

# CHOLESTEROL

## STEROLS

and

## LECITHIN

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### **IMPORTANT**

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### **Introduction**

#### **What is Cholesterol?**

Cholesterol is a steroid alcohol sterol, produced naturally by the liver, and is an essential component for animal cell health. It is needed maintain cell membrane health, to form bile acids, maintain a healthy metabolism, and to produce various hormones.

Cholesterol is a waxy steroid metabolite found in the cell membranes and transported in the blood plasma of all animals. It is an essential structural component of mammalian cell membranes, where it is required to establish proper membrane permeability and fluidity. In addition, cholesterol is an important component for the manufacture of bile acids, steroid hormones, and several fat-soluble vitamins. Cholesterol is the principal sterol synthesized by animals, but small quantities are synthesized in other eukaryotes, such as plants and fungi. It is almost completely absent among prokaryotes, which include bacteria.

Unfortunately, cholesterol cannot dissolve in the blood, so it has to be transported to and from the cells by carriers called lipoproteins. Low-density lipoprotein, or LDL, is known as “bad” cholesterol. High-density lipoprotein, or HDL, is known as “good” cholesterol. These two types of lipids, along with triglycerides and Lp(a) cholesterol, make up your total cholesterol count, which can be determined through a blood test.

## **LDL (Bad) Cholesterol**

When too much LDL (bad) cholesterol circulates in the blood, it can slowly build up in the inner walls of the arteries that feed the heart and brain. Together with other substances, it can form plaque, a thick, hard deposit that can narrow the arteries and make them less flexible. This condition is known as atherosclerosis. If a clot forms, and blocks a narrowed artery, then a heart attack or stroke can result.

## **HDL (Good) Cholesterol**

About one-fourth to one-third of blood cholesterol is carried by high-density lipoprotein (HDL). HDL cholesterol is known as "good" cholesterol, because high levels of HDL seem to protect against heart attack. Low levels of HDL (less than 40 mg/dL) also increase the risk of heart disease. Medical experts think that HDL tends to carry cholesterol away from the arteries and back to the liver, where it's passed from the body. Some experts believe that HDL removes excess cholesterol from arterial plaque, slowing its build-up.

## **Triglycerides**

Triglyceride is a form of fat made in the body. Elevated triglycerides can be due to overweight/obesity, physical inactivity, cigarette smoking, excess alcohol consumption and a diet very high in carbohydrates (60 percent of total calories or more). People with high triglycerides often have a high total cholesterol level, including a high LDL (bad) level and a low HDL (good) level. Many people with heart disease and/or diabetes also have high triglyceride levels.

## **Lp(a) Cholesterol**

Lp(a) is a genetic variation of LDL (bad) cholesterol. A high level of Lp(a) is a significant risk factor for the premature development of fatty deposits in arteries. Lp(a) is not fully understood, but it may interact with substances found in artery walls and contribute to the build-up of fatty deposits.

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## **What are plant sterols and stanols?**

Sterols and stanols are found naturally in a range of plant sources such as vegetable oils, nuts, grains, seeds, wood pulp and leaves. Their chemical structure is similar to cholesterol made by the human body, but they are thought to help lower cholesterol levels in the blood. A high level of cholesterol is one of the main risk factors for coronary heart disease - along with smoking, lack of physical activity, high blood pressure, diabetes, family history and being overweight or obese.

Sterols of plants are called phytosterols and sterols of animals are called zoosterols. Important zoosterols are cholesterol and some steroid hormones; notable phytosterols include campesterol, sitosterol, and stigmasterol. Ergosterol is a sterol present in the cell membrane of fungi, where it serves a role similar to cholesterol in animal cells.

Phytosterols, more commonly known as "plant sterols", have been shown in clinical trials to block cholesterol absorption sites in the human intestine, thus helping to reduce cholesterol in humans.

## **How do plant sterols and stanols work?**

Cholesterol has a special transport system for reaching all cells that need it. It uses the blood circulation as its 'road system' and is carried on vehicles made up of proteins. These combinations of cholesterol and proteins are called lipoproteins. There are two main forms of lipoproteins - low density lipoproteins (LDL cholesterol) which carry cholesterol from the liver to the cells. These are harmful to the heart as they can get converted into fatty deposits in the inner lining of the coronary arteries. The second form are the high density lipoproteins (HDL) that are protective to the heart as they return the excess harmful cholesterol back to the liver to be broken down.

Plant sterols and stanols are thought to reduce the absorption of cholesterol by our intestine. This reduction in absorption makes the liver remove more harmful LDL cholesterol from our circulation, thereby reducing the amount of LDL in the blood. It is believed that plant sterols and stanols lower the total cholesterol level and the level of harmful low density lipoproteins (LDL), but seem to have no effect on the heart-friendly HDL cholesterol levels.

It is difficult to get significant amounts of sterols from the foods that we eat. It is, however, important to eat high sterol foods, as well as take supplementary sterols, because these foods contain important vitamins and minerals, as well as fibre. In fact, by eating foods that naturally contain sterols, you will also naturally increase your intake of dietary fibre.

All vegetables contain values from 5 to 40 mg of plant sterols, with fruits containing slightly less. The amount of sterols can be increased by drying, because vegetables contain a large percentage of water. Unfortunately, cooking, milling, and refining processes all remove a lot of the sterols from the finished product. However, grating or juicing retains sterols, because the food remains in a raw state.

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## **Foods Containing Sterols**

### **Cereals**

All whole grains are rich in plant sterols. Some that have the highest amounts include:

- Rice bran
- Wheat germ
- Oat bran
- Bran
- Whole wheat
- Brown rice

### **Legumes**

Legumes are a rich source of sterols:

- Dried peas
- Dried beans
- Lentils

### **Nuts and Seeds**

Nuts and seeds are a good source of plant sterols - peanuts are one of the best sources of natural sterols.

- Peanuts
- Almonds
- Walnuts
- Pecans
- Sunflower seeds
- Pumpkin seeds
- Sesame seeds

### **Fruits and Vegetables**

Fruits and vegetables have trace amounts of plant sterols. However, the amounts are so small that an individual would need to eat just under 22.7 Kg of produce to get the recommended 800 mg of plant sterols per day.

Fruits and vegetables that are a good source of sterols include:

- Apples
- Avocados
- Broccoli
- Brussels sprouts
- Cauliflower
- Dill
- Tomato
- Vegetable oils
- Wheat germ oil

#### Common sterol sources and values - USA

Product	Serving Size	Amount
Almonds	1 oz.	30 mg
Apple	one	25 mg
Benecol	1 tbs.	450 mg
Corn oil	1 tbs.	135 mg
Garbanzo beans	1 oz.	10 mg
Minute Maid Heartwise O.J.	8 oz.	1000 mg
Promise Activ Super Shots	1 tbs.	2000 mg
Sesame seeds	1 tbs.	100 mg

#### Nature's Top Ten Sterol Sources

1. Corn oil - This is a good source of healthy polyunsaturated fat, which helps cut cholesterol.  
*0.13 g\* per 1 Tbsp*
2. Sunflower oil - High in monounsaturated fat, it lowers risk of heart disease and provides nutrients to keep cells healthy.  
*0.1 g\* per 1 Tbsp*
3. Beans - They are full of fibre; studies show fibre-rich foods help lower your heart attack risk.  
*0.07 g\* per 1/2 c*
4. Corn - It contains folate, a B vitamin that reduces damage to blood vessels.  
*0.06 g\* per 1/2 c*
5. Peanut butter - The protein keeps you feeling full, which helps keep weight in check.  
*0.05 g\* per 2 Tbsp*
6. Olive oil - An excellent source of good monounsaturated fats, which help lower bad LDL cholesterol and raise good HDL cholesterol.  
*0.03 g\* per 1 Tbsp*
7. Almonds - The monounsaturated fats and vitamin E work together to cut cholesterol.  
*0.02 g\* per 1 oz*
8. Orange - This fruit is an excellent source of immune-boosting vitamin C.  
*0.02 g\* per 1 small*
9. Apple - It provides filling, waist-friendly fibre.  
*0.01 g\* per 1 small*
10. Avocado - Known for its monounsaturated fat, and also contains potassium to help regulate blood pressure.  
*0.008 g\* per 1 oz*

*\*Amount of natural sterols present.*

## **Common Foods containing Sterols**

The following are common foods naturally rich in plant sterols and sterolins:

- Almonds
- Avocado
- Cold-pressed olive oil
- Peanuts
- Sesame seeds
- Soybeans
- Sunflower seeds
- Walnuts
- Wheat germ oil

Other forms of natural herbs and supplements believed to help reduce LDL cholesterol include:

- Aspirin (80 mg 2 x a week)
- Extra Virgin Olive Oil (1 tablespoon daily)
- Green Tea
- Liquorice Extract
- Vitamin C and E

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## **Reducing LDLs**

- Reduce saturated fat to less than 7% of calories (for a 2,000 calorie diet, that's less than 15.5 g)
- Control calories to help maintain a healthy weight
- Decrease dietary cholesterol to less than 200 mg per day
- Have 20-30 g of fibre per day (10-25 g should be soluble fibre)
- Add 2 g of sterols/stanols per day

## **Foods to Lower LDL**

### **Oatmeal and oat bran**

Oatmeal contains soluble fibre, which reduces your low-density lipoprotein (LDL), the "bad" cholesterol. Soluble fibre is also found in such foods as kidney beans, apples, pears, psyllium, barley and prunes.

Soluble fibre appears to reduce the absorption of cholesterol in your intestines. Ten grams or more of soluble fibre a day decreases your total and LDL cholesterol. Eating 1.5 cups of cooked oatmeal provides 6 grams of fibre. If you add fruit, such as bananas, you'll add about 4 more grams of fibre. To mix it up a little, try steel-cut oatmeal or cold cereal made with oatmeal or oat bran.

### **Nuts, esp. Walnuts, almonds, etc**

Studies have shown that walnuts can significantly reduce blood cholesterol. Rich in polyunsaturated fatty acids, walnuts also help keep blood vessels healthy and elastic. Almonds and some other nuts appear to have a similar effect.

According to the USA Food and Drug Administration, eating about a handful (43 grams) a day of most nuts, such as almonds, hazelnuts, peanuts, pecans, some pine nuts, pistachio nuts, and walnuts, may reduce the risk of heart disease.

However, all nuts are high in calories, so only a handful is recommended. As with any food, eating too much can cause weight gain, and being overweight places the individual at higher risk of heart

disease, etc. To avoid weight gain, replace foods high in saturated fat with nuts. For example, instead of using cheese, meats, or croutons in a salad, add a handful of walnuts or almonds.

### **Fish and omega-3 fatty acids**

Research has confirmed the cholesterol-lowering benefits of eating fatty fish because of its high levels of omega-3 fatty acids. Omega-3 fatty acids also help the heart by reducing blood pressure and the risk of blood clots. In people who have already had heart attacks, fish oil - or omega-3 fatty acids - significantly reduces the risk of sudden death.

Therapists recommend eating at least two servings of fish per week. The highest levels of omega-3 fatty acids are in mackerel, lake trout, herring, sardines, albacore tuna, and salmon. However, to maintain the heart-healthy benefits of fish, it should be baked or grilled it. If an individual does not like fish, they can also get omega-3 fatty acids from foods like ground flaxseed or canola oil.

Moreover, an individual can take an omega-3 or fish oil supplement to get the beneficial effects; nevertheless, they will not get all the other nutrients in fish, such as selenium. If it is decided to take a supplement, the individual should remember to watch their diet and eat lean meat or vegetables in place of fish.

### **Olive oil**

Olive oil contains a potent mix of antioxidants that can lower the "bad" (LDL) cholesterol, but leave the "good" (HDL) cholesterol untouched.

The USA Food and Drug Administration recommend using about 2 tablespoons (23 grams) of olive oil a day to get its heart-healthy benefits. To add olive oil to your diet, you can sauté vegetables in it, add it to a marinade, or mix it with vinegar as a salad dressing. You can also use olive oil as a substitute for butter when basting meat.

Some research suggests that the cholesterol-lowering effects of olive oil are even greater if you choose extra-virgin olive oil, meaning the oil is less processed and contains more heart-healthy antioxidants. However, avoid "light" olive oils - this usually means the oil is more processed and lighter in colour, not in fat content or calories.

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### **How much do I need to eat a day to have an impact on my cholesterol levels?**

Stanols and sterols are present in small amounts in many fruits, vegetables, nuts, seeds, cereals and other plant foods but a healthy diet can only provide a modest intake. Our typical daily intake usually ranges from 160 to 400 mg a day, although strict vegetarians may have a daily intake between 600 and 800 mg. It is thought that plant sterols/stanols have little effect on cholesterol absorption at these levels of intake.

Margarines, orange juice and yogurt drinks fortified with plant sterols can help reduce LDL cholesterol by more than 10 percent. The amount of daily plant sterols needed for results is at least 2 grams - which equals about two 237 ml servings of plant-sterol fortified orange juice a day.

Studies suggest that if you consume around 2g of plant sterols/stanols, this can reduce LDL cholesterol levels by 10-15%, although there is considerable variation between individuals. Higher intakes are achieved from supplements or functional foods, such as premium price margarines, yogurts and other milk products. To sustain LDL-cholesterol reductions from these products, individuals need to consume them daily.

Plant sterols or stanols in fortified foods do not appear to affect levels of triglycerides or of "good" high-density lipoprotein (HDL) cholesterol. Nor do they interfere with the absorption of the fat-soluble vitamins - vitamins A, D, E and K.

The American Heart Association recommends foods fortified with plant sterols for people with levels of LDL cholesterol over 160 milligrams per decilitre (4.1 mmol/L).

### **Sterol Supplements**

Plant sterols are naturally found in many fruits, vegetables, nuts and seeds as part of their cell membrane. They are similar to the body's own cholesterol and help in the regulation of LDL cholesterol. A good sterol supplement should provide least 700 mg plant sterol esters (this is similar to ones found in expensive margarine spreads, etc). Dosage should be as directed by the manufacturer.

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### **Lecithin**

The action of lecithin on the heart is the most important of all its proved benefits. It achieved its popularity initially in this area. Cholesterol is a fatty substance that tends to collect in the walls of the arteries and veins, thus narrowing them. This may eventually lead to a fatal blood clot.

Studies have shown that lecithin has the ability to break up cholesterol into small particles which can be easily handled by the system. With sufficient intake of lecithin, cholesterol cannot build up against the walls of the arteries and veins.

Like cholesterol, lecithin is continuously produced in the liver, passes into the intestine with bile and is absorbed in the blood. It helps in the transportation of fats. It also helps the cells to remove fats and cholesterol from the blood and to utilise them. It increases the production of bile acids made from cholesterol, thereby reducing the amount in the blood. It will thus be seen that cholesterol can cause trouble only if lecithin is lacking in the system.

All atherosclerosis or changes in the arterial walls are characterised by an increased of the blood cholesterol and a decrease in lecithin. It has been shown that experimental heart disease, produced by feeding cholesterol, could be prevented merely by giving a small quantity of lecithin.

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## **Appendix - Cholesterol Levels**

### **Introduction**

Cholesterol Levels are typically measured in \*mg/dL (milligrams (mg) per decilitre (dL)), and are broadly interpreted as follows:

\*(mg/dL - A measure of concentration (mass per unit volume) using milligrams per decilitre)

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### **Total Cholesterol Levels**

#### **Less than 200 mg/dL - Desirable**

If the LDL, HDL and triglyceride levels are at desirable levels, and there are no other risk factors for heart disease, total blood cholesterol below 200 mg/dL puts the individual at a relatively low risk of coronary heart disease.

#### **200-239 mg/dL - Borderline-High Risk**

If the total cholesterol falls between 200 and 239 mg/dL, it is advisable that the individual LDL, HDL, and triglyceride levels be evaluated.

#### **240 mg/dL and over - High Risk**

Individuals who have a total cholesterol level of 240 mg/dL or more typically have twice the risk of coronary heart disease as people whose cholesterol level is desirable (<200 mg/dL).

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### **HDL Cholesterol Levels (Good Cholesterol)**

With HDL (good) cholesterol, higher levels are better:

Low HDL cholesterol (less than 40 mg/dL for men, less than 50 mg/dL for women) puts you at higher risk for heart disease.

In the average adult male, HDL cholesterol levels range from 40 to 50 mg/dL.

In the average adult female, HDL cholesterol levels range from 50 to 60 mg/dL.

An HDL cholesterol of 60 mg/dL, or higher, gives some protection against heart disease.

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### **LDL Cholesterol Levels (Bad Cholesterol)**

Less than 100 mg/dL	Optimal
100 to 129 mg/dL	Near Optimal/ Above Optimal
130 to 159 mg/dL	Borderline High
160 to 189 mg/dL	High
190 mg/dL and above	Very High

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### **Triglyceride Levels**

Normal:	less than 150 mg/dL
Borderline-High:	150–199 mg/dL
High:	200–499 mg/dL
Very High:	High: 500 mg/dL
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