

Hypercholesterolemia

Hypercholesterolemia, or high cholesterol, occurs when there is too much cholesterol in the body. Cholesterol is a soft, waxy, fat-like substance that is a natural component of all the cells of the body. Your body makes all the cholesterol it needs. Any added cholesterol, which comes through the foods you eat, can cause harm.

High cholesterol raises your risk for heart disease, heart attack, and stroke. When there is too much cholesterol circulating in the blood, it can create sticky deposits (called plaque) along the artery walls. Plaque can eventually narrow or block the flow of blood to the brain, heart, and other organs. And blood cells that get caught on the plaque form clots, which can break loose and completely block blood flow through an artery, causing heart attack or stroke.

The normal range for total blood cholesterol is between 140 and 200 mg per decilitre (mg/dL) of blood (usually just expressed as a number). However, the total number doesn't tell the whole story: There are two types of cholesterol -- HDL (high density lipoproteins, or "good" cholesterol) and LDL (low density lipoproteins, or "bad" cholesterol). The amount of HDL relative to LDL is considered a more important indicator of your heart disease risk. There is a third kind of fatty material, triglycerides, found in the blood. They also play a role (generally as triglyceride levels rise, "good" HDL cholesterol falls). When you have high cholesterol, it usually means you have high levels of LDL cholesterol, normal or low levels of HDL cholesterol, and normal or high levels of triglycerides.

More Americans are diagnosed with high cholesterol every year. While heredity may be a factor for some people, the main culprits are lack of exercise and diets high in saturated fat. High cholesterol can be prevented, sometimes with lifestyle changes (diet and exercise) alone. If these do not work, your doctor may recommend medications to lower your cholesterol levels.

Signs and Symptoms:

There usually aren't any symptoms of high cholesterol, especially in early stages. The only way to tell if your cholesterol is high is through a blood test.

Causes:

In some cases, high cholesterol levels may be inherited -- your liver may make too much cholesterol, or your body may not remove LDL from your blood as efficiently as normal. High cholesterol or triglycerides can also be associated with other diseases, such as diabetes. But most often high cholesterol is caused by eating foods high in saturated fat and not getting enough exercise. High cholesterol is more common in people who are overweight or obese, a condition that affects almost half of U.S. adults.

Risk Factors:

Some factors increase a person's risk of having high cholesterol. While some of these cannot be changed, many can be. The most important risk factors for high cholesterol are:

- Being overweight or obese
- Eating a diet high in saturated fat and trans fatty acids (found in processed and fried foods)
- Not getting enough exercise
- Family history of heart disease
- High blood pressure
- Smoking
- Diabetes

Diagnosis:

Most people don't have any symptoms of high cholesterol. A blood test is the only way to check levels of cholesterol in your blood. If your levels are above 200 mg/dL or your HDL is below 40, your doctor may do a fasting lipid profile (a test performed after you abstain from food for 12 hours).

Although cholesterol levels above 200 are generally considered high, what's considered safe for each person depends on whether you are at risk for, or have, heart disease.

Total cholesterol levels:

- Desirable: Below 200 mg/dL
- Borderline high: 200 - 239
- High: Above 240

LDL cholesterol levels:

- Optimal for people with heart disease or who are at high risk: Below 70 mg/dL
- Optimal for people at risk of heart disease: Below 100
- Optimal: 100 - 129
- Borderline high: 130 - 159
- High: 160 - 189

HDL cholesterol levels:

- Poor: Below 40 mg/dL
- Acceptable: 40 - 59
- Optimal: 60 or above

Triglyceride levels:

- Optimal: Below 150 mg/dL
- Borderline high: 150 - 199
- High: Above 200

Adults with normal total and HDL cholesterol levels should have their cholesterol checked every 5 years. If you have high cholesterol, you should be checked every 2 - 6 months. You should have liver function tests as well if you are on cholesterol-lowering medication.

Preventive Care:

Most people can lower cholesterol levels by eating a well-balanced diet, getting regular exercise, and losing any excess weight.

Diet

A healthy diet can help you lose any extra pounds. Even losing just 5 or 10 pounds may help lower your cholesterol. To eat a healthy diet:

- Cut down on saturated fats and trans fats. No more than 10% of your daily calories should come from saturated fat, and you should avoid trans fats completely. Based on data from 4 studies, it is

estimated that a 2% increase in energy intake from trans fats increases the incidence of heart disease by 23%. Choose unsaturated fats, such as olive oil and canola oil, instead.

- Eat whole grains -- whole wheat bread and pasta, oatmeal, oat bran, and brown rice.
- Eat more fruits and vegetables, which are high in fiber and can help lower cholesterol levels. Studies show that plant based diets are associated with decreases in total cholesterol and LDL cholesterol of up to 15%.
- Limit cholesterol in your diet. The highest amounts are found in egg yolks, whole milk products, and organ meats.
- Eat fatty fish. The American Heart Association recommends that people eat at least 2 servings of fatty fish (such as salmon or herring) each week.
- Eat phytosterols and stanols found in nuts, seeds, vegetable oils, and fortified food products, such as orange juice, yogurt, margarine spreads, and salad dressing. Studies show that eating spreads enriched with phytosterols per day reduced total cholesterol by up to 11% and LDL cholesterol by up to 15%.

The American Heart Association (AHA) has developed dietary guidelines that help lower fat and cholesterol intake and reduce the risk of heart disease. The AHA does not recommend very low fat diets, because new research shows that people benefit from unsaturated ("good") fats, such as those found in olive oil, in their diet.

Many fad diets are popular, but they may not help you lose weight and keep it off -- and in some cases, they may not even be healthy. Any healthy diet will include a variety of foods. If a diet bans an entire food group (such as carbohydrates), it's probably not healthy.

For healthy eating, eat a balanced diet that emphasizes fruit and vegetables:

- Grains: 6 - 8 servings per day (half should be whole grains)
- Vegetables: 3 - 5 servings per day
- Fruits: 4 - 5 servings per day
- Fat free or low fat dairy: 2 - 3 servings per day
- Lean meat, poultry, seafood: 3 - 6 oz. per day (about the size of a deck of cards)
- Fats and oils: 2 - 3 tbsp. per day (use unsaturated fats such as olive oil or canola oil)
- Nuts, seeds, legumes: 3 - 5 servings per week
- Sweets, sugars: 5 or fewer servings per week (the fewer, the better)

In addition, the American Heart Association also recommends eating 2 servings of fatty fish (such as salmon, herring, or lake trout) per week; holding sodium (salt, including salt already added to food) to less than 2,400 mg per day; and limiting alcohol intake to 1 drink a day for women and 2 for men. However, moderate alcohol consumption may help lower triglyceride levels and increase HDL levels.

The TLC (therapeutic lifestyle changes) diet is recommended for people who have high cholesterol. With the TLC diet, less than 7% of your daily total calories should come from saturated fat, and only 25% -35% of your daily calories should come from fat, overall. Sodium should be limited to 2,400 mg per day. If these steps don't lower your cholesterol, your doctor may suggest adding more soluble fiber to your diet, along with plant sterols (found in cholesterol lowering margarines and salad dressings).

The Mediterranean style diet concentrates on whole grains, fresh fruits and vegetables, fish, olive oil, and moderate, daily wine consumption. This diet is not low fat. It is low in saturated fat but high in monounsaturated fat. This diet is naturally rich in fiber, antioxidants, and omega-3 fatty acids. It appears to be heart healthy: In a long term study of 423 patients who had a heart attack, those who followed a Mediterranean style diet had a 50 - 70% lower risk of recurrent heart disease compared with people who received no special dietary counseling.

Losing Weight

Being overweight increases risk of high cholesterol and heart disease. Even a 5 - 10 pound weight loss can lower LDL twice as much as diet alone. Weight loss often results in lower triglyceride levels and increased HDL, too. To maintain a healthy diet, you should aim for a gradual, weekly weight loss of 1/2 to 1 pound.

Getting Exercise

Regular exercise both reduces the risk of death from heart disease and helps lower LDL cholesterol levels, especially when combined with a healthy diet. Just 30 minutes of moderate exercise 5 times per week can help you lose weight or maintain a proper weight, reduce LDL and triglyceride levels, and increase levels of HDL. And studies show that for every 10 minute prolongation of exercise per session is associated with a 1.4 mg/dL increase in HDL cholesterol. Exercise may also lower blood pressure. Talk with your doctor before starting a new exercise plan.

Treatment Approach:

Lowering your cholesterol level reduces your risk of heart disease and stroke. Studies have shown that for every 1% reduction in cholesterol levels there is a 2% reduction in the rate of heart disease. People who already have heart disease or are at higher risk benefit most from lowering their cholesterol.

Changes in lifestyle -- improved diet, more exercise -- are the most effective means of both preventing and, in less severe cases, treating high LDL cholesterol levels. In addition to recommending lifestyle changes, physicians often prescribe specific cholesterol lowering medications.

Medications

If your LDL cholesterol remains high, after changing your diet and exercise habits, your doctor may prescribe medications to lower it. If your cholesterol is very high (more than 200 mg/dL), you may start drug therapy at the same time you improve your diet and exercise habits. Drugs commonly used to treat high cholesterol include:

Statins -- These are usually the drugs of choice as they are easy to take and have few interactions with other drugs. Side effects can include myositis (inflammation of the muscles), joint pain, stomach upset, and liver damage. People who are pregnant or have liver disease should not take statins. Statins include:

- Lovastatin (Mevacor)
- Pravastatin (Pravachol)
- Rosuvastatin (Crestor)
- Simvastatin (Zocor)
- Atorvastatin (Lipitor)
- Fluvastatin (Lescor)

Niacin (nicotinic acid) -- In prescription form, niacin is sometimes used to lower LDL cholesterol. It can be more effective in raising HDL cholesterol than other medications. Side effects may include redness or flushing of the skin (which can be reduced by taking aspirin 30 minutes before the niacin), stomach upset (which usually subsides in a few weeks), headache, dizziness, blurred vision, and liver damage. Dietary supplements of niacin should not be used instead of prescription niacin, as it can cause side effects. Only take niacin for high cholesterol under a doctor's supervision.

Bile acid sequestrants -- These are used to treat high levels of LDL. Common side effects include bloating, constipation, heartburn, and elevated triglycerides. People who have high levels of triglycerides (fats in the blood) should not take bile acid sequestrants. These drugs include:

- Cholestyramine (Prevalite, Questran)
- Colestipol (Colestid)
- Colesevelam (WelChol)

Cholesterol absorption inhibitors -- The medication ezetimibe (Zetia) limits how much LDL cholesterol can be absorbed in the small intestine. Side effects include headaches, nausea, muscle weakness. Ezetimibe is combined with simvastatin in the drug Vytorin.

Fibric acid derivatives -- These medicines are effective at lowering triglyceride levels, and moderately effective at lowering LDL. They are used to treat high triglycerides and low HDL in people who cannot take niacin. Side effects include myositis, stomach upset, sun sensitivity, gallstones, irregular heartbeat, and liver damage.

- Gemfibrozil (Lopid)
- Fenofibrate (Tricor, Lofibra)

If you do not respond to one class of drugs, your doctor may use a combination of drugs from 2 classes.

Nutrition and Dietary Supplements

In addition to eating a healthy diet -- low in saturated fat, with plenty of whole grains, fruits, and vegetables -- some specific foods and supplements may help lower cholesterol.

Fiber -- Several studies have shown that soluble fiber (found in beans, oat bran, barley, apples, psyllium, flaxseed, and glucomannan) lowers LDL cholesterol and triglycerides. Fiber can also help you lose weight because it makes you feel full faster. Your doctor will encourage you to get more fiber in your diet. You may also take a fiber supplement. Men should get 30 - 38 g of fiber per day. Women should get 21 - 25 g.

Beta-glucan -- is a type of soluble fiber found in oat bran and other plants. It slightly reduces LDL cholesterol, which is why oat bran is touted as a cholesterol reducing food.

Soy -- Many studies have shown that eating soy protein (tofu, tempeh, miso), rather than animal meat, helps lower blood cholesterol levels, especially when you eat a diet low in saturated fat. One study found that as little as 20 g of soy protein per day is effective in reducing total cholesterol, and that 40 - 50 g shows faster effects (in 3 weeks instead of 6). Another study showed that soy can help reduce triglyceride levels. The AHA recommends that people with elevated total and LDL cholesterol add soy to their daily diet, and that soy is safe when consumed as part of your regular diet. Before you take soy supplements, however, talk to your doctor. Soy isoflavones may have estrogen like effects on the body, which might lead to an increased risk of breast and other cancers.

Omega-3 fatty acids, found in fish oil -- There is good evidence that omega-3 fatty acids (namely EPA and DHA) found in fish oil can help prevent heart disease, lower blood pressure, and reduce the level of triglycerides (fats) in the blood. However, fish oil can also raise levels of both HDL and LDL slightly. When taken as a supplement, it can also act as a blood thinner, so people who already take blood thinning medication should only take a fish oil supplement under their doctor's supervision. One preliminary study found that people with high cholesterol who took fish oil and red yeast rice lowered cholesterol levels about as much as people who took simvastatin (Zocor). The AHA recommends that people eat at least 2 servings of fatty fish (such as salmon) per week, and that fish is safe when consumed as part of your regular diet. If you have high cholesterol, talk to your doctor before taking a fish oil supplement.

Alpha-linolenic acid (ALA) -- ALA is another omega-3 fatty acid that may protect the heart against heart disease. However, studies have shown conflicting results about its ability to lower LDL, and it does not appear to lower triglyceride levels.

Vitamin C (100 - 200 mg per day) -- Several studies suggest that eating a diet high in vitamin C can help lower cholesterol levels, but there is no evidence that taking extra vitamin C through a supplement will help.

Beta-sitosterol (800 mg to 6 g per day in divided doses about 30 minutes before meals) -- Beta-sitosterol is a plant sterol, a compound that can stop cholesterol from being absorbed by the intestines. Several well designed scientific studies have shown that beta-sitosterol does lower "bad" LDL cholesterol levels in the body. Beta-sitosterol may lower the amount of vitamin E and beta-carotene absorbed by the body, so you may want to ask your doctor if you need to take extra vitamin E or carotene.

Policosanol (5 - 10 mg 2 times per day) -- Policosanol is a mix of waxy alcohols usually derived from sugar cane and yams. Several studies have indicated it may lower "bad" LDL cholesterol and maybe even raise "good" HDL cholesterol. One study found that policosanol was equivalent to fluvastatin (Lescol) and simvastatin (Zocor) in lowering cholesterol levels. It may also inhibit blood clots from forming. However, almost all the studies have been conducted in Cuba or Latin America using a proprietary form of policosanol, so it is hard to evaluate the evidence. Policosanol may increase the risk of bleeding, and should not be taken by people who also take blood thinning medication.

Coenzyme Q10 (CoQ10) -- Researchers believe that CoQ10 may boost levels of antioxidants. One study found that people who received daily CoQ10 supplements within 3 days of a heart attack were much less likely to experience subsequent heart attacks and chest pain. They were also less likely to die of the condition than those who did not receive the supplements. Still, more research is needed to say whether CoQ10 has any role in preventing or treating atherosclerosis. People who take statins may have low levels of CoQ10. If you take statins, you may want to ask your doctor about taking a CoQ10 supplement. CoQ10 can interfere with anticoagulant / antiplatelet drugs.

Polyphenols -- Polyphenols are chemical substances found in plants that have antioxidant properties. Test tube, animal, and some population based studies suggest that the flavonoids quercetin, resveratrol, and catechins (all found in high concentration in red wine, and in grape juice) may help reduce the risk of atherosclerosis by protecting against the damage caused by LDL cholesterol. However, more studies in humans are needed to confirm these findings.

Resveratrol -- A study in mice found that resveratrol protected against age related damage to vital organs, including the heart and liver, even when the mice ate a high fat diet. Although this study is promising, more studies are needed to see whether resveratrol would have the same effect in humans. No one is sure how much resveratrol is needed to see a benefit. In addition, resveratrol may have estrogen-like effects, and researchers don't yet know whether it would pose the same risks as estrogen supplements.

Herbs

The use of herbs is a time honored approach to strengthening the body and treating disease. Herbs, however, can trigger side effects and can interact with other herbs, supplements, or medications. For these reasons, you should take herbs with care, under the supervision of a health care provider.

Hawthorn(*Crataegus monogyna*, 900 - 1,800 mg per day in 2 - 3 divided doses) -- Hawthorn contains the polyphenols rutin and quercetin, and was used traditionally to treat cardiovascular diseases. Animal and laboratory studies show that hawthorn has antioxidant properties that may help lower high cholesterol and high blood pressure. Talk to your doctor before taking hawthorn, as it can interact with other drugs taken for heart disease and high blood pressure.

Garlic (*Allium sativum*, 900 mg per day of garlic powder, standardized to 0.6% allicin) -- Previous clinical trials have shown that fresh garlic and garlic supplements may lower cholesterol levels, prevent blood clots, and destroy plaque. However, more recent studies show no effect on cholesterol. Garlic can increase the risk of bleeding and should not be taken if you are also taking blood thinning medication.

Olive leaf extract (*Olea europaea*, 1000 mg per day) -- One study found that people with mild high blood pressure (hypertension) lowered cholesterol and blood pressure by taking olive leaf extract, compared to those who took placebo. More research is needed to confirm this study's findings.

Red yeast rice (*Monascus purpureus*, 1,200 mg 2 times per day with meals) -- Several studies indicate that a proprietary form of red yeast (Cholestin) can lower cholesterol levels, and that the herb acts like prescription statin drugs (See "Medications" section). For that reason, you should not take red yeast without a doctor's supervision, especially if you already take statins to lower cholesterol.

Psyllium (*Plantago psyllium*, 10 - 30 g per day in divided doses taken 30 - 60 minutes after meals) -- Taking psyllium, a type of fiber, helps lower cholesterol levels, as well as blood sugar levels. If you take medicine for diabetes, talk to your doctor before taking psyllium.

Guggul (*Commiphora mukul*, 3 - 6 g per day) -- Guggul is used in Ayurvedic medicine to treat high cholesterol levels. Scientific studies have found mixed results -- guggul appears to work in Indian populations, but not in people who eat Western style, high fat diets. Guggul may have estrogen like properties and caution should be taken with people with a history of estrogen sensitive cancers or on hormonal medications; speak with your doctor.

Other Considerations:

Pregnancy

Cholesterol lowering medications should be avoided during pregnancy.

Prognosis and Complications

Several complications may occur if high cholesterol is left untreated. These include:

- Heart disease -- high cholesterol levels more than double the risk of heart attack. Lowering cholesterol by 1% reduces the risk of coronary artery disease by 2%.
- Stroke -- low levels of "good" HDL cholesterol have been associated with an increased risk of stroke.
- Insulin resistance -- 88% of people with low HDL and 84% with high triglycerides also have insulin resistance (which leads to high blood sugar levels). Many people with insulin resistance go on to develop diabetes.

Maintaining a proper weight, eating a diet low in saturated fat, and exercising can lower cholesterol levels and improve long term prognosis.