cookbook industry has responded by providing an abundance of guides and recipes for various age groups and customs. Many seasonings (e.g., herbs, spices, lemon, wine, onion, garlic, nonfat milk and yogurt, fat-free/low-sodium broth) can help to train taste preferences for less

TABLE 19-6 THE DASH EATING PLAN

CALORIES PER DAY	SERVINGS PER DAY (UNLESS OTHERWISE SPECIFIED)							
	Grains*	Vegetables	Fruits	Fat-free or Low-Fat Milk and Milk Products	Lean Meats, Poultry, and Fish	Nuts, Seeds, and Legumes	Fats and Oils†	Sweets and added Sugars
1600	6	3 to 4	4	2 to 3	3 to 6	3 per week	2	0
2000	6 to 8	4 to 5	4 to 5	2 to 3	6	4 to 5 per week	2 to 3	≤ 5 per week
2600	10 to 11	5 to 6	5 to 6	3	6	1	3	≤ 2
3100	12 to 13	6	6	3 to 4	6 to 9	1	4	≤ 2
Serving sizes	1 slice bread; 1 oz dry cereal‡; ½ cup cooked rice, pasta, or cereal	1 cup raw leafy vegetables, ½ cup cut-up raw or cooked vegetables, ½ cup vegetable juice	1 medium fruit; ¼ cup dried fruit; ½ cup fresh, frozen, or canned fruit; ½ cup fruit juice	1 cup milk or yogurt, 1½ oz cheese	1 oz cooked meat, poultry, or fish; 1 egg§	⅓ cup or 1½ oz nuts, 2 Tbsp peanut butter, 2 Tbsp or ½ oz seeds, ½ cup cooked legumes (dry beans and peas)	1 tsp soft margarine, 1 tsp vegetable oil, 1 Tbsp mayonnaise, 2 Tbsp salad dressing	1 Tbsp sugar, 1 Tbsp jelly or jam, ½ cup sorbet, gelatin; 1 cup lemonade

*Whole grains are recommended for most grain servings as a good source of fiber and nutrients.

†Fat content changes the serving amount for fats and oils. For example, 1 Tbsp of regular salad dressing equals one serving, whereas 1 Tbsp of a low-fat dressing equals a half serving and 1 Tbsp of a fat-free dressing equals zero servings.

‡Serving sizes vary between ½ cup and 1¼ cups, depending on the cereal type. Check the product's Nutrition Facts label.

§Because eggs are high in cholesterol, limit egg yolk intake to no more than four per week; two egg whites have the same protein content as 1 oz of meat.

Modified from the National Institutes of Health; National Heart, Lung, and Blood Institute. *Your guide to lowering your blood pressure with DASH, NIH Publication No. 06-4082.* Washington, DC: U.S. Department of Health and Human Services; 2006.

CULTURAL CONSIDERATIONS

INFLUENCE OF ETHNICITY AND SOCIODEMOGRAPHICS ON A PERSON'S RISK FOR HEART DISEASE

Although the mortality rate from heart disease has declined since the 1960s, it is still the leading cause of death in the United States. The major conditions of heart disease, hypertension and high blood cholesterol, are more prevalent among certain ethnic and sociodemographic groups than others within the United States. Unlike weight and dietary habits, certain aspects constitute nonmodifiable risk factors for cardiovascular disease (e.g., ethnicity, gender), as shown in the graph.

Distinguishing between environmental factors and the genetics associated with a culture is important to help identify the specifics regarding the cause of disease. Only when those factors have been recognized can prevention and treatment programs be directed on an individual basis. A complex combination of such risk factors contributes to an individual's risk for death from cardiovascular disease. By acknowledging the risks associated with certain sociodemographic factors, warning signs may be detected earlier than they would be otherwise.

Death Rates for Diseases of the Heart by Race/Ethnicity and Sex
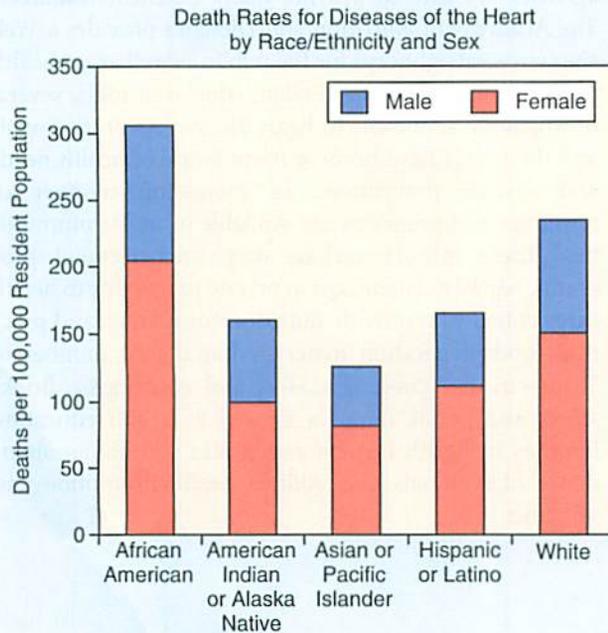
From the National Center for Health Statistics. *Health, United States, 2010: with special feature on death and dying.* Hyattsville, Md: U.S. Government Printing Office; 2011.

RISK FACTOR[1]	PREVALENCE OF MULTIPLE RISK FACTORS FOR HEART DISEASE AND STROKE BY SELECTED CHARACTERISTIC* (%)
Education	
Did not complete high school	52.5
High school graduate or equivalent	43.8
Some college	36.9
College graduate	25.9
Annual Household Income	
< $10,000	52.5
$10,000 to $19,999	49.3
$20,000 to $34,999	42.8
$35,000 to $49,999	37.0
≥ $50,000	28.8
Employment Status	
Unable to work	69.3
Retired	45.1
Unemployed	43.4
Homemaker	34.3
Employed	34.0
Student	31.0

*Two or more of the following: high blood pressure, high cholesterol, diabetes, obesity, current smoking, or physical inactivity.

For further reading: Moe GW, Tu J. Heart failure in the ethnic minorities. *Curr Opin Cardiol.* 2010;25(2):124-130.

1. Centers for Disease Control and Prevention. Racial/ethnic and socioeconomic disparities in multiple risk factors for heart disease and stroke–United States, 2003. *MMWR Morb Mortal Wkly Rep.* 2005;54(5):113-117.

salt and fat. Less meat in leaner and smaller portions can be combined with more complex carbohydrate foods (e.g., starches such as potatoes, pastas, rice, bulgur, and beans) to make more healthful main dishes. Whole-grain breads and cereals provide needed fiber, and an increased use of fish can add healthier forms of fat in smaller quantities. A variety of vegetables may be used (e.g., in salads or steamed and lightly seasoned), and fruits add interest, taste appeal, and nourishment to meals. The American Heart Association publishes several cookbooks that are excellent guides to newer, lighter, more tasteful, and healthier food preparation (www.americanheart.org).

Special Needs

The individual adaptation of diet principles is important in all nutrition teaching and counseling. Special attention must be given to personal desires, ethnic diets, individual situations, and food habits (see Chapter 14). Successful diet planning must meet both personal and health needs.

Education Principles

Starting Early

The prevention of hypertension and heart disease begins during childhood, especially with children from high-risk families. Preventive measures in family food habits relate to healthy weight maintenance and the limited use of foods that are high in salt, saturated fats, and trans fats. For adults with heart disease and hypertension, learning should be an integral part of all therapy. If a heart attack occurs, education should begin early during convalescence (rather than at hospital discharge) to give patients and their families clear and practical knowledge regarding positive diet and lifestyle needs.

Focusing on High-Risk Groups

Education about heart disease and hypertension should be particularly directed toward individuals and families with one or more high-risk factors (see Box 19-1). For example, hypertension has been closely associated with certain high-risk groups, including African Americans and Native Americans, people with a strong family history of the disease, and obese individuals (see the Cultural Considerations box, "Influence of Ethnicity and Sociodemographics on a Person's Risk for Heart Disease").

Using a Variety of Resources

As researchers learn more about heart disease and hypertension, the American Heart Association and other health agencies are able to provide many excellent resources. The Academy of Nutrition and Dietetics provides a Web site (www.eatright.org) for the public as well as for health professionals with helpful client education tools, several of which are applicable to heart disease. As professionals and the public have become more aware of health needs and disease prevention, an increasing number of resources and programs are available in most communities. These include various weight-management programs, registered dietitians in private practice or in health care centers who provide nutrition counseling, and practical food-preparation materials found in a number of "light cuisine" cooking classes and cookbooks. Bookstores and public libraries as well as health education libraries in health centers and clinics provide an abundance of materials that address health promotion and self-care.

SUMMARY

- Coronary heart disease is the leading cause of death in the United States. Atherosclerosis is the underlying blood vessel disease. If fatty buildup on the interior surfaces of the blood vessels becomes severe, it cuts off the supply of oxygen and nutrients to the cells, which in turn die. When this occurs in a major coronary artery, the result is an MI.
- The risk for atherosclerosis increases with the amount and type of blood lipids (fats) or lipoproteins in circulation. An elevated serum cholesterol level is a primary risk factor for the development of atherosclerosis.

- Current recommendations to help prevent coronary heart disease involve a low-fat and balanced diet, weight management, and increased physical activity.
- Dietary recommendations for acute CVD include measures to ensure cardiac rest. People with chronic heart disease that involves congestive heart failure benefit from a low-sodium diet to control pulmonary edema.
- People with hypertension may improve their condition with weight control, exercise, sodium restriction, and a diet that is rich in fruits, vegetables, whole grains, lean meats, and low-fat dairy products.

CRITICAL THINKING QUESTIONS

1. Why are fat and cholesterol the primary factors in heart disease? How are they carried in the bloodstream? Which of these lipoproteins carry so-called "good cholesterol," and which carry "bad cholesterol" (i.e., the cholesterol of concern)?

2. How can people influence the relative amounts of fat and cholesterol in the blood? Describe the food changes that are involved.

3. Identify the risk factors for heart disease. What control do people have over these risk factors?

4. Identify four dietary recommendations for a patient who has had a heart attack. Describe how each recommendation facilitates recovery.

5. Discuss the three levels of hypertension and the treatment options for each.

6. What does the term *essential hypertension* mean? Why would weight control and sodium restriction contribute to its control? What other nutrient factors may be involved in hypertension?

CHAPTER CHALLENGE QUESTIONS

True-False

Write the correct statement for each statement that is false.

1. *True or False:* In the disease process that underlies heart disease (i.e., atherosclerosis), the fatty deposits in blood vessel linings are made up mainly of cholesterol.

2. *True or False:* Hypertension occurs more frequently among Caucasians than among African Americans.

3. *True or False:* The problem of CVD could be solved if cholesterol could be removed entirely from the body.

4. *True or False:* Cholesterol is a dietary essential for adults, because people depend entirely on food sources for their supply.

5. *True or False:* Lipoproteins are the major transport form of lipids in the blood.

6. *True or False:* One of the initial clinical objectives when treating an acute heart attack is cardiac rest.

7. *True or False:* In a patient with chronic congestive heart disease, the heart eventually may fail, because its weakened muscle must work at a faster rate to pump the body's necessary blood supply.

8. *True or False:* The taste for salt is instinctive to ensure a sufficient supply.

9. *True or False:* Reduced sodium intake is an effective therapy for congestive heart failure and hypertension.

Multiple Choice

1. A low-cholesterol diet restricts which of the following foods? *(Circle all that apply.)*
   a. Fish
   b. Liver
   c. Butter
   d. Nonfat milk

2. Helpful seasonings to use as part of a sodium-restricted diet include which of the following? *(Circle all that apply.)*
   a. Lemon juice
   b. Soy sauce
   c. Herbs and spices
   d. Seasoned salt

3. Prehypertension is defined as a blood pressure of _____ (systolic)/_____ (diastolic) mm Hg.
   a. < 120; < 80
   b. 120 to 139; 80 to 89
   c. 140 to 159; 90 to 99
   d. > 160; > 100

4. Which of the following foods may be eaten *freely* as part of a low-sodium diet?
   a. Fruits
   b. Milk
   c. Cured meats
   d. Canned vegetables

⊝volve **Please refer to the Students' Resource section of this text's Evolve Web site for additional study resources.**

REFERENCES

1. National Center for Health Statistics. *Health, United States, 2010: with special feature on death and dying.* Hyattsville, Md: U.S. Government Printing Office; 2011.

2. Katcher HI, Hill AM, Lanford JL, et al. Lifestyle approaches and dietary strategies to lower LDL-cholesterol and triglycerides and raise HDL-cholesterol. *Endocrinol Metab Clin North Am.* 2009;38(1):45-78.

3. Marin C, Ramirez R, Delgado-Lista J, et al. Mediterranean diet reduces endothelial damage and improves the regenerative capacity of endothelium. *Am J Clin Nutr.* 2011; 93(2):267-274.

4. Jenkins DJ, Chiavaroli L, Wong JM, et al. Adding monoun-saturated fatty acids to a dietary portfolio of cholesterol-

lowering foods in hypercholesterolemia. *CMAJ.* 2010; 182(18):1961-1967.

5. Skulas-Ray AC, Kris-Etherton PM, Harris WS, et al. Dose-response effects of omega-3 fatty acids on triglycerides, inflammation, and endothelial function in healthy persons with moderate hypertriglyceridemia. *Am J Clin Nutr.* 2011; 93(2):243-252.

6. Canoy D. Distribution of body fat and risk of coronary heart disease in men and women. *Curr Opin Cardiol.* 2008;23(6): 591-598.

7. Taylor AE, Ebrahim S, Ben-Shlomo Y, et al. Comparison of the associations of body mass index and measures of central adiposity and fat mass with coronary heart disease, diabetes, and all-cause mortality: a study using data from 4 UK cohorts. *Am J Clin Nutr.* 2010;91(3):547-556.

8. dos Santos RE, Aldrighi JM, Lanz JR, et al. Relationship of body fat distribution by waist circumference, dual-energy x-ray absorptiometry and ultrasonography to insulin resistance by homeostasis model assessment and lipid profile in obese and non-obese postmenopausal women. *Gynecol Endocrinol.* 2005;21(5):295-301.

9. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation.* 2002; 106(25):3143-3421.

10. Stone NJ, Bilek S, Rosenbaum S. Recent National Cholesterol Education Program Adult Treatment Panel III update: adjustments and options. *Am J Cardiol.* 2005;96(4A): 53E-59E.

11. ESHRE Capri Workshop Group. Hormones and cardiovascular health in women. *Hum Reprod Update.* 2006; 12(5):483-497.

12. Polotsky HN, Polotsky AJ. Metabolic implications of menopause. *Semin Reprod Med.* 2010;28(5):426-434.

13. Lavie CJ, Milani RV, Ventura HO. Obesity and cardiovascular disease: risk factor, paradox, and impact of weight loss. *J Am Coll Cardiol.* 2009;53(21):1925-1932.

14. Singh S, Somers VK, Clark MM, et al. Physician diagnosis of overweight status predicts attempted and successful weight loss in patients with cardiovascular disease and central obesity. *Am Heart J.* 2010;160(5):934-942.

15. American Dietetic Association. *ADA nutrition care manual.* Chicago: American Dietetic Association; 2010.

16. Panagiotakos DB, Dimakopoulou K, Katsouyanni K, et al; AIRGENE Study Group. Mediterranean diet and inflammatory response in myocardial infarction survivors. *Int J Epidemiol.* 2009;38(3):856-866.

17. Pérez-López FR, Chedraui P, Haya J, Cuadros JL. Effects of the Mediterranean diet on longevity and age-related morbid conditions. *Maturitas.* 2009;64(2):67-79.

18. Buckland G, González CA, Agudo A, et al. Adherence to the Mediterranean diet and risk of coronary heart disease in the Spanish EPIC Cohort Study. *Am J Epidemiol.* 2009; 170(12):1518-1529.

19. Walker C, Reamy BV. Diets for cardiovascular disease prevention: what is the evidence? *Am Fam Physician.* 2009; 79(7):571-578.

20. Food and Nutrition Board, Institute of Medicine. *Dietary reference intakes for water, potassium, sodium, chloride, and sulfate.* Washington, DC: National Academies Press; 2004.

21. U.S. Department of Agriculture, Agricultural Research Service. *Nutrient intakes from food: mean amounts consumed per individual, by gender and age. What we eat in America NHANES 2007-2008* (website): www.ars.usda.gov/ SP2UserFiles/Place/12355000/pdf/0708/Table_1_NIN_ GEN_07.pdf. Accessed October 2010.

22. National Institutes of Health; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program. *The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.* Bethesda, Md: National Institutes of Health; 2004.

23. Dagogo-Jack S, Egbuonu N, Edeoga C. Principles and practice of nonpharmacological interventions to reduce cardiometabolic risk. *Med Princ Pract.* 2010;19(3):167-175.

24. Elmer PJ, Obarzanek E, Vollmer WM, et al; PREMIER Collaborative Research Group. Effects of comprehensive lifestyle modification on diet, weight, physical fitness, and blood pressure control: 18-month results of a randomized trial. *Ann Intern Med.* 2006;144(7):485-495.

25. Appel LJ, Champagne CM, Harsha DW, et al; Writing Group of the PREMIER Collaborative Research Group. Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. *JAMA.* 2003;289(16):2083-2093.

26. Pimenta E, Gaddam KK, Oparil S, et al. Effects of dietary sodium reduction on blood pressure in subjects with resistant hypertension: results from a randomized trial. *Hypertension.* 2009;54(3):475-481.

27. Kanbay M, Chen Y, Solak Y, Sanders PW. Mechanisms and consequences of salt sensitivity and dietary salt intake. *Curr Opin Nephrol Hypertens.* 2011;20(1):37-43.

28. Savica V, Bellinghieri G, Kopple JD. The effect of nutrition on blood pressure. *Annu Rev Nutr.* 2010;30:365-401.

29. Berry SE, Mulla UZ, Chowienczyk PJ, Sanders TA. Increased potassium intake from fruit and vegetables or supplements does not lower blood pressure or improve vascular function in UK men and women with early hypertension: a randomised controlled trial. *Br J Nutr.* 2010;104(12): 1839-1847.

30. He FJ, Marciniak M, Carney C, et al. Effects of potassium chloride and potassium bicarbonate on endothelial function, cardiovascular risk factors, and bone turnover in mild hypertensives. *Hypertension.* 2010;55(3):681-688.

31. Appel LJ, Moore TJ, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *N Engl J Med.* 1997;336(16): 1117-1124.

32. Sacks FM, Svetky LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med.* 2001;344(1):3-10.

33. Harsha DW, Sacks FM, Obarzanek E, et al. Effect of dietary sodium intake on blood lipids: results from the DASH-sodium trial. *Hypertension.* 2004;43(2):393-398.

34. Chen ST, Maruthur NM, Appel LJ. The effect of dietary patterns on estimated coronary heart disease risk: results