

Cholesterol Management

Elevated cholesterol is associated with a greater-than-normal risk of atherosclerosis and cardiovascular disease. While antioxidants can inhibit cholesterol from oxidizing onto the linings of the arteries, knowing and controlling your cholesterol levels is still an important step in preventing cardiovascular disease.

Estimates are that 52% of the total population have cholesterol levels of 200 mg/dL, and about 21% have levels of 240 or above. In adults, total cholesterol levels from 200 to 239 mg/dL are considered borderline-high, while levels above 240 are considered dangerously high. Knowing cholesterol numbers can allow a person to manage "fat intake," which has other benefits, such as lowering one's risk of various cancers caused by fat-soluble toxins.

During the past 20 years, deaths from heart disease have gone down 33% in the United States saving as many as 250,000 lives each year! This is because people are beginning to learn about and take the proper precautions to prevent and treat heart problems. Keeping cholesterol levels in the safest range (between 180 and 200 mg/dL) is one way of statistically reducing your risk of suffering a heart attack or stroke.

TYPES OF CHOLESTEROL, AND THE IMPACT ON YOUR HEALTH

Low Density Lipoprotein (LDL)

Low density lipoprotein (LDL) is called the "bad" form of cholesterol. LDL carries most of the cholesterol in the blood, and the cholesterol from LDLs is the main source of damaging accumulation and blockage in the arteries. Thus, the more LDL cholesterol you have in your blood, the greater your risk of disease. If you have coronary heart disease (CHD) and your LDL is higher than 100 mg/dL, your cholesterol may well be too high for you.

High Density Lipoprotein (HDL)

High density lipoprotein (HDL) is called the "good" form of cholesterol. HDL picks up and transports cholesterol in the blood back to the liver, which leads to its elimination from the body. HDL can help keep LDL cholesterol from building up in the walls of the arteries. If your level of HDL cholesterol is below 35 mg/dL, you are at substantially higher risk for CHD. The higher your HDL cholesterol level, the better. The average HDL-cholesterol for men is about 45 mg/dL, and for women it is about 55 mg/dL.

Triglycerides

Triglycerides are a form of fat carried through the bloodstream. Most of your body's fat is in the form of triglycerides stored in fat tissue. Only a small portion of your triglycerides are found in the bloodstream. High blood triglyceride levels alone do not cause atherosclerosis. But lipoproteins that are rich in triglycerides also contain cholesterol, which causes atherosclerosis in many people with high triglycerides. So high triglycerides may be a sign of a lipoprotein problem that contributes to CHD.

Serum (blood) cholesterol levels are affected not only by what you eat, but also by how quickly your body creates LDL cholesterol and eliminates it. Most people manufacture all the cholesterol they need in their liver, and it is not necessary to obtain any surplus cholesterol from food.

Patients with coronary artery disease typically have too high a level of LDL cholesterol in their blood. Multiple factors help determine whether your LDL cholesterol level is high or low. The factors discussed next are the most important:

The following factors are the most important:

Heredity

Your genes control how high your LDL cholesterol is by affecting how fast LDL is made and removed from the blood. One specific form of inherited high cholesterol is familial hypercholesterolemia, which often leads to early CHD. Even if you do not have a specific genetic form of high cholesterol, genes play a role in affecting your LDL cholesterol level.

What you eat

Saturated fat, found mostly in foods that come from animals, increases your LDL cholesterol level more than anything else in your diet. Dietary cholesterol also plays a part. The average American man consumes about 360 mg of cholesterol a day; the average woman, between 220 and 260 mg. Eating too much saturated fat and cholesterol-rich foods such as eggs is the main reason for high levels of cholesterol and a high rate of heart attacks in the United States according to the Centers for Disease Control. Reducing the amount of saturated fat and cholesterol you eat is a very significant step in reducing blood cholesterol levels.

Here are the 1999 dietary recommendations from the American Heart Association:

"Cholesterol is found in meat, poultry, seafood and dairy products. Foods from plants-such as fruits, vegetables, vegetable oils, grains, cereals, nuts, and seeds-don't contain cholesterol. Egg yolks and organ meats are high in cholesterol. Shrimp and crayfish are somewhat high in cholesterol. Chicken, turkey, and fish contain about the same amount of cholesterol as do lean beef, lamb and pork."

As can be seen from the above recommendations, it is hard to avoid consuming foods that cause cholesterol to build up in the blood.

Weight

Excess weight tends to increase LDL cholesterol level. If you are overweight and have a high LDL cholesterol level, losing weight may help lower it. Weight loss also helps to lower triglycerides and raise HDL. Conversely, it is now accepted that even small increases in weight may increase cholesterol and the general risk of cardiovascular disease.

Physical activity/exercise

Frequent physical activity may lower LDL cholesterol and raise HDL cholesterol levels.

Age and sex

Before menopause, women usually have total cholesterol levels that are lower than those of men the same age. As women and men get older, their blood cholesterol levels rise until about 60 to 65 years of age. In women, menopause often causes an increase in LDL cholesterol and a decrease in HDL cholesterol level, and after the age of 50, women often have higher total cholesterol levels than men of the same age.

Alcohol

Alcohol intake increases HDL cholesterol but does not lower LDL cholesterol. Drinking too much alcohol can damage the liver and heart muscle, lead to high blood pressure, and raise triglycerides. Because of the risks, doctors don't recommend alcoholic beverages as a way to prevent CHD, yet the consumption of just one glass of red wine or other alcoholic beverage statistically reduces the risk of heart attack and stroke without causing other health problems for most people.

Stress

Stress over the long term has been shown in several studies to raise blood cholesterol levels. One way that stress may do this is by affecting your habits. For example, when some people are under stress, they console themselves by eating fatty foods. The saturated fat and cholesterol in these foods contribute to higher levels of blood cholesterol.

Who's at Risk?

"At risk" cholesterol numbers are considered to be anything above 200 mg/dL for total serum cholesterol with the caveat that the dangerous LDL cholesterol (low density lipoprotein) number be less than 100 mg/dL. HDL cholesterol (high density lipoprotein), the aptly named "good" cholesterol, can be increased using specific nutrient supplements and by limiting total serum cholesterol intake. If your HDL is less than 35 mg/dL, your physician will try to help you increase it, while lowering LDL cholesterol.

Here's a fact for you to consider! A person with a total serum cholesterol number of 260 mg/dL increases his or her chance of a heart attack by 500% (Annals of Internal Medicine (United States), 1979).

Cholesterol is a vital substance that is synthesized by the liver and other bodily tissues. The body uses cholesterol as a building block for essential organic molecules such as steroid hormones, cell membranes, and bile acids. Our bodies produce between 500 to 1000 mg total serum cholesterol each day, and this amount is added to the typical American's diet, which may contain an additional 500 to 1000 mg a day of additional cholesterol-half of which is absorbed into the body. Therefore, the total elimination of all cholesterol from dietary sources may not be enough for some people, and over time they may face elevated cholesterol levels and require additional measures to control or reduce cholesterol (Heart Disease, Preventive Medicine, 1992).

Source of risk factors: Columbia and Boston Universities, 1999.

CHOLESTEROL AND THE THREAT OF UNSTABLE PLAQUE

Cholesterol is a major ingredient of the plaque that collects in the coronary arteries and causes CHD, so it is important to understand how plaques develop. Excess cholesterol is deposited in the artery walls as it travels through the bloodstream. Then special cells in the artery wall gobble up this excess cholesterol, creating a "lump" in the artery wall. This cholesterol-rich "lump" then is covered by a scar that produces a hard coat or shell over the cholesterol and cell mixture. It is this collection of cholesterol covered by a scar that is called plaque.

The plaque buildup narrows the space in the coronary arteries through which blood can flow, decreasing the supply of oxygen and nutrients to the heart. If not enough oxygen-carrying blood can pass through the narrowed arteries to reach the heart muscle, the heart may respond with a pain called angina. The pain usually happens with exercise when the heart needs more oxygen. It is typically felt in the chest or sometimes in other places like the left arm and shoulder. However, this same inadequate blood supply may cause no symptoms. Cardiovascular disease is often a "silent" disease, until something happens.

Plaques come in various sizes and shapes. Throughout the coronary arteries many small plaques build themselves into the walls of the arteries, blocking less than half of the artery opening. These small plaques are often invisible on many of the tests doctors use to identify coronary heart disease. It used to be thought that the most dangerous plaques and the ones most likely to cause total blockage of coronary arteries were the largest ones. The largest plaques are in fact the ones most likely to cause angina. However, small plaques that are full of cholesterol but not completely covered by scar are now thought to be very unstable and more likely to rupture or burst, releasing their cholesterol contents into the bloodstream.

When this happens, it precipitates blood clotting inside the artery. If the blood clot totally blocks the artery, it reduces or stops blood flow, and a heart attack occurs. The muscle on the far side of the blood clot does not get enough oxygen and begins to die. The damage can be permanent.

Lowering your blood cholesterol level can slow, stop, or even reverse the buildup of plaque. Cholesterol lowering can reduce your risk of a heart attack by lowering the cholesterol content in unstable plaques to make them more stable and less prone to rupture. This is why lowering your LDL cholesterol is such an important way to reduce your risk for having a heart attack. Even in people who have had one heart attack, the chances of having future attacks can be substantially reduced by cholesterol reduction.

One of the best methods of reducing cholesterol is through dietary modification (see Dash Diet in Hypertension protocol). Supplements offer excellent synergistic benefits to augment dietary measures.

THE BENEFITS OF LOWERING CHOLESTEROL

A 5-year clinical trial with over 4400 patients with heart disease found that lowering cholesterol can prevent heart attacks and reduce death in men and women who already have heart disease and high cholesterol. Researchers say that the following benefits could be expected if physicians were to treat their heart disease patients for the same 5-year period and lower cholesterol to the same extent.

For every 1000 patients,

- Forty people would be saved out of the 90 who would otherwise die from heart disease.
- Seventy of the expected 210 nonfatal heart attacks would be avoided.
- Heart procedures such as bypass surgery would be avoided in 60 of the 210 patients who would be expected to need these procedures.

The most recent report of the National Cholesterol Education Program identified low HDL cholesterol as a coronary artery disease risk factor and recommended that "all healthy adults be screened for both total cholesterol and HDL cholesterol levels" (Am. J. Cardiol., Nov. 1998, 82:9A, 13Q-21Q).

Landmark clinical studies in the past several years have demonstrated diminished mortality and first coronary events following lowering of low density lipoprotein (LDL) cholesterol. The Framingham Heart Study (a long-term research study) produced compelling evidence indicating that a low level of HDL cholesterol was an independent "predictor" of coronary artery disease (CAD).

Many community health organizations, local drug stores, and health food stores regularly provide low-cost or free cholesterol screening for those interested in monitoring their serum cholesterol. Seek the advice of a competent physician experienced in cholesterol management using dietary modification and nutritional supplements. A physician with this kind of background can also help with the substitution of nutrient-based cholesterol-reduction plans which may allow the reduction or elimination of prescription drugs.

If you already have high blood pressure as well as high blood cholesterol (and many people do), your physician may also tell you to cut down on sodium or salt. As long as you are working on getting your blood cholesterol number down, this is a good time to work on your blood pressure, too.

TRADITIONAL THERAPIES

HMG CoA Reductase Inhibitors

Drugs that inhibit the enzyme HMG-CoA reductase are referred to as "statins." These drugs lower cholesterol by slowing down the production of cholesterol and by increasing the liver's ability to remove the LDL cholesterol already in the blood.

The latest introduction to the powerful group of lipid-lowering drugs known as statins, or HMG reductase inhibitors, is atorvastatin (Lipitor). It is the only statin approved for the reduction of triglycerides as well as total and LDL cholesterol. It reduces LDL by 40 to 60%, triglycerides by 20 to 40%, and raises HDL cholesterol by 5 to 10%, changes which may be bigger than those produced by other statins. It can be taken once a day, at any time of day, and the recommended dose range is from 10 to 80 mg a day. Atorvastatin provides the lowest cost per percentage of LDL cholesterol reduction of available statins. Other available statins, which primarily reduce LDL cholesterol are cerivastatin (Baychol), fluvastatin (Lescol), lovastatin (Mevacor), pravastatin (Pravachol), and simvastatin (Zocor).

Additional drugs that are commonly prescribed and approved for lowering elevated triglyceride levels are gemfibrozil and clofibrate. These drugs may be prescribed alone or in combination with other drugs. These triglyceride-lowering drugs have toxic side effects that cause many people to avoid them.

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INTEGRATED AND ALTERNATIVE MEDICAL APPROACHES

Some people with high cholesterol are able to reduce to safe levels by using combinations of dietary supplements that have been shown to lower serum cholesterol, protect against LDL cholesterol oxidation, and reduce the risk of an abnormal arterial blood clot formation.

Benefits of Policosanol

Policosanol is a natural supplement derived from sugar cane. The main ingredient is octacosanol. Octacosanol is an alcohol found in the waxy film that plants have over their leaves and fruit. The leaves and rinds of citrus fruits contain octacosanol, as does wheat germ oil.

Policosanol has been shown to normalize cholesterol as well or better than cholesterol-lowering drugs, without side effects such as liver dysfunction and muscle atrophy (Mas et al. 1999). Efficacy and safety have been proven in numerous clinical trials, and it has been used by millions of people in other countries. Policosanol lowers harmful LDL-cholesterol and raises protective HDL-cholesterol. HDL-cholesterol removes plaque from arterial walls.

Policosanol helps stop the formation of artery lesions (Noa et al. 1995), an effect similar to that of statin drugs. This was proven in studies on rabbits fed a diet designed to create high cholesterol. According to researchers "in most policosanol-treated animals, atherosclerotic lesions were not present, and in others, thickness of fatty streaks had less foam cell layers than in controls" (Arruzazabala et al. 2000).

Policosanol also inhibits the oxidation of dangerous LDL-cholesterol (Menendez et al. 1999), which promotes the destruction of blood vessels by creating a chronic inflammatory response. Oxidized LDL can also provoke metalloproteinase enzymes. (Xu et al. 1999). These enzymes promote blood vessel destruction, partly by interfering with HDL's protective effect. Studies show that rats treated with policosanol have fewer foam cells, reflecting less inflammatory response and blood vessel destruction (Noa et al. 1996; Lindstedt et al. 1999).

Healthy arteries are lined with a smooth layer of cells so that blood can race through with no resistance. This layer becomes thick and overgrown with cells as a consequence of diseased arteries. As the artery narrows, blood flow slows down or is blocked completely. Policosanol can stop the proliferation of these cells in much the same way as lipid-lowering drugs (Noa et al. 1998; Negre-Aminou et al. 1996).

Policosanol also inhibits the formation of clots, and may work synergistically with aspirin in this respect. In a comparison of aspirin and policosanol, aspirin was better at reducing one type of platelet aggregation (clumping together of blood cells). But policosanol was better at inhibiting another type. Together, policosanol and aspirin worked better than either alone (Arruzazabala et al. 1997; Stusser et al. 1998).

Policosanol has also been shown to inhibit thromboxane, a blood vessel-constricting agent that contributes to abnormal platelet aggregation that can lead to heart attack or stroke. One study showed significant reductions in the level of thromboxane in humans after two weeks on policosanol (Carbajal et al. 1998).

Benefits of Fiber

High intake of soluble fiber is a very effective way of lowering serum cholesterol. Most people, however, find that high amounts of fiber produce gastrointestinal upset, and therefore do not consistently take enough fiber to lower cholesterol levels.

In populations with reported higher incidence of elevated cholesterol, fiber may be of benefit as found in a 1998 study conducted in Mexico City.

Psyllium and oat bran have been shown to lower plasma LDL cholesterol levels in different populations. Hypercholesterolemia is prevalent in the Northern part of Mexico and might be associated to dietary habits and sedentary lifestyle. These results indicate that psyllium and oat bran are efficacious in lowering plasma LDL cholesterol in both normal and hypercholesterolemic individuals from this population (Journal of the American College of Nutrition, Dec. 1998, 17(6):601-8).

Another study contradicts this as follows:

Various soluble fibers reduce total and LDL cholesterol by similar amounts. The effect is small within the practical range of intake. For example, 3 grams soluble fiber from oats (3 servings of oatmeal, 28 grams each) can decrease total and LDL cholesterol by approximately 0.13 mmol/L. Increasing soluble fiber can make only a small contribution to dietary therapy to lower cholesterol

Caution: DO NOT take psyllium if you are presently taking the prescription drugs digitalis or nitrofurantoin.

Chitosan is a fiber composed of chitin, which is a component of the shell of shellfish. Scientists in Norway have processed chitin to provide a magnetic binding affinity for fat and cholesterol in the digestive tract. Chitosan can absorb as much as seven to eight times its weight of fat and bile in the digestive tract. The fat and cholesterol are then excreted through the bowel, thereby improving bowel function and reducing cholesterol levels in the body.

One of the first studies to show a direct correlation between lowering of serum cholesterol with chitosan-suggesting that the agent could be used to inhibit the development of atherosclerosis in individuals with hypercholesterolemia-appeared in the June 1998 issue of the journal *Atherosclerosis*. Researchers at the Department of Medicine, University of Auckland, New Zealand, found that animals fed for 20 weeks on a diet containing 5% chitosan or on a control diet attained blood cholesterol levels significantly lower in the chitosan-fed animals throughout the study and at 20 weeks were 64% below that of control animals. That's right, 64%!

Additionally, when the area of aortic plaque in the two groups of animals were compared, a highly significant inhibition of plaque deposits was observed in the chitosan-fed animals-42% and 50%, compared to 42% in the control animals.

Earlier in the August-October 1994 issue of the journal *ARM Medicina*, Helsinki, clinical studies with chitosan demonstrated that in 5 weeks total cholesterol (LDL) was reduced by 32%, HDL increased by 7.5%, and triglycerides were lowered by 18%.

Another study done almost 20 years ago in the April 1980 *American Journal of Clinical Nutrition* reported a 25 to 30% reduction in cholesterol over a several-month period, initially documenting chitosan's potential cholesterol-lowering effectiveness.

Because of chitosan's ability to bind fat, chitosan is also an excellent aid in weight loss as well as normalization of cholesterol levels in the body.

Caution: Chitosan, like other fibers, can reduce absorption of trace minerals as well as dietary fat. For that reason, it is recommended that trace minerals be taken at a separate time than when the fiber is consumed.

Benefits of Niacin

Niacin (vitamin B3) improves cholesterol profiles when given in doses well above the vitamin requirement. Nicotinic acid lowers total cholesterol, LDL-cholesterol, and triglyceride levels, while raising HDL-cholesterol levels. Most people cannot use the doses (1000 to 3000 mg a day) of niacin required to suppress cholesterol levels. Niacin causes a flushing effect, resembling an acute allergic reaction that many people find intolerable. While niacin is considered relatively safe, like other cholesterol-lowering drugs, it can cause liver toxicity when taken in high doses. Monitoring liver enzymes every 6 months is important when taking more than 1000 mg of niacin a day. Those with hepatitis should avoid niacin.

Flush-free niacin may lower cholesterol while boosting the beneficial HDL fraction. In a report on the antiatherogenic role of HDL (high density lipoprotein) cholesterol, flush-free niacin (inositol hexanicotinate) "appears to have the greatest potential to increase HDL cholesterol [by] 30%." This study was made over a 5-year period and focused on the effect of high LDL numbers exhibited before a patient's first coronary event(s).

As reported in a November 1998 *American Journal of Cardiology* research study, "Nicotinic acid (niacin) has been shown to decrease triglyceride, increase HDL cholesterol, lower LDL cholesterol, and decrease lipoprotein (a); it also decreases fibrinogen," an additional benefit that reduces the risk of related cardiovascular disease.

To determine whether lower doses of nicotinic acid are as effective and better-tolerated than the typical regimen currently used, researchers at the University of Texas Southwestern Medical Center in Dallas, as reported and described in the *Archives of Internal Medicine*, 1996, conducted a trial using two different doses (1.5 g and 3.0 g) of nicotinic acid.

The results showed that the lower dose (1.5 g) nicotinic acid treatment significantly lowered triglyceride levels, raised HDL concentrations by approximately 22%, and favorably altered the ratio of total cholesterol: HDL cholesterol in both normal patients and those with abnormal lipid levels at baseline. Further improvement in lipid levels was also observed in those patients who tolerated the higher dose of nicotinic acid.

In this study, significant improvement in blood lipids levels was observed among the 75% of patients who tolerated low-dose nicotinic acid therapy. The authors conclude that use of nicotinic acid in lower doses than traditionally prescribed is both well-tolerated and effective in altering blood lipid levels. In addition, they suggest that this vitamin may be particularly worthwhile when combined with other lipid-lowering medications.

Note: Nicotinamide, another form of the vitamin B3, does not lower cholesterol levels and should not be used in the place of niacin.

Benefits of Artichoke

The discovery that artichoke leaf extract reduces elevated cholesterol levels opens up exciting perspectives in the prevention and treatment of arteriosclerosis and coronary heart disease.

It was as early as the 1930s that scientists first discovered that artichoke extract had a favorable effect on atherosclerotic plaques in the arteries (Tixier, 1939). Later animal studies, in which rats were fed a high-fat diet, also showed that artichoke extract prevented a rise in serum cholesterol levels and the manifestation of atherosclerotic plaque (Samochowicz, 1959 and 1962).

In addition to findings in animal experiments (Samochowicz et al., 1971; Frohlich and Ziegler, 1973; Wojcicki 1976; Lietti 1977 and 1978), a study by Fintelmann in 1996 of 553 outpatients demonstrated a significant effect of the extract on fat (lipid) metabolism. The researchers found a significant decline in both the cholesterol and triglyceride levels in the blood, which confirmed a discovery made as early as the 1930s.

Recent research confirms these earlier findings. The study by Fintelmann demonstrated a significant reduction in cholesterol and triglyceride levels in spite of the relatively short duration of the study (6 weeks). On an average, there was an 11.5% reduction in serum cholesterol from 264 mg/dL initially to 234 mg/dL. Serum triglycerides were similarly reduced from 215 mg/dL initially to 188 mg/dL, corresponding to a decrease of 12.5%. Although this was an open study, its reliability is buttressed by the relatively large number of patients (302) and the very high level of statistical significance attained for the main results.

Very fascinating results came out of an excellent double-blind clinical trial conducted by Petrowicz in 1996. He studied the cholesterol-lowering effect of artichoke leaf extract on 44 healthy individuals under strictly controlled conditions over a 12-week period. There was a significant decrease of cholesterol levels in the volunteers who had high initial levels (greater than 220 mg/dL). In fact, the higher the initial cholesterol value, the more significant was the reduction in cholesterol levels. It was moreover observed that the protective HDL cholesterol levels showed a tendency to increase.

The restricting effect of artichoke leaf extract on cholesterol synthesis was demonstrated in some very interesting studies by Gebhardt (1995, 1996, and 1997) on rat hepatocytes (liver cells). A highly significant concentration-dependent inhibition of cholesterol synthesis was found. The 1997 study indicates that artichoke leaf extract reduces the formation of cholesterol in a physiologically favorable, long-lasting manner. This reduction of cholesterol synthesis persisted for hours following the period of exposure.

The study further indicates that artichoke extract may work through indirect inhibition of the enzyme HMGCoA-reductase, which might avoid problems known to occur with strong direct inhibitors of HMGCoA-reductase during long-term treatment. The indirect inhibition was supported by the fact that artichoke leaf extract effectively blocked insulin-dependent stimulation of HMGCoA-reductase without affecting insulin in general. HMGCoA-reductase is a key enzyme in cholesterol synthesis, and HMGCoA-reductase inhibitors generally reduce total cholesterol, LDL cholesterol and triglyceride levels

The International Antioxidant Research Centre, UMDS-Guy's Hospital, London, UK, published its research in September 1998 in *Free-Radical Research*, in which investigators stated, "Artichoke extract retarded LDL oxidation. . . and . . . overall, the results demonstrate the antioxidant activity of the artichoke extract."

Benefits of Garlic

A study published in the *Journal Nutrition Research* (1987, 7:139-49) showed that a liquid garlic extract made by Kyolic caused a 12 to 31% reduction in cholesterol levels in the majority of test subjects after 6 months. The study showed that 73% of the subjects given the Kyolic garlic experienced a greater than 10% reduction in cholesterol, compared with only 17% of the subjects in the placebo group showing the same improvement.

If you have high LDL cholesterol levels, garlic supplementation is especially important because LDL cholesterol oxidation causes atherosclerosis, and garlic specifically inhibits LDL oxidation. And garlic helps protect the arterial lining against oxidation. Most importantly, garlic prevents abnormal platelet aggregation (thrombosis) via several different mechanisms. The formation of arterial blood clots is the primary cause of most heart attacks and strokes.

Investigators reported in a study published in the *American Journal of Clinical Nutrition* (1996, 64:866-70) that the daily administration of 7.2 grams of Kyolic garlic powder for 6 months produced a modest reduction (of between 6.1 and 7%) in total cholesterol, compared with the placebo group. The more dangerous LDL cholesterol was reduced 4 to 4.6% in the Kyolic group.

The heart-healthy benefits of garlic include protecting the endothelial lining of the arterial system against oxidative damage. A study published in *Atherosclerosis* (1999, 144:237-49) shows an actual reduction in buildup of fatty plaque in arteries in garlic-supplement users. Fatty plaque is comprised of many substances, including cholesterol. When plaque accumulates in the

coronary arteries, the condition can lead to heart attack. In a study of 280 adults, German researchers reported that participants who took 900 mg of garlic powder a day had up to 18% less plaque in their arteries than those who took a placebo, or "dummy," powder. Male study participants who took a placebo had a 5.5% increase in plaque volume, while those who took the garlic powder experienced just a 1.1% increase in plaque buildup during the 4-year study period. By comparison, women who took the garlic showed a 4.6% decrease in plaque volume, while those who took the placebo powder had a 5.3% increase. Garlic may affect plaque buildup by reducing blood platelet stickiness (aggregation) and specifically preventing the oxidation of LDL cholesterol onto the lining of the arteries. Platelet aggregation helps plaque cling to the arteries.

An April 1998 study reported on the effect of garlic on blood lipids, blood sugar fibrogen, and fibrinogenic activity of 30 patients who received 4 grams of garlic daily for 3 months. The patients were monitored at 1.5 and 3 months when it was determined that garlic had "significantly reduced total serum cholesterol and triglycerides, and significantly increased HDL cholesterol." With regard to fibrinogenic activity, it was determined that the garlic inhibited platelet aggregation (Prostagland. Leuk. Essent. Fatty Acids, April 1998, 58[4]:257-63).

An earlier study in June 1994, the University of Massachusetts Medical School published a report that found that those U.S. adults who consumed one-half to one clove of garlic each day showed cholesterol levels that were reduced by 9% (JAMA, June 1, 1994, 271[21]:1660-61). A survey of 7 out of 8 studies on garlic showed that dosages of between 600 to 900 mg of garlic powder (*Allium sativum* L.) produced a 5 to 20% reduction in cholesterol and triglycerides. (Fortschr. Med. (Germany) 1990, 108[36]:49-54). Other studies have shown that much higher doses of garlic were required for cholesterol reduction.

Human patients fed a daily dose of Kyolic ("Aged Garlic Extract") over a 10-month study showed that "adhesion to fibrinogen was reduced by 30%-compared to placebo . . . and that . . . the beneficial effect of garlic preparations on lipids and blood pressure extends also to platelet function" (Journal of Cardiovascular Pharmacology [United States], 1998, 31[6]:904-8).

Note: Overall studies seem to indicate that dosages of garlic may be a factor in its efficacy. The suggested dose of high allicin garlic extract should be between 6000 mg and 8000 mg daily taken with meals. Since large amounts of garlic may cause stomach upset, we recommend that garlic be taken with the largest meal of the day.

In summary, the mechanisms by which garlic have shown to protect against cardiovascular disease include the following: cholesterol reduction, preventing abnormal blood clot formation inside of blood vessels; protecting against LDL cholesterol oxidation; and protecting the endothelial lining of the arterial system against oxidation. A review of all the studies on garlic indicates that high doses are required for effective cholesterol reduction. If you were to use garlic alone to lower serum cholesterol, you should take 6000 to 8000 mg a day. When used in combination with other cholesterol-lowering nutrients, lower doses of garlic may be effective.

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Benefits of Curcumin

Curcumin, also known as turmeric root, an ancient spice in the ginger family, is gaining attention for its positive impact on a number of diseases, including cholesterol reduction. Scientific evidence has been building since the mid-1980s of curcumin's potential cholesterol-lowering capabilities.

For example, animals fed small doses of curcumin had their cholesterol levels drop by one half (50%) over those that did not receive curcumin. Curcumin reduces cholesterol by interfering with intestinal cholesterol uptake, increasing the conversion of cholesterol into bile acids, and increasing the excretion of bile acids, according to the *International Journal of Vitamin Nutritional Research* (1991, 61:364-69).

The 1992 Indian Journal of Physiology reported that ten human volunteers taking curcumin showed a 29% increase in beneficial HDL cholesterol in only 7 days. Total cholesterol also fell 11.6% and lipid peroxidation was reduced by 33%.

In January of 1997, the *Journal of Molecular Cell Biochemistry* reported curcumin has demonstrated, in vivo, the ability to decrease total cholesterol and LDL cholesterol levels in serum and to increase the beneficial HDL cholesterol. "Blood cholesterol was lowered significantly by dietary curcumin in these diabetic animals. Significant decrease in blood triglyceride and phospholipids was also brought about by dietary curcumin in diabetic rats."

The research has continued and curcumin's ability to lower blood cholesterol levels was reported in the April 1998 issue of *Molecular Cell Biochemistry*, and again, later that year, researchers in *Biofactors* (1998, 8:1-2, 51-57) reported that "curcumin extract may be protective in preventing lipoperoxidation of subcellular membranes."

Curcumin also provides an additional benefit by potentially reducing the risk of cardiovascular-related disease as it inhibits platelet aggregation and significantly decreases the level of lipid (LDL) peroxidation. "Observation of curcumin's mechanism of action shows that it blocks the formation of thromboxane A2, a promoter of platelet aggregation, thereby inhibiting abnormal blood clot formation. Curcumin also increases a prostacyclin, a natural inhibitor of platelet aggregation" (*Arzneim. Forsch.*, 1986, 36:715-17).

Benefits of Gugulipid (Commiphora mukul)

This powerful ancient remedy has been re-discovered by Western culture. Gugulipid is made from the resin of the commiphora mukul tree of north central India. Gugulipid (gugulesterones) has been used for thousands of years to alleviate problems associated with obesity, acne, viral infections, and other ailments.

In a study published in 1989 by the *Journal of Associated Physicians-India*, 125 patients receiving gugulipid showed an 11% decrease in total serum cholesterol, a drop of 16.8% in triglycerides, and a 60% increase in HDL cholesterol within 3 to 4 weeks. Patients with elevated cholesterol levels showed much greater improvement than normal patients.

The study quoted a second trial (included in the article noted above) where 205 patients receiving gugulipid at a dose rate of 25 mg administered 3 times daily showed a 70 to 80% reduction of serum cholesterol, whereas no response was found in the placebo group (*Journal of Associated Physicians-India*, 1989, 37[5]:328).

A placebo-controlled trial of 40 patients with high blood-fat levels showed a serum cholesterol reduction of 21.75%, with triglycerides being reduced by 27.1% in only 3 weeks, and after continuing the study for 16 weeks it was learned that HDL cholesterol was increased by 35.8% (*Journal of Associated Physicians-India*, 1989, 37[5]:328).

Benefits of Green Tea

Green tea has been shown to lower "bad" LDL cholesterol and serum triglyceride levels. Further, green tea's potent antioxidant effects inhibit the oxidation of LDL cholesterol in the arteries, which plays a major contributory role in the formation of atherosclerosis. "There is considerable epidemiological evidence that tea drinking lowers the risk of heart disease" (*FEBS Lett.*, Aug. 1998, 433(1-2):44-46).

The cholesterol-lowering (hypocholesterolemic) effects of green tea (as well as black tea) have been confirmed by both animal and human epidemiological studies. High consumption of green tea by humans, especially more than 10 cups a day, was found to be associated with higher HDLs and lower LDL and VLDL cholesterol, as well as with various biomarkers indicating better liver health. Lower levels of lipid peroxides in the liver are one well-confirmed benefit of green-tea supplementation found in study after study.

A Japanese study relates, "Green tea catechin acts to limit the excessive rise in blood cholesterol" based on a series of studies reported in 1996 (*Journal Nutritional Science Vitaminol.*, 32:613).

Additionally, some very exciting results were found when rats were fed 2.5% green tea leaves in their diet. The experimental group showed a drop in total cholesterol, low-density cholesterol, and triglycerides. The body weight of green tea-fed rats was 10 to 18% lower than that of rats not consuming green tea. In addition, the activity of antioxidant enzymes superoxide dismutase (SOD) and catalase, and of anticarcinogenic phase-II enzyme glutathione S-transferase (GST), were significantly higher in the green tea group, as was the glutathione level in the liver. There was no liver or kidney toxicity. Thus, the study demonstrated combined cardiovascular and anticancer effects of green tea.

The relation between green tea consumption and serum lipid concentrations were examined using cross-sectional data on 1306 males in Japan. Results indicated that total cholesterol levels were found to be inversely related to the consumption of green tea. "Adjusted mean concentrations of total cholesterol were significantly lower in men drinking nine cups or more a day than in those consuming zero to two cups a day" (Prev. Med. July 1992, 21(4):526-31). No wonder the Japanese people have the longest life span. Most Japanese sip tea all day long.

Green tea also has been shown to elevate levels of HDL, the good cholesterol that helps remove atherosclerotic plaque from arterial walls. Green tea is a natural ACE inhibitor. This is an extra benefit for those with high cholesterol and blood pressure, as published studies show lowered blood pressure in animals and humans given green tea extracts. We recommend one capsule (350 mg) of green tea 95% extract daily, or drinking one to ten cups of green or black tea a day.

Benefits of Fish Oil

Fish oil has been shown to reduce high levels of triglycerides by an average of 35%. Fish oil does not appear to reduce cholesterol to that extent, but does offer benefits when consumed as part of an integrated therapy.

A study conducted in The Netherlands on mice and published in June 1998 stated, "Triglyceride turnover studies revealed that fish oil significantly decreased the hepatic VLDL-triglyceride production rate (down 60%)" (Journal of Lipid Research (United States), June 1998, 39(6):1181-88).

Another study indicates, "Our results suggest that fish oil lowers plasma lipid levels significantly" (J. Formos. Med. Assoc., Sept. 1997, 96(9):718-26). Investigations published in the American Journal of Clinical Nutrition in 1997 examined the effects of n-3 fatty acids on serum lipid and lipoprotein concentrations in seven species of experimental animals. n-3 Fatty acids consistently lower serum triglyceride concentrations in humans, but not in most animals. These differences between animals and humans may arise from underlying species differences in lipoprotein metabolism.

Scientific studies have demonstrated that alpha-linolenic acid (from flax or perilla oil) reduces the incidence of atherosclerosis, stroke, and second heart attacks. One study showed a 70% reduction in second heart attacks in those consuming this type of fatty acid. Additionally, perilla oil suppresses platelet-activating factor (PAF), a major cause of arterial blood clots that cause heart attacks and strokes. Perilla oil was shown to decrease PAF by 50% in rats, compared with the administration of safflower oil (Journal of Lipid Mediators and Cell Signaling (Netherlands), 1997, 17/3:207-20).

Fish oil and garlic is a beneficial combination: Forty subjects, all with cholesterol over 200 mg/dL, were enrolled in a single-blind, placebo-controlled crossover study to evaluate both fish oil and garlic extract used in a synergistic regimen. Each patient received 1800 mg of fish oil plus 1200 mg of garlic for 1 month. Crossovers were then made to placebos for 1 month. This study found an 11% decrease in cholesterol, a 34% decrease in triglycerides, and a 10% decrease in LDL levels as well as a 19% decrease in HDL risk. Although not significant, there was a trend toward increase in HDL. The doctors concluded by stating

These results suggest that in addition to the known anticoagulant and antioxidant properties of both fish oil and garlic, the combination causes favorable shifts in the lipid subfractions within 1 month. Triglycerides are affected to the largest extent. The cholesterol lowering and improvement in lipid/HDL risk ratios suggests that these combinations may have antiatherosclerotic properties and may protect against the development of coronary artery disease (J. Natl. Med. Assoc., [United States], Oct. 1997, 89[10]:673-78).

Although fish oil appears to be beneficial for cholesterol reduction, there is a remaining problem: fish and flax oil, traditional sources of omega-3 fatty acids, can cause gastrointestinal side effects as well a stomach upset. There is good news in this regard; a new source of essential fatty acids, perilla oil, is showing superior health benefits without adverse gastrointestinal side effects. For cardiovascular disease risk reduction, we recommend 6000 mg of perilla oil a day.

Benefits of Vitamin E

To say that vitamin E is very important to our health is an understatement: it is protective against approximately 80 diseases.

The National Institute of Aging, Tufts University, and the University of Arizona, College of Medicine have found that vitamin E may help inhibit and slow the development of LDL oxidation, the progression of cardiovascular-related diseases, and possibly slow aging.

Oxidation of low density lipoprotein is involved in the development of atherosclerotic disease. An extensive study by the National Institute of Aging of 11,178 seniors aged 67 to 109 found that seniors who supplement with vitamin E are less likely to die prematurely. The research, reported in the American Journal of Clinical Nutrition late in 1997, discovered that vitamin E has the ability to stabilize free radicals. Free radicals are unstable oxygen molecules that can break down and degenerate cells, much as oxygen causes rust on iron. Partly caused by increased LDL cholesterol oxidation, free radicals result in increased plaque deposits and restricted blood flow, making them extremely dangerous to the interior of arteries.

A study by the National Institute of Aging found that people who took vitamin E supplementation over a 9-year period (1984 to 1993) had a 27% lower risk of all-cause mortality, a 41% reduction in heart disease risk!

Similarly, Dr. Jeffrey Blumberg, professor of nutrition at Tufts University in Boston, who heads the Antioxidant Research NIH Laboratories found that vitamin E helped prevent exercise-induced muscular damage based on many of the same mechanisms mentioned above, in the publication *Advanced Nutrition*, 1997. "The potential benefit is great, data are consistent and compelling, and the risk of side effects is essentially nil. It makes a clear case for recommending supplements," Dr. Blumberg said.

Increased blood cell adhesion to human aortic endothelial cells (ECs) lining veins and arteries is one of the early events in the development of atherogenesis. Investigators in 1997, in the *Journal of Thrombosis and Vascular Biology (United States)*, indicate that vitamin E has an "inhibitory effect" on LDL-induced production of adhesion molecules and adhesion of blood cell to ECs via its antioxidant function and/or its direct regulatory effect on cell adhesion and arteriosclerosis.

The elderly may receive extra value from vitamin E supplementation, as supplementation with 100 IU vitamin E in the elderly has been reported as beneficial in lowering the rate of oxidation of LDL, slowing the progression of atherosclerosis (*Atherosclerosis*, Sept. 1997, 133[2]:255-63).

Smokers may benefit from long-term vitamin E supplementation, as it has been reported to improve endothelium-dependent relaxation in forearm resistance in vessels of hypercholesterolemic smokers which are characterized by increased levels of auto-antibodies against oxidized LDL. These findings suggest the beneficial effect of vitamin E for subjects with increased exposure to oxidized LDL such as smokers (*J. Am. Coll. Cardiol.*, Feb., 1999, 33[2]:499-505).

Vitamin E may even work as well as some hypocholesterolemic drugs. Results of a study in the *Journal of Circulation Research*, August 1998, suggest that vitamin E and selenium inhibited atherosclerosis as effectively as an equally hypocholesterolemic dose of the drug probucol.

The recommended dose of vitamin E ranges from 400 to 800 IU a day. Minimum effective dose for selenium supplementation is 200 mcg a day. Selenium works with vitamin E to protect against LDL oxidation.

Benefits of Soy

The FDA has approved soy as a method of lowering the risk of coronary heart disease. For this dietary supplement, one research abstract says it all:

Soy has been a staple part of the Southeastern diet for nearly 5,000 years and is associated with a reduction in the rates of cardiovascular disease, and certain types of cancer. The research is now showing that phyto-chemicals in soy are the mechanism of action responsible (*Society for Experimental Biology and Medicine [United States]*, 1998, 217[3]:386-92).

Diets rich in soy protein can protect against the development of atherosclerosis. The mechanisms of action of soy protein include cholesterol lowering, inhibition of LDL oxidation, protection against the development of atherosclerosis, and reduction in risk of thrombosis. The active constituents in soy responsible for these benefits are the isoflavones genistein, daidzein, and glycitein. In a study to determine whether soy isoflavones would protect against atherosclerosis in mice, it was reported that mice fed a soy diet averaged 30% lower cholesterol (*J. Nutr. [United States]*, June 1998, 128[6]:954-59).

In a study in *Metabolism*, June 1997, investigations suggest that dietary soybean protein has a beneficial effect on cardiovascular risk factors. According to another study completed at about the same time, "Potential mechanisms by which soy isoflavones might prevent atherosclerosis include a beneficial effect on plasma lipid concentrations, antioxidant effects, antiproliferative and antimigratory effects on smooth muscle cells, effects on thrombus formation, and maintenance of normal vascular reactivity" (*American Journal of Clinical Nutrition*, Dec. 1988, 68[6] Suppl., 1390S-93S).

Postmenopausal women may also benefit from intake of soy protein, and it is suggested to be beneficial by researchers in a 1998 issue of *American Journal of Clinical Nutrition* for diseases and the risk factors (cholesterol) associated with cardiovascular disease.

Adding to the evidence that soy is beneficial, conclusions of a September 1998 *Journal of Nutrition* study are that "the efficacy of

the American Hospital Association Step 1 cholesterol-lowering diet can be improved with the addition of soy protein." If you want to reduce your disease risk to heart disease and avoid elevated cholesterol levels, it is recommended that you take soy.

SUMMARY

Diseases associated with high cholesterol (and fats) are the number one killer. Fats also play a key role in the incidence of cancers and many other degenerative diseases. Cholesterol exists only in animal tissues, therefore, one's diet is an important first step in its control. For some people, however, limiting fat and cholesterol intake alone is not enough to reduce serum cholesterol to safe levels because of their own liver's production of excess cholesterol. The use of supplements to augment dietary modification can help reduce cholesterol without the side effects of many drugs.

The effectiveness of any cholesterol-reduction therapy varies considerably between individuals. The nutrients we recommend have not only been shown to lower cholesterol, but also protect against cardiovascular disease by other mechanisms such as inhibition of cholesterol-oxidizing free radicals and abnormal blood clots inside arteries (thrombosis).

The following nutritional supplements offer synergistic benefits to assist dietary modification to reduce total serum cholesterol and elevate HDL cholesterol:

- Policosanol – take one tablet twice per day with meals: one in the afternoon and one in the evening. Or Sytrinol – one capsule twice daily. Note: Do not take if it causes your cholesterol to drop below 180 mg/dL
- Fiber – 4 to 6 grams before any high-fat meal.
- Chitosan – three to six 500-mg chitosan capsules and one 1000 mg ascorbic acid capsule right before a high-fat meal.
- Niacin – 1500 to 3000 mg a day (if tolerable).
- Artichoke extract – 300 mg, 3 times a day.
- Garlic – 600 to 4800 mg a day.
- Curcumin – 900 to 1800 mg a day.
- Gugulipid – 140 mg 1 to 2 times a day.
- Green tea – 725 mg a day of green tea, 98% polyphenol extract.
- Perilla oil – 6000 mg a day. We suggest taking six 1000-mg gel caps daily. If triglycerides are high, consider taking 4-8 softgels of fish oil (EPA/DHA).
- Vitamin E – 400 to 800 IU daily
- Soy protein extract – 2 heaping teaspoons (5 to 6 grams) of soy powder daily.
- Selenium – 200 to 600 mcg daily.

Caution: Anyone who is seeking to use dietary supplements to lower high cholesterol must verify efficacy by having a cholesterol blood test 45 to 60 days after initiating a nutritional regimen. If supplements fail to work, cholesterol-lowering drugs should be considered. While blood testing is not mandatory for healthy people seeking to reduce their risk of heart attack or stroke, it is recommended that everyone have an annual blood test to establish a benchmark giving you the ability to monitor and optimize your life extension program.

FOR MORE INFORMATION

Contact the National Heart, Lung, & Blood Institute (301) 251-1222.

PRODUCT AVAILABILITY

Policosanol, Sytrinol, Niacin, Soy protein, vitamin E, garlic, perilla oil, Super EPA/DHA w/Sesame Lignans, fiber, chitosan, and artichoke extract, are available by phoning 1-800-544-4440 or order online.

Blood testing availability: Cholesterol testing information and costs can be obtained by calling (800) 208-3444.

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