Diet in cardiovascular diseases

Introduction

What is cardiovascular disease (CVD)?

Cardiovascular disease (CVD) is a general term that describes a disease of the heart or blood vessels.

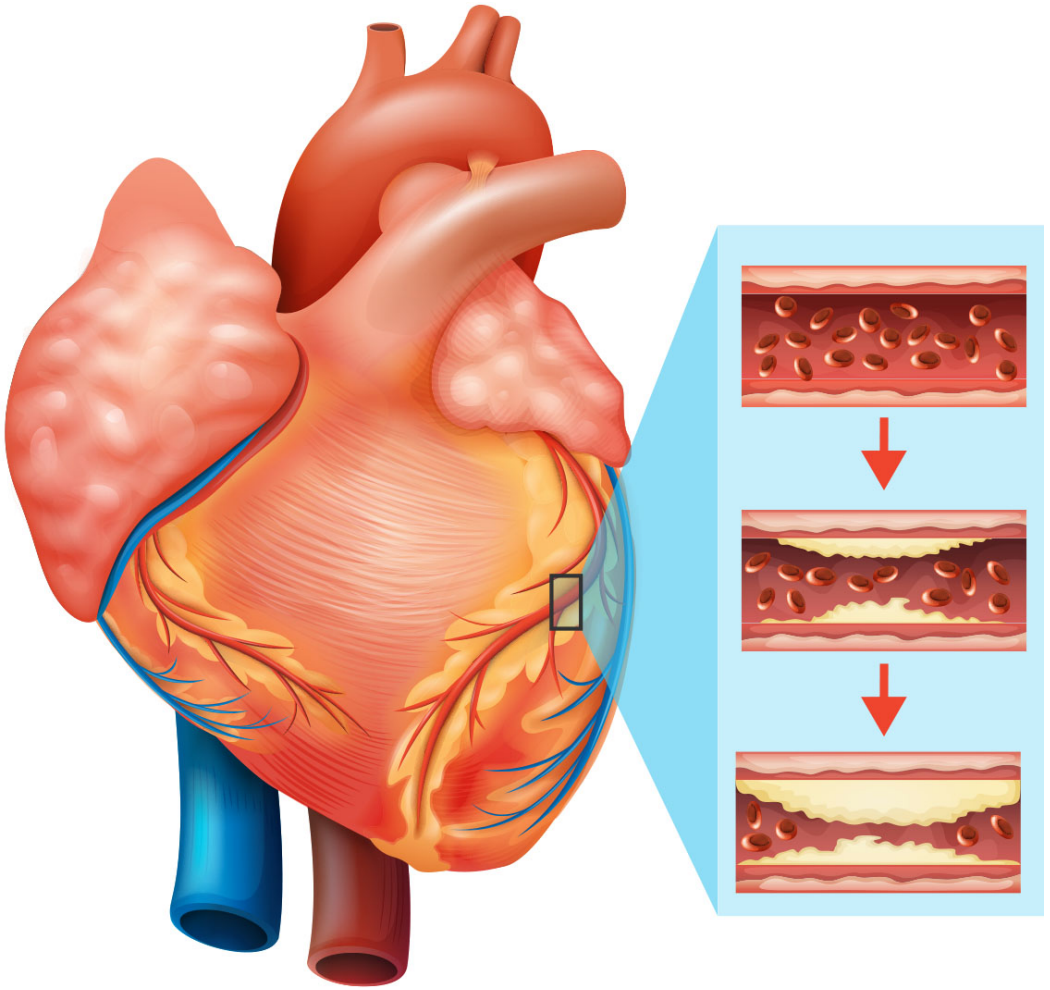
Blood flow to the heart, brain or body can be reduced as the result of a blood clot (thrombosis), or by a build-up of fatty deposits inside an artery that cause the artery to harden and narrow (atherosclerosis).

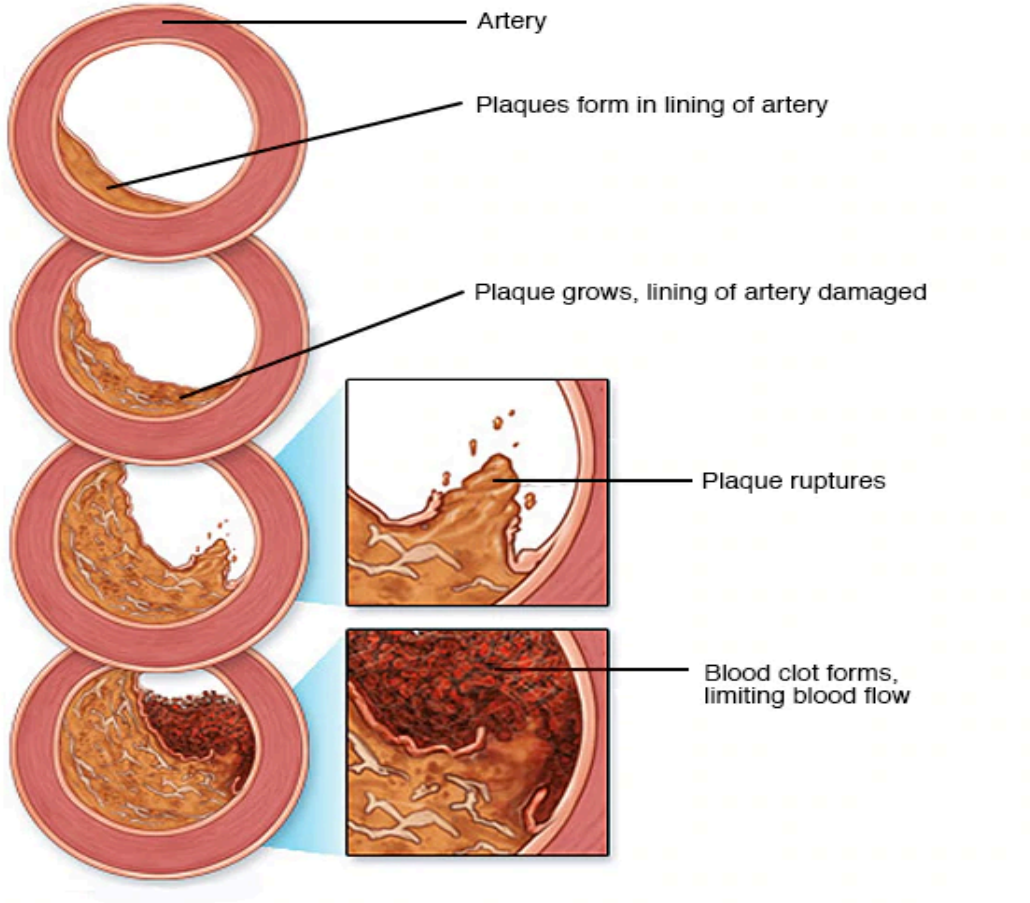
There are four main types of CVD. They are:

- coronary heart disease
- stroke
- peripheral arterial disease
- aortic disease

CORONARY HEART DISEASE

- Coronary heart disease (CHD) is the most common cause of death for both men and women in Western countries and is increasingly prevalent in developing countries. The coronary arteries are the two major blood vessels that supply our heart with blood. Over time, the walls of your arteries can become filled up with fatty deposits. This process is known as atherosclerosis and the degeneration of the walls of the arteries caused by accumulated fatty deposits and scar tissue are called atheroma. As they narrow because of a build-up of atheroma, the blood supply to your heart will be restricted. This can cause angina (chest pain). If a coronary artery becomes completely blocked, it can cause a heart attack.





Pathophysiology of atherosclerosis: response to injury hypothesis

- Different risk factors (hyperlipidemia, LDL oxidation, hypertension, etc.) induce endothelial injury
- This leads to compensatory responses that alter the normal homeostatic functions of the endothelium
- It occurs particularly at certain areas of the coronary tree such as the branching points, where blood turbulence is high.
- In particular, a variety of forms of injury increase the permeability of the endothelium to lipids and proteins, and increase the adhesion to monocytes and platelets
- This in turn induces the endothelium to have pro-coagulant instead of anticoagulant properties and to form vasoactive molecules, such as cytokines and growth factors, which promote the migration and internalisation of monocytes and proliferation of vascular smooth-muscle cells.

Pathophysiology of atherosclerosis: response to injury hypothesis

- These, together with increased lipid accumulation and increased connective tissue synthesis, lead to the formation of atheromas.
- If the atherogenic process continues, there will be cycles of accumulation and activation of mononuclear cells, migration and proliferation of smooth-muscle cells with cell necrosis and formation of fibrous tissue, which eventually lead to the formation of advanced lesions, the fibrous atheromas
- Fibroatheromas grow slowly and can induce arterial stenosis, but often represent an unstable lesion that can be complicated by intraplaque haemorrhage and rupture
- plaque rupture is followed by blood entry into the plaque core from the lumen, with activation of platelets and the coagulation cascade. This leads to the formation of a thrombus, which can cause acute ischaemia.
- When the arterial lumen is significantly narrowed following the progressive increase in arterial stenosis or, more frequently, the formation of thrombus, atherosclerosis becomes clinically manifest: depending on the arteries involved in this process, the individual will suffer from myocardial or cerebral infarction, peripheral vascular disease or mesenteric ischaemia.

RISK FACTORS OF ATHEROSCLEROSIS

Atherosclerosis can be caused by lifestyle factors and other conditions, such as:

- **Smoking:** Smoking promotes cardiovascular disease through a number of mechanisms. It damages the endothelium (the lining of the blood vessels), increases fatty deposits in the arteries, increases clotting, raises low-density lipoprotein cholesterol and reduces high-density lipoprotein
- **Family History:** There is certainly a genetic component to the development of AS. This genetic component may be related to endothelial function or cholesterol metabolism.
- **Obesity:** Only in the last decade has obesity been listed as a separate and independent risk factor for CVD. Hypothyroidism leading to obesity has also been identified as a factor leading to increased risk of coronary AS. This relationship is due at least in part to the altered lipid metabolism in this population.

RISK FACTORS OF ATHEROSCLEROSIS

- **Dyslipidemia:** Dyslipidemia refers to a lipid profile that increases the risk of atherosclerotic development. Typically, dyslipidemia is a condition in which LDL levels are elevated and high-density lipoprotein (HDL) levels are low. HDL particles are involved in reverse cholesterol transport, in that they transport cholesterol from tissues and other lipoproteins to the liver. LDL are most heavily involved in the atherosclerotic process. Oxidation of the LDL causes this lipoprotein to be altered and can initiate damage, starting the atherosclerotic process. Additionally, oxidized LDL is more likely to be taken up into the atherosclerotic plaque (see the Pathophysiology section). Thus, the higher the serum LDL levels, the greater the risk of the initiation of an atherosclerotic plaque and the greater the risk of continual development of an existing atherosclerotic plaque.

RISK FACTORS OF ATHEROSCLEROSIS

- **Diabetes:** Uncontrolled diabetes causes damage to your body's blood vessels making them more prone to damage from atherosclerosis and hypertension. Normalization of postprandial hyperglycemia reduces cardiovascular events in these patients.
- **Impaired Fasting Glucose and Metabolic Syndrome:** An impaired fasting glucose is defined as plasma glucose between 110 and 125 mg/dL (fasting plasma glucose of >126 mg/dL is diagnostic for diabetes). The metabolic syndrome is a constellation of metabolic risk factors, including abdominal obesity, insulin resistance, dyslipidemia, hypertension, and prothrombotic state (a state in which the formation of blood clots is facilitated). The presence of metabolic syndrome predicts CHD more strongly than its individual components do
- **Stress:** Stress triggers reduced blood flow to the heart, promotes your heart to beat irregularly and increases the likelihood of your blood clotting. All of these can trigger the development of cardiovascular disease

RISK FACTORS OF ATHEROSCLEROSIS

- **Physical Inactivity:** The exact mechanism by which physical inactivity increases AS risk has not been identified. However, increasing physical activity is known to impact several factors related to AS by lowering blood pressure and triglycerides, increasing HDL, improving endothelial function, and decreasing platelet aggregation
- **Atherogenic Diet:** Research over the years has used the term "Westernized Diet" to describe a diet high in saturated fat, high in sodium, and low in fiber. When compared with populations that eat diets high in saturated fat, populations that consume diets higher in fruits, vegetables, whole grains, and unsaturated fats have lower rates of atherosclerotic disease than can be explained by other risk factors.

TREATMENT

Diet and lifestyle changes to modify risk factors (e.g, smoking, obesity, hypertension, lack of physical activity, and dyslipidemia) are the cornerstone of treatment, with medications playing an adjunctive role. Unfortunately, counseling of patients regarding the importance of diet and exercise in the prevention of heart disease remains suboptimal.

Important preventive steps include the following:

- ✧Blood pressure control. (See Hypertension.)
- ✧Reduction of plasma lipids. (See Hyperlipidemia.)
- ✧Smoking cessation.
- ✧Dietary change.

Nutritional treatment of CHD

The role of diet in coronary heart disease is evident from its pathological process, which involves the formation of arterial plaques, alterations in endothelial function (which, in turn, influence blood pressure), heightened risk for thrombosis, and inflammatory processes.

The primary goals of dietary intervention are:

- Controlling Blood Lipid Concentrations
- Reducing inflammation
- Control of major CHD risk factors

Table 13.9 Diagnosis of Metabolic Syndrome

Risk Factor	NCEP ATP III Criteria	IDF Criteria	WHO Criteria†
Abdominal Obesity*	Men: waist circumference** >102 cm (>40 in) Women: waist circumference >88 cm (>35 in)	Europoid, Sub-Saharan, Eastern Mediterranean, and Middle Eastern (Arab) men: waist circumference ≥94 cm for men Europoid, Sub-Saharan, Eastern Mediterranean, and Middle Eastern (Arab) women: waist circumference ≥80 cm South Asian, Chinese, Ethnic South and Central American men: waist circumference ≥90 cm South Asian, Chinese, Ethnic South and Central American women: waist circumference ≥80 cm Japanese men: waist circumference ≥85 cm Japanese women: waist circumference ≥90 cm	Men: waist-hip ratio >0.9 Women: waist-hip ratio >0.85
Triglycerides	<150 mg/dL (1.7 mmol/L)	>150 mg/dL (1.7 mmol/L) or treatment for this lipid abnormality	≥150 mg/dL
HDL Cholesterol	Men: <40 mg/dL (0.9 mmol/L) Women: <50 mg/dL (1.1 mmol/L)	Men: <40 mg/dL (0.9 mmol/L) Women: <50 mg/dL (1.1 mmol/L) or specific treatment for this lipid abnormality	Men: <35 mg/dL Women: <39 mg/dL
Blood Pressure	≥130/≥85 mmHg	≥130/≥85 mmHg or treatment of previously diagnosed hypertension	≥140 (systolic) or ≥90 (diastolic) mmHg or treatment of previously diagnosed hypertension
Insulin Resistance	Fasting plasma glucose ≥100 mg/dL	Fasting plasma glucose ≥100 mg/dL (5.6 mmol/L) or previously diagnosed T2DM	Impaired fasting glucose or impaired glucose tolerance or glucose uptake below the lowest quartile for background population under investigation under hyperinsulinemic, euglycemic conditions (in patients with normal fasting glucose levels <110 mg/dL) or previously diagnosed T2DM
Other	—	—	BMI >30 Urinary albumin excretion rate ≥20 mcg/min or albumin/creatinine ratio ≥30 mg/g

TABLE 16-1 Criteria for Treatment Intervention in Adults

Classification based on total cholesterol
< 200 mg/dl—desirable level
200–239 mg/dl—borderline high blood cholesterol
≥ 240 mg/dl—high blood cholesterol
Classification based on LDL cholesterol
< 130 mg/dl—desirable LDL cholesterol
130–159 mg/dl—borderline high risk
≥ 160 mg/dl—high risk

Source: Second Report of the Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, September 1993, and Report of the Expert Panel on Blood Cholesterol Levels in Children and Adolescents, September 1991.

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- **Total fat and saturated fatty acids:** Elevated LDL cholesterol is an independent risk factor for CHD. Saturated fat is the principal dietary determinant of LDL cholesterol levels. A diet consisting of 25% to 35% total fat, <7% saturated and trans fat, and <200 mg cholesterol lowers serum total cholesterol and LDL cholesterol by 9% to 16% and decreases the risk of CHD. Sources of saturated fatty acids include: butter, lard, vegetable shortening, baked and pastry products, fat in meat, poultry, whole dairy products, palm oil, palm kernel oil, and cocoa butter. Moderate reduction of total fat (25% to 30% of total energy) facilitates a decrease in saturated fatty acids and may also help in weight reduction in overweight patients

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- **Omega-3 fatty acids:** Studies have demonstrated beneficial effects of increased intake of omega-3 fatty acids (e.g. eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA] or fish oil) at daily dosages ranging from 850 mg to 2.9 g in patients with coronary artery disease. Epidemiological studies indicate that regular consumption of an average of two servings of fatty fish per week (about 3.5 oz) high in long chain omega-3 fatty acids is associated with a 30% to 40% reduced risk of death from cardiac events in subjects with prior disease. One serving of fatty fish can provide approximately 1,000 mg of EPA and DHA.
- The AHA Dietary Guidelines 2006 recommends consumption of more than two fish meals per week for the general population. Epidemiological studies indicate that inclusion of vegetable oils and food sources high in alpha-linolenic acid, resulting in a total intake of more than 1.5 g/day, is associated with a 40% to 65% reduced risk of death from cardiac events. This amount is equivalent to consuming 1⁄2 to 1 tablespoon ground flaxseed meal, 1 teaspoon flaxseed oil, or 1 tablespoon of canola or walnut oil.

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- **Omega-3 fatty acids:** The 2006 AHA recommendations advise patients with documented CHD to consume approximately 1 g/day of EPA plus DHA, preferably from oily fish. EPA plus DHA supplements could be considered in consultation with a physician. For individuals with hypertriglyceridemia (> 200 mg/dL), 2 to 4 g/day of EPA plus DHA, provided as capsules under a physician's care, are recommended as a therapeutic option.
- Sources of omega-3 fatty acids include cold-water fish (salmon, mackerel, Atlantic herring, lake trout, albacore tuna, sardines, swordfish) tofu, soybean and canola oils, flaxseed, and English walnuts.

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- **MUFA**: Oleic acid is the primary MUFA. Evidence indicates that oleic acid may cause as great a decrease in LDL cholesterol levels as does linoleic acid when substituted for saturated fatty acids in the diet. Substitution of MUFA for saturated fat lowers LDL cholesterol levels without decreasing HDL cholesterol levels .
- Evidence supports that a diet high in MUFA (up to 30% of total energy) can improve specific dyslipidemias compared with diets of equal energy value that replace fat with carbohydrate.
- A diet relatively high in unsaturated fat can prevent a decrease in HDL cholesterol levels and an increase in triglycerides levels that can occur in some individuals consuming a high-carbohydrate (more than 60% total energy), low-fat diet.
- Sources of MUFA include canola oil, olive oil, peanut oil, and avocados etc.

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- **Trans fatty acids:** Trans fatty acids are created through hydrogenation, a process in which vegetable oils are heated in the presence of metal catalysts to produce vegetable shortening and margarine. Trans fatty acids increase LDL cholesterol levels and decrease HDL cholesterol levels. Because saturated fats increase LDL cholesterol levels but do not decrease HDL cholesterol levels, trans fatty acids can produce a greater increase in the ratio of LDL cholesterol to HDL cholesterol.
- Sources of trans fatty acids include hardened vegetable fat, stick margarine, shortening, and baked products made with these fats.
- According to the 2006 guidelines from the AHA, a diet should consist of <7% saturated fat and <1% trans fat

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- **Cholesterol:** Dietary cholesterol is found only in animal products, especially those foods that are high in saturated fatty acids (e.g. meats and whole dairy products). There is some evidence that dietary cholesterol enhances the serum cholesterol-raising action of saturated fatty acids, although to a lesser extent than saturated fat
- Most foods high in saturated fat are also sources of dietary cholesterol. Reduced intake of foods high in saturated fat provides the additional benefit of limiting cholesterol intake. Cholesterol rich foods that are relatively low in saturated fatty acids, notably eggs and, to a lesser extent, shellfish, have smaller effects on LDL cholesterol
- Therefore, periodic consumption of eggs and shellfish can be integrated into the Therapeutic Lifestyle Changes Diet meal plan

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- **Carbohydrates**: Complex carbohydrates should make up the majority of digestible carbohydrates. When fat intake is reduced and nutrient replacement is required to maintain energy balance, the replacement should be complex carbohydrates. Recommended sources include whole grains, legumes, fruits, vegetables, nuts, and low-fat dairy products. Data on the ideal isocaloric substitution of carbohydrate for fat to maximize LDL cholesterol lowering are presently not available.
- **Total protein and soy protein**: Approximately 15% of total energy should be provided as protein. Consuming 26 to 50 g/day of soy protein in place of animal protein can reduce total cholesterol by 0% to 20% and LDL cholesterol by 4% to 25%. If consistent with patient preference and not contraindicated by risks or harms, then soy (e.g. isolated soy protein, textured soy, tofu) may be included as part of a cardioprotective diet, except for patients with breast cancer.

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- **Fiber:** Current recommendations for dietary intake of soluble fiber in cardiovascular disease are based on its ability to reduce LDL and total serum cholesterol levels. An intake of total dietary fiber 25 to 30 g is recommended for adults and is associated with decreased risk for CHD and cardiovascular disease. ncreased intake of foods rich in soluble fiber correlates with decreased serum cholesterol levels
- Soluble, viscous fiber may reduce serum cholesterol and LDL levels in several ways. First, soluble fiber may decrease overall absorption of lipids. Secondly, soluble fiber is thought to bind bile acids and increase their excretion rather than allow bile to enter enterohepatic circulation. This excretion decreases the overall body pool of cholesterol. Finally, in response to the decreasing amounts of cholesterol, the body transfers low-density lipoproteins (LDL) and the cholesterol they contain to the liver to support the increased synthesis of bile
- Consuming diet from whole food or supplements in total fiber (17 to 30 g/day) and soluble fiber (7 to 13 g/day) as part of a diet low in saturated fat and cholesterol can further reduce total cholesterol levels by 2% to 3% and LDL cholesterol levels by up to 7%
- Choosing soluble fibers (notably beta glucan and pectin) found in oats, barley, and pectin-containing fruits and vegetable, beans and legumes provides adjunctive lipid-lowering benefits

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- **Reducing Inflammation:** The role of inflammatory processes in atherosclerosis is increasingly apparent. Loss of excess body fat reduces the inflammation that acts as both a promoter of atherosclerosis progression and a trigger for cardiovascular events. In addition, shifting the balance of dietary fat away from saturated fats toward omega–3 fatty acids appears to reduce atherosclerosis and may help lower coronary risk, presumably by reducing inflammatory processes. This balance can be altered by the elimination of animal products, tropical oils (the leading sources of saturated fats), and partially hydrogenated vegetable oils (trans fats).

Hypertension and cardiovascular disease

- ***What counts as hypertension?***
  High blood pressure is defined as a systolic blood pressure at or above 140 mmHg and/or a diastolic blood pressure at or above 90 mmHg. Systolic blood pressure is the maximum pressure in the arteries when the heart contracts. Diastolic blood pressure is the minimum pressure in the arteries between the heart's contractions.

- ***How hypertension impacts on your heart and blood vessels***
  Hypertension is a risk factor for coronary heart disease and the single most important risk factor for stroke. Atherosclerosis and narrowing of the blood vessels making them more likely to block from blood clots or bits of fatty material breaking off from the lining of the blood vessel wall. Damage to the arteries can also create weak places that rupture easily.

Hypertension and cardiovascular disease

- ***Types of hypertension***
  The amount of blood pumped by the heart and the size and condition of the arteries determines your blood pressure. However, many other factors can affect blood pressure including the condition of your kidneys and levels of various hormones in the body.

- Some people experience essential hypertension, which has no identifiable cause. If you are diagnosed with this its origins may be genetic, or due to your lifestyle including diet, weight and physical inactivity. Secondary hypertension is caused by another condition such as problems with your kidneys, certain medicines and some other medical problems.

Dietary Approaches to Stop Hypertension (DASH)

- The DASH diet is based on the research studies: Dietary Approaches to Stop Hypertension, and has been proven to lower blood pressure, reduce cholesterol, and improve insulin sensitivity. Blood pressure control with the DASH diet involves more than just the traditional low salt or low sodium diet advice.
- It is based on an eating plan proven to lower blood pressure, a plan rich in fruits, vegetables, and low-fat or nonfat dairy. It emphasizes whole grains and contains less refined grains compared with a typical diet. It is rich in potassium, magnesium, calcium, and fiber.
- At 2000 kcal a day, the DASH Sodium Diet provides approximately 4700 mg (120 mEq) potassium, 500 mg magnesium, 1240 mg calcium, 90 g protein, 30 g fiber, and 2400 mg (100 mEq) sodium.

Food Group	Daily Servings (except as noted)	Serving Sizes	Examples and Notes	Significance of Each Food Group to the DASH Eating Plan
Grains and grain products	7–8	1 slice bread 1 oz dry cereal* ½ cup cooked rice, pasta, or cereal	Whole-wheat bread, English muffin, pita bread, bagels, cereals, grits, oatmeal, crackers, unsalted pretzels and popcorn	Major sources of energy and fiber
Vegetables	4–5	1 cup raw leafy vegetable ½ cup cooked vegetable 6 oz vegetable juice	Tomatoes, potatoes, carrots, green peas, squash, broccoli, turnip greens, collards, kale, spinach, artichokes, green beans, lima beans, sweet potatoes	Rich sources of potassium, magnesium, and fiber
Fruits	4–5	6 oz fruit juice 1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit	Apricots, bananas, dates, grapes, oranges, orange juice, grapefruit, grapefruit juice, mangoes, melons, peaches, pineapples, prunes, raisins, strawberries, tangerines	Important sources of potassium, magnesium, and fiber
Low-fat or fat-free dairy foods	2–3	8 oz milk 1 cup yogurt 1½ oz cheese	Fat-free (skim) or low-fat (1%) milk, fat-free or low-fat buttermilk, fat-free or low-fat regular or frozen yogurt, low-fat and fat-free cheese	Major sources of calcium and protein
Meats, poultry, and fish	2 or less	3 oz cooked meats, poultry, or fish	Select only lean; trim away visible fats; broil, roast, or boil, instead of frying; remove skin from poultry	Rich sources of protein and magnesium
Nuts, seeds, and dry beans	4–5 per week	⅓ cup or 1½ oz nuts 2 Tbsp or ½ oz seeds ½ cup cooked dry beans/peas	Almonds, filberts, mixed nuts, peanuts, walnuts, sunflower seeds, kidney beans, lentils	Rich sources of energy, magnesium, potassium, protein, and fiber
Fats and oils	2–3†	1 tsp soft margarine 1 Tbsp low-fat mayonnaise 2 Tbsp light salad dressing 1 tsp vegetable oil	Soft margarine, low-fat mayonnaise, light salad dressing, vegetable oil (such as olive, corn, canola, or safflower)	DASH has 27% of calories as fat, including fat in or added to foods
Sweets	5 per week	1 Tbsp sugar 1 Tbsp jelly or jam ½ oz jelly beans 8 oz lemonade	Maple syrup, sugar, jelly, jam, fruit-flavored gelatin, jelly beans, hard candy, fruit punch, sorbet, ices	Sweets should be low in fat

*Equals ½–1¼ cups, depending on cereal type. Check the product's Nutrition Facts Label.

†Fat content changes serving counts for fats and oils: For example, 1 Tbsp of regular salad dressing equals 1 serving; 1 Tbsp of a low-fat dressing equals ½ serving; 1 Tbsp of a fat-free dressing equals 0 servings

SODIUM

- Although the use of sodium restriction to manage BP has been a controversial issue in the past, recent consistent evidence has supported the efficacy of a reduction of sodium for controlling BP.
- The DASH trials have further supported the role of sodium reduction in treatment for hypertension.
- Individual response to sodium restriction can vary.
- The DASH Sodium trial tested the response to three different sodium levels and provided further evidence of a reduction in blood pressure with sodium restriction.

The DASH sodium restricted diet

The Diet Guidelines for Americans recommends the use of salt and sodium in moderation (see Chapter 1.) Four levels of sodium restriction are recommended by the American Heart Association to control a patient's sodium intake. The levels vary from 250 mg up to 3 to 5 grams of sodium daily.

The DASH diet (Dietary Approach to Stop Hypertension) from the NIH is more commonly recommended to prevent or control hypertension than is the AHA diet. The eating plan is rich in various nutrients believed to benefit blood pressure and in other factors involved in maintaining good health. The sodium content is –2400 mg/day.

The DASH sodium restricted diet

Mild Sodium Restriction (3 to 5 Grams Daily)

This is a regular diet that omits only salty foods and the use of salt at the table. Salt may be used lightly in cooking; for example, use half the amount stated in the recipe. This diet is used frequently after discharge from the hospital, when edema is under control. A wide variety of foods from the basic food groups is recommended. T

Moderate Sodium Restriction (1000 Milligrams Daily)

This diet is used both in the hospital and at home. In addition to avoiding the foods indicated for the 3- to 5-gram sodium diet, the diet has the following restrictions:

1. No more than 2 c milk per day.
2. No more than 5 oz meat per day. One egg may be substituted for 1 oz meat.
3. No salt in cooking.
4. Bread and butter beyond three servings daily should be unsalted.
5. No commercial mixes or regular canned vegetables.

Strict Sodium Restriction (500 Milligrams Daily)

This diet is used primarily for hospitalized patients, though it may be followed at home. The restrictions, however, result in low patient compliance except in a hospital setting. In addition to the restrictions indicated for 3- to 5-gram and 1000-mg sodium diets, two other restrictions are required to lower the dietary sodium to 500 mg:

1. No bread and butter that has salt added
2. No vegetables that are naturally high in sodium content

The DASH sodium restricted diet

Severe Sodium Restriction (250 Milligrams Daily)

The substitution of low-sodium milk for regular milk in the 500-mg sodium diet will lower the dietary sodium content to 250 mg.

Minerals

- **Potassium, Calcium, and Magnesium:** Potassium, calcium, and magnesium have all been positively correlated with reduction of BP and treatment of hypertension. The role of these minerals as part of the nutrition therapy for hyper- tension is highlighted by the results of the DASH studies.
- All three minerals appear to have an inverse relationship to hypertension suggesting that as dietary intakes increase, BP decreases.
- The diet used in the DASH trials provided an average of 4–6 g of potassium/day from fruits and vegetables and the equivalent of 3 cups of dairy products as their major source of calcium.
- It is important to remember that the nutritional effects demonstrated by the DASH study and in particular, the relationship between K, Ca, and Mg and blood pressure reduction were a result of a dietary *pattern* rich in these nutrients rather than mineral intake from *supplements*.

Whole diet approaches

- ***Fruit, Vegetable, and Whole Grain Cereals :*** Fruits and vegetables are complex foods and contain many bioactive components, including folate, potassium, hundreds of phytochemicals, and dietary fiber, while also having a negligible amount of fat. Epidemiological studies have repeatedly shown that consumption of fruit and vegetables has a strong protective association with risk of CHD
- ***Nuts :*** Nuts are rich in unsaturated fat. Their consumption tends to displace SFA from the diet. Not surprisingly, therefore, they tend to lower the TC and LDL-C while some epidemiological studies have suggested that they may help lower the risk of CHD
- ***The Portfolio Diet :*** The portfolio diet is a plant-based diet that includes <7% SFA, <200 mg/day cholesterol, viscous fiber 10 g/day, plus phytosterols/stanols, almonds, and soy protein. The diet is designed to maximize the reduction in serum LDL-C levels.