

# CHOLESTEROL

## What Is Cholesterol?

### What is cholesterol and why is it normally present in the body?

Cholesterol is a fat. Fat is the substance which stores energy in the body. Cholesterol, however, has special functions. It provides support to the walls of each cell. (Cell walls like the walls of a house, keep certain things in and other things out.) Cholesterol also provides structure to certain hormones such as estrogen, progesterone, testosterone, and cortisol, which protects against inflammation. Cholesterol does another important thing. During the formation of cholesterol, small pieces are broken off, just like a sculptor removes clay as a figure is being created. These small pieces are used by the body to help turn on different chemical reactions that happen inside each cell.

### Where does cholesterol come from?

A small amount comes from the diet, but most is made by assembling other smaller fats. Saturated fats – fats that are “saturated” with hydrogen – raise the cholesterol. Unsaturated fats lower the cholesterol. Saturated fats are usually solid at room temperature. Unsaturated fats are usually liquid at room temperature except for the tropical oils like palm and coconut oil, which are more saturated. Trans fats are fats that start out as liquid fats but hydrogen is added to make them last longer (and possibly taste better). These are used in fast food products.

### Where does it go?

Cholesterol circulates largely attached to a lipid and protein mixture called a lipoprotein. This helps the cholesterol stay dissolved in the blood and makes it easier to get the cholesterol to where it has to go (to cell walls for example). It is then metabolized in the liver and some is secreted in the bile. Low density lipoprotein (LDL) is associated with blood vessel disease, while high density lipoprotein (HDL) actually reduces the risk of disease associated with cholesterol in the blood vessel wall.

### Can anything get the cholesterol out of the vessel wall?

Reducing the amount of saturated fat in the diet and increasing the amount of unsaturated fat helps to lower the cholesterol in the blood and reduce the amount in the vessel wall. If diet alone does not work, there are drugs that can help. One type of drug works by reducing cholesterol production. Another type reduces the absorption of cholesterol from the intestine. Still another works, in part,

by increasing the metabolism of cholesterol. There is another type of cholesterol in circulation found in a lipoprotein (see question 3) called a high density lipoprotein. This lipoprotein actually helps to remove cholesterol from the vessels. Some drugs help to increase this, as does exercise.

### What are triglycerides?

Triglycerides are another type of fat. The production of triglycerides is increased by carbohydrates (like sugars) in the diet. Triglycerides can indirectly influence blood vessel disease because they influence the size of the LDL (see question 3) particle. Small, dense LDL particles are more likely to get into the blood vessel and cause damage. Large buoyant LDL particles are less likely to cause damage. High triglycerides are associated with more of the small, dense LDL particles.

## Signs & Symptoms

To help you determine if you are at risk for developing heart problems due to cholesterol, please review the following risk assessment.

Questions	Yes	No
Do you have high cholesterol? High cholesterol $\geq$ 240 mg/dL		
Do you have low HDL – C? Low HDL (higher risk) = Less than 40 mg/dL		
Are you over the age of 65?		
Do you smoke cigarettes?		
Do you have a family history of coronary artery disease?		
Do you have problems with your blood clotting?		

The number of times you answered yes, indicates your increased chances of developing heart problems. Ideally, we would like to eliminate these risk factors through prevention, which is the best method. But if it is too late for prevention, healthy living to control these risk factors is the best next step. Medications and/or lifestyle changes can lower levels, thereby decreasing your chances of having complications from these risk factors.

## Conditions

### High Cholesterol

High cholesterol levels often go hand in hand with diabetes. The cholesterol can lead to blocked arteries. This can cause heart attacks and strokes. You can reduce your risk by eating a low-fat diet, stop smoking, and exercise often. You may also need to take a cholesterol medication.

### Why does cholesterol become harmful?

Cholesterol gets into many places in the body, including inside the lining of blood vessels. Once inside the lining, some of the cholesterol is damaged by a highly charged form of oxygen (oxygen provides particles, which help to release energy from food but the oxygen becomes highly charged and very reactive). The damaged cholesterol causes a plaque to be formed in the vessel wall. If this plaque breaks loose (ruptures) it can cause a clot to form inside the vessel wall and block the flow of blood. This can lead to a heart attack or stroke, or problems with blood flowing to the legs.

### Diabetes

High cholesterol increases diabetes complications. Having diabetes increases the risk of heart disease. Diabetics can protect their heart by controlling their cholesterol, blood pressure, and triglyceride levels.

### What is diabetes?

Diabetes is a disorder associated with a high sugar level in the blood. Normally, insulin moves the sugar from the blood into tissues where it is used for energy. In type 1 Diabetes Mellitus, there is a deficiency of insulin due to a disease of the pancreas. In type 2 Diabetes Mellitus, the body is resistant to the effect of insulin. In either case, because the sugar cannot go into the tissues, it stays in the blood and results in a high “blood sugar.” High blood sugar is defined as a fasting blood sugar (a sugar done after not eating for 8 hours) of 126 mg/dl or greater or a random blood sugar over 200 mg/dl. (mg/dl refers to the number of milligrams of sugar dissolved in a certain volume of blood -- either whole blood, or the liquid part of blood, plasma or serum)

## Prevention

To help you stay “heart healthy,” please complete the following action plan. You can adopt several suggestions below or add your own. Just completing one of the suggestions will get you on the road to a healthier you. Remember, it is important to discuss your plan with your doctor prior to implementation to make sure the plan is right for you.

1. I will see my doctor to discuss how I can either eliminate or control my risk factors.

2. I will develop an exercise program that fits into my lifestyle and needs.
3. I will follow a healthy diet that includes protein, carbohydrates, fat, fiber and calories.
4. I will see my doctor on a regular basis.
5. I will stop smoking.
6. I will practice intensive diabetes self management.
7. I will reduce my BMI to a healthy number.

## Treatment

### What should be done if the fats are high?

First, an underlying cause should be sought. For example, thyroid disease can be associated with abnormalities of the fats in the blood. A condition in which there is resistance to the action of insulin that can lead to a high triglyceride and low HDL. A few other conditions must be considered as well. Even if there is no underlying problem, other things which increase the risk of heart disease and other vascular disorders such as obesity, diabetes, smoking, and high blood pressure must be treated if present.

### What should be done to be sure the lipids are under control?

The cholesterol associated with the LDL (low density lipoprotein) should be monitored carefully. The LDL & HDL values are more important than the total cholesterol. The goal depends on the situation –whether there are no, one, or more than one risk factor for heart disease and other vascular problems. The exact target should be set by the physician. The HDL (the good cholesterol) should be treated if it is too low. The triglycerides should also be lowered if too high. These levels usually should be measured fasting. Imaging of the heart and blood vessels should be carried out to see if any plaque is present. A careful eye exam and foot exam is needed.

### High Triglycerides

#### *What can be done about high triglycerides?*

Reducing the amount of carbohydrate (especially simple sugars) in the diet often helps and losing weight (for those who are overweight) is useful also. If none of this works, medication is available.

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## REFERENCES

- American Heart Association. 2004. *What Do My Cholesterol Levels Mean?* <http://www.americanheart.org/pre-senter.jhtml?identifier=3004817>
- Centers for Disease Control and Prevention. 2007. <http://www.cdc.gov/cholesterol/prevention.htm>

