

Cholesterol and Triglycerides

What You Should Know

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What are lipids?

Lipids are the fats that are present in the body. The major lipids in the bloodstream are cholesterol and triglycerides.

What are the normal functions of cholesterol in the body?

Cholesterol is an essential part of every cell in the body. It is necessary for new cells to form and for older cells to repair themselves after injury. Cholesterol is also used by the adrenal glands to form hormones such as cortisol, by the testicles to form testosterone, and by the ovaries to form estrogen and progesterone.

What are the normal functions of triglycerides in the body?

Triglycerides supply energy for the body. Triglycerides either meet immediate energy needs in muscles or stored as fat for future energy requirements.

What are the harmful effects of elevated serum cholesterol and triglycerides in the body?

Elevated serum levels of cholesterol are a major risk factor for coronary artery disease. Elevated triglyceride levels are a milder risk factor for coronary artery disease. Very high triglyceride levels are also a risk factor for acute pancreatitis. This is a condition where the pancreas becomes severely inflamed.

What are lipoproteins?

Lipoproteins are the large particles of cholesterol, triglycerides, and proteins found in the blood. Cholesterol and triglycerides are fats that are not soluble in the blood. As part of lipoproteins the cholesterol and triglycerides can be carried around in the bloodstream throughout the body. The major lipoproteins are low density lipoproteins (LDL), very low density lipoproteins (VLDL), and high density lipoproteins (HDL).

What are the "bad" and the "good" types of cholesterol?

LDL cholesterol, the cholesterol carried in LDL particles, is the "bad" cholesterol because. When elevated, LDL cholesterol can promote coronary artery disease. HDL cholesterol, the cholesterol carried in HDL particles, is the "good" cholesterol. It protects against coronary artery disease.

What causes cholesterol and triglyceride levels to be high?

High levels of cholesterol or triglycerides are usually caused by genetic or inherited disorders of lipid metabolism. These lipids may also be increased by:

- Some common medical conditions such as diabetes mellitus, hypothyroidism, kidney disease and liver disease.
- Certain medications including diuretics, blood pressure medications, prednisone, estrogens and testosterone.
- Diets high in saturated fats.
- Alcoholic beverages may significantly increase serum triglycerides.

What levels of cholesterol are considered high?

Cholesterol levels greater than 200 mg/dL plus your age are generally considered high. However, we are mainly concerned with LDL cholesterol since this is the major type that relates to coronary artery disease. It is important to also consider an individual's overall coronary risk factor profile when deciding what LDL cholesterol level is too high. Other coronary risk factors include:

- an age of 45 or older in men
- an age of 55 or older in women
- diabetes mellitus
- hypertension
- cigarette smoking
- a family history of coronary artery disease
- HDL cholesterol levels less than 40 mg/dL.

Taking these factors into consideration, the following guidelines have been recommended by the National Cholesterol Education Program (NCEP):

- For patients with less than 2 risk factors: LDL cholesterol levels above 160 mg/dL are too high.
- For patients with 2 or more risk factors: LDL cholesterol levels above 130 mg/dL are too high.
- For patients with known coronary artery disease: LDL cholesterol levels above 100 mg/dl are too high.

What levels of serum triglycerides are considered high?

Most experts consider serum triglyceride levels greater than 200 mg/dL to be too high.

How can elevated levels of cholesterol and triglycerides be lowered?

The first steps in lowering cholesterol and triglycerides are diet and exercise. When these measures fail to lower lipids enough, medications are generally added. Patients taking medications should continue their diet and exercise programs as these enhance the effects of the medications.

What types of fats are there in the diet?

- *Saturated fats* are usually solid at room temperature and are white or yellowish in color. They are found in animal products (dairy, meat, poultry) and tropical oils such as coconut oil and palm kernel (mostly used in the food industry for baked goods).

- *Unsaturated fats* are liquid at room temperature and are found mainly in vegetable oils. There are 2 types of unsaturated fats:
 - Monounsaturated fats found in olive oil, canola oil, peanut oil, almonds, hazelnuts and avocado.
 - Polyunsaturated fats found in safflower, sunflower, corn and soybean oils. A specific type of polyunsaturated fats, the omega-3 fatty acids, is produced by algae and is found in the oil of fish that eat algae.
- *Trans fatty acids or hydrogenated fats* are polyunsaturated fats (oils) that have been processed (hardened). They are found in margarine, shortening and processed foods.
- *Triglycerides* are the most common form of fat in the diet and the human body.
- *Cholesterol* is found in animal fats.

How do the different types of fats in the diet affect cholesterol levels?

The total amount of fat eaten increases body weight and serum levels of triglycerides and cholesterol.

- *Saturated fats* raise blood cholesterol more than any other type of fat.
- *Unsaturated fats* tend to lower blood cholesterol. Polyunsaturated fats lower both LDL and HDL, while monounsaturated fats lower LDL but tend to preserve HDL levels. Omega-3 fatty acids tend to increase HDL and lower triglycerides.
- *Trans fatty acids* are similar to saturated fats in regard to their effects on cholesterol and triglycerides.
- *Cholesterol* increases the serum cholesterol level, but the increase is not as great as that seen with saturated fats.

What dietary measures are useful for lowering cholesterol?

A diet that is low in cholesterol and saturated fat will lower serum cholesterol levels by up to 10%. The American Heart Association has two diets it recommends for lowering cholesterol levels. Check with your health care provider for more specifics about these.

The types of fats eaten should be 30-45% monounsaturated fats, less than 30% polyunsaturated fats and less than 30% saturated fats. Cholesterol intake should be less than 300 mg/day.

Soluble fiber, like that found in oats, rice, bran, barley, dried peas and beans, and fruits, also helps lower the serum cholesterol level.

What medications are useful for lowering cholesterol?

- *Statins* lower LDL cholesterol by 20-50%. The medications in this category include pravastatin (Pravachol), simvastatin (Zocor), atorvastatin (Lipitor), lovastatin (Mevacor), and fluvastatin (Lescol).
- *Nicotinic acid* lowers LDL cholesterol by 15-25%. The available medications include Niacin and Niaspan.
- *Bile acid resins* lower LDL cholesterol levels by 15-25%. The medications in this category are cholestyramine (Questran) and colestipol (Cholestid).
- *Fibrates* lower LDL cholesterol by 10-20%. Currently available fibrates include gemfibrozil (Lopid) and fenofibrate (Tricor).

What are the potential side effects from these medications?

Statins rarely have side effects but on occasion may cause inflammation of the liver and/or muscles. This could cause muscle aches or weakness. These conditions are easily detected by simple blood tests for levels of liver enzymes (AST and ALT) and muscle enzymes (CPK). They generally resolve once the medication is stopped.

Nicotinic acid commonly causes flushing of the skin and a diffuse warm or burning sensation. These symptoms can be minimized or eliminated by starting at a low dose and increasing very gradually to the target dose and increasing very gradually to the target dose by taking aspirin. (Follow your doctor's orders carefully.) Another side effect is abdominal pain due to irritation of the esophagus and/or stomach. Patients with a history of significant heartburn, gastritis, or ulcers should probably avoid this drug. It may also increase the serum glucose level and the uric acid level. It must be used with caution in patients with diabetes or gout.

Bile acid resins most often cause constipation.

Fibrates may, like the statins, cause inflammation in the liver and/or muscles. This is even more likely to occur if they are used in combination with a statin drug. Fibrates may also increase the risk of developing gallstones.

What are the goals levels of cholesterol on treatment?

Considering both LDL cholesterol and other risk factors, the National Cholesterol Education Program recommends the following goals:

- For patients with less than 2 risk factors: LDL cholesterol levels should be less than 160 mg/dL.
- For patients with 2 or more risk factors: LDL cholesterol levels should be less than 130 mg/dL.
- For patients with known coronary artery disease: LDL cholesterol levels should be less than 100 mg/dL.
- For patients with diabetes: LDL cholesterol levels should be less than 100mg/dL.

Does lowering cholesterol prevent heart attacks or strokes?

Multiple studies have shown that aggressively lowering serum cholesterol levels significantly reduces a patient's risk of having heart attacks and of having strokes.

What dietary measures are useful for lowering triglycerides?

The American Heart Association diets, discussed earlier, are also effective for lowering triglycerides. Additionally, patients with high serum triglycerides should significantly limit their intake of alcoholic beverages and refined carbohydrates (sweets).

What medications are useful for lowering triglycerides?

- *Fibrates* lower triglycerides by 35-50%. Currently available fibrates include gemfibrozil (Lopid) and fenofibrate (Tricor).
- *Nicotinic acid* lowers triglycerides by 20-40%. The available medications include Niacin and Niaspan.
- *Omega 3 fatty acids* lower triglycerides by 15-35%. The fatty acids of interest are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Capsules typically contain 300-375 mg of EPA and DHA combined. Common brands include MaxEPA and Promega. Ask your physician about appropriate amounts to take.
- *Statins* lower triglycerides by 10-35%. The medications in this category include pravastatin (Pravachol), simvastatin (Zocor), atorvastatin (Lipitor), lovastatin (Mevacor), and fluvastatin (Lescol).

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What other measures help to lower triglycerides?

Many people with elevated serum triglyceride levels have diabetes mellitus. Good control of blood glucose levels often dramatically reduces triglyceride levels. Since alcohol is a potent stimulus for triglyceride production in the body, not drinking alcohol can also have dramatic effects. Some women develop marked elevations of their triglyceride levels after being placed on oral estrogens. (Speak with your physician about what would be best for you to treat this problem.)

How can HDL cholesterol levels be increased?

Low HDL cholesterol is one of the most difficult lipid problems to treat. Regular aerobic exercise is probably the best overall measure to raise the HDL level. Drinking alcohol, particularly red wine, will also raise the HDL in many people. Caution must be used because of the adverse health effects of excess alcohol and alcohol addiction. Ask your physician about whether using alcohol is appropriate for you. Grape juice has also been found to increase HDL levels. Medications may also be effective. Nicotinic acid often raises the HDL cholesterol by 10-20%, fibrates may raise the HDL by 10-15% and statins may raise it by 5-10%.