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Winning the Battle with Cholesterol

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Cholesterol's Good Side

Many people don't realize that cholesterol is an important part of your life. The fact is, you wouldn't be able to live without cholesterol. Cholesterol is defined as a waxy, fatty alcohol, and this fatty substance has very important functions in your body.

Cholesterol is an important part of the membranes of every cell in your body, helping them to be mobile so that they don't crumble or break when you move. Cholesterol is necessary to make certain hormones, like reproductive hormones (estrogen, testosterone, progesterone, etc.) and adrenal hormones (aldosterone, cortisol, etc.).

Cholesterol is used to make Vitamin D, which is actually a hormone and not a vitamin. Vitamin D is necessary to help your bones be healthy by regulating your calcium levels. Low vitamin D levels are associated with poorer mental function, asthma, obesity, diabetes, heart disease, cancer, and a number of other conditions.

Cholesterol is also an important component of bile. Bile is like a detergent, breaking down the fats in the digestive tract into small pieces so that the digestive enzymes can digest the fat. Bile is produced in your liver and stored in your gallbladder. The gallbladder releases the bile when fats enter your digestive tract so that the fats can be broken down. And bile is what makes your stool brown in color.

Cholesterol also assists in the transportation of molecules inside your cells so that they can function properly. It is involved in the communication process between the outside and the inside of the cell, allowing cells to respond to their environment around them. It helps nerves to be able to conduct impulses from one area to another. And it also helps cells be able to take larger particles inside of itself (like white blood cells eating bacteria and other harmful substances), through a process called phagocytosis (cell eating).

Cholesterol Metabolism

Liver cells produce the greatest amount of cholesterol (~20%), but other tissues produce it as well. Other high producers are the intestines, adrenal glands, and reproductive organs. It is estimated that a 150-pound male will produce about 1,000mg of cholesterol every day. His body will contain about 35,000mg of cholesterol in total, most of which is found within the cell membranes. And depending upon the needs of the body, the digestive tract will absorb between 15 and 75% of the cholesterol in the meal, with an average absorption of about 50%.

There is a process in which cholesterol, in the form of bile, recycles between the liver and the intestines, called the enterohepatic circulation. In this process, cholesterol is made into bile, and the bile is released into the digestive tract to assist with the breakdown of fats. That bile travels down the small intestines, and near the end of the small intestines, about 95% of the cholesterol is reabsorbed into the blood and taken back to the liver, which recycles it to make more bile with.

Besides simply eating or not eating cholesterol, or changing how much cholesterol is absorbed, there is another mechanism in place to control cholesterol levels. As absorption and dietary intake of cholesterol increases, cellular production of cholesterol decreases, and as absorption and dietary intake of cholesterol decrease, cellular production increases.

Cholesterol Levels

How much cholesterol should you have in your blood? Ideally, your total cholesterol level should be less than 150mg/dl. Several large studies have shown that the level of total cholesterol which is protective against heart attacks is below 150mg/dl. In fact, approximately 35% of all heart attacks happen in people with cholesterol levels between 150 and 200, which is considered to be normal on your blood tests. Triglycerides are the storage form of fats which fill your fat cells and get broken down into sugars when you need energy, and triglycerides should be below 100mg/dl. Low density lipoprotein (LDL), which is your “bad” cholesterol, should be ideally be below 70mg/dl. And your high density lipoprotein (HDL), which is your “good” cholesterol, should be as high as possible. But if your total cholesterol is below 150mg/dl, your HDL may be low, and that is okay.

Cholesterol Transportation

Since cholesterol is a fat, and your blood is mostly water, and because fats and waters don’t mix well, how can you carry all of that fat in the blood? The body’s solution is to wrap the fats in a blanket which has a type of carbohydrate called glycerol on the outside and fats on the inside. The glycerol likes water and mixes well with it, and the cholesterol and triglycerides like the fatty side of the blanket and stay on the inside. That blanket wraps around the fat, making a sphere around it, and transporting it through the blood to different parts of the body.

“Bad” cholesterol (very low density lipoprotein (VLDL), intermediate density lipoprotein (IDL), large buoyant low density lipoprotein (LDL), and especially small dense LDL) contain a protein marker on its surface, called apoB, which carries cholesterol from the liver to the body (like the arteries) to drop it off there. This cholesterol then contributes to the formation of plaques in your arteries. “Good” cholesterol (high density lipoprotein [HDL]) contains a protein marker on its surface called apo A-1, which carries cholesterol from the body to the liver so the liver can use it. Different types of these fat shuttles are different sizes, with VLDL being very large, HDL being very small, and the others in between.

High Cholesterol & the Arteries

Cholesterol is not a problem. High cholesterol is a problem. Why is it a problem? When you have high levels of cholesterol, especially the smaller sized “bad” cholesterol (LDL), the white blood cells in your blood stream start eating up some of the extra cholesterol molecules and carrying them around inside of themselves. When there is a problem with the wall of an artery, inflammatory signals are released, and those white blood cells go to the area to find out what is wrong and take care of it. In the process, they come out of the circulation and enter the wall of the artery and die in the process of fighting whatever they find. When they die, they leave behind the cholesterol that they were carrying.

More and more of these white blood cells come to finish up the work, and they die, leaving more cholesterol behind. The cells in the wall of the artery start changing because of this and start trying to put a cap on the top of the cholesterol and contain it. Now you have a developing plaque or blockage in the artery. This plaque can rupture and cause a blood clot or can continue growing until there is too little room for blood to go by, and then you have problems.

When the plaque blocks the blood going to the brain, it can cause a stroke. If it blocks blood going to the heart, it can cause a heart attack. When it blocks blood going to the kidney, it can cause high blood pressure, kidney damage and eventually kidney failure. And if it blocks blood flow going to the legs, it can cause poor wound healing, ulcers, and a painful condition called claudication where you have aching pain in your legs when you walk a certain distance.

But not all cholesterol acts the same. It is the smaller sized LDL cholesterol molecules which are strongly associated with the development of plaque. The more HDL you have, conversely, the less plaque development you have. So HDL appears to be protective.

As mentioned before, those plaques can either continue growing until they block off the artery and stop blood flow, or they can rupture and form a blood clot. This is dangerous, because you can have a relatively small plaque (only blocking about 30% of the artery lumen), and therefore no symptoms related to it, but it can kill you if it is in a very important artery and it ruptures. Because when it ruptures, a blood clot will form and immediately cut off blood flow. But how do these soft plaques rupture?

We know that cholesterol concentration increases within minutes of a meal containing cholesterol, and it can remain elevated for up to 7 hours after the meal. If you have cholesterol collected in a plaque in your artery and then you eat a meal high in fats and cholesterol, more cholesterol will get deposited in those plaques, and when the cholesterol becomes concentrated, it can crystalize forming sharp crystals that can puncture the wall of the artery, causing a blood clot. So, the next high-fat meal you eat, could be your last.

Cholesterol Sources

Where is cholesterol found? Cholesterol is found in animals, including cattle, fish, poultry, and anything else that moves on its own. If it can run, swim, or fly away from you if you try to kill it and eat it, it has cholesterol. If it has a face or a mother, it has cholesterol. Simply put, if it is or was an animal, or it comes from an animal (diary & eggs), it has cholesterol in it.

Triglycerides

Triglycerides are fat molecules made of a glycerol backbone and three fatty acid tails. This is the main form of fat in humans, animals, and plants. Triglycerides are the form of fat that gets stored in adipose (fat) tissue and is then broken down in the cells of the body to sugars to be used as energy.

The fatty acid tails in the triglyceride molecule are important. These fatty acid tails are made of long chains of carbons hooked together. And on the sides, they have hydrogen atoms attached. If the fatty acid chain has the maximum number of hydrogen atoms attached to it, it is called a saturated fat (saturated—full—with hydrogen atoms), and saturated fats have straight tails. If the fatty acid chain has one double bond between two of the carbons, it removes two of the hydrogen atoms, and causes the tail to bend. This is a monounsaturated fat (mono means one or alone). If the fatty acid chain has more than one double bond between the carbons, it causes the chain to bend and then bend multiple times. This is a polyunsaturated fat (poly means many).

Usually, when there is a double bond in the tail, the two hydrogens stay on the same side—the cis side (cis means same-sided). This makes the tail bend. But, you can have a situation where the two hydrogens end up on the opposite side of each other—the trans side (trans means across from). This makes the tail straighten back out. These tails have a weak attraction for each other, but they have to be very close together in order for these attractive forces to draw them together. When the fatty acid tail is straight, they can fit together very closely and then attract to each other and hold together. If the tails are bent, they cannot come close enough together to attract well, and there is not as much force to draw them together.

This shape of the fatty acid tails explains why saturated fats and trans fats (which have straight tails) are solid at room temperature, and monounsaturated and polyunsaturated fats (which have bent tails) are liquid at room temperature. Trans fats are harmful for the body. They promote inflammation, increase the bad cholesterol, and decrease the good cholesterol. Saturated fats from animal sources is also bad for you, as they promote more cholesterol deposits and promote heart disease. It appears that the healthier fats are polyunsaturated and monounsaturated fats. But these should be eaten mostly in their natural form (in the olive, vegetable, etc.) rather than in the oil form.

Steps in Overcoming High Cholesterol

Now that we understand cholesterol and triglycerides a little more, let us look at steps that you and I can take to win the battle with high cholesterol.

Step 1 – stop eating animals and their byproducts.

The only source of cholesterol in the diet is in animals and their byproducts. Your body produces all of the cholesterol that you need, so you don't need any cholesterol in your diet. The cholesterol that you get from your diet increases the cholesterol in your body beyond what your body can tolerate and leads to high cholesterol levels and all of the complications discussed already (heart attack, stroke, etc.). The single thing that you can do to make the largest impact upon your cholesterol levels is to stop eating animals and their byproducts.

Step 2 – eat a high fiber diet.

Fiber, which is a form of carbohydrate that you cannot digest, is only found in plants. Fiber has been shown to help with a number of things. We know that the more fiber you have in the diet, the less you struggle from constipation. Fiber also helps to decrease the blood sugar levels, decreases your risk for colon cancer, helps to reduce high blood pressure, etc. But fiber also helps lower your cholesterol levels. Fiber is found in plant foods, like fruits and vegetables, whole grains, beans, peas, lentils, and nuts and seeds. So eat lots of fruits and vegetables, beans and whole grains, and you will be helping yourself to lower cholesterol levels.

Remember the cycle of cholesterol between the digestive tract and the liver called the enterohepatic circulation? This is where the liver releases the bile into the digestive tract, and near the end of the small intestines, most of the cholesterol that makes up the bile is reabsorbed into the blood stream and brought back to the liver to reuse. Well, fiber binds to the bile and cholesterol and prevents it from being absorbed back into the blood stream. The more fiber you have in your diet, the more bile and cholesterol is bound to the fiber, and the less cholesterol is reabsorbed into the blood stream. Even if you don't have any cholesterol in your diet, eating more fiber decreases cholesterol levels, because it binds and then excretes the cholesterol that your body makes in producing bile.

Step 3 – avoid fried or high-fat foods.

Fried foods and high-fat foods promote the production of cholesterol in the body. The more fats that you take in—especially trans fats and saturated fats, but also too many polyunsaturated and monounsaturated fats—the more cholesterol your body will produce. This includes margarines, shortening, condiments, pastries, desserts, all fried foods, etc.

Step 4 – include some nuts/seeds daily.

Research shows that the more regularly include nuts and seeds into your diet, the better your cholesterol levels will be. Nuts and seeds are high in fiber and have many healthy phytonutrients that are beneficial for the heart, blood vessels, and body in general. But don't eat too many nuts. You should limit your nut intake to a handful a day (about 3.5 ounces or 100 grams). The nuts should be dry roasted (not in oil), and unsalted.

Step 5 – avoid processed carbohydrates.

Processed carbohydrates (like pastries, white breads, cookies, pies, desserts, jams and jellies, and other white-flour or sugar-containing products) also have been shown to increase cholesterol levels. Part of the reason is that many pastries have a significant amount of trans fats in them, and trans fats are known to increase your cholesterol and promote inflammation in the body. These are best to avoid when trying to lower your cholesterol levels.

Step 6 - avoid oils and too many nuts.

If you are already on a plant-based diet, and you have eliminated the other fats that we discussed, and your cholesterol levels are still too high, I would recommend that you cut oils out of your diet entirely and you take a critical look at the amount of nuts you are consuming. Some individuals produce more cholesterol easier than others, and these persons need to be more strict regarding their fat intake than others do. In this case, it would be best to cut all oils out of your diet (oil, margarine, condiments, salad dressings, etc.). You may use a little oil in making bread, but keep it to a minimum. Use non-stick skillets and water with herbs to sauté your vegetables, or do more steaming than sautéing.

Also, take a look at how many nuts you are using. Some people eat a handful of nuts with their breakfast, along with almond milk. For lunch, they have cashew cheese sauce, pecan nut balls, and sunflower dressing, and for supper they have a cashew-based dessert. Some people on a plant-based diet don't realize how many nuts they are eating. Again, the nuts should be dry roasted and you should have no more than a handful (3.5 ounces or 100 grams) daily.

Step 7 – Eat foods particularly power in lowering cholesterol.

The studies show that barley (which has lots of fiber), B-3 (also called niacin), blond psyllium (which is basically fiber), oats (which has lots of fiber), red yeast rice (which contains natural statins—substances that they used to make the popular cholesterol medications out of), and foods with beta-glucans (like whole grains, mushrooms, and dates), beta-sitosterol (like avocado, nuts, and beans), and sitostanol (like soy and nuts) all help to decrease one's blood cholesterol levels. It could be because of the fiber content, the anti-cholesterol chemicals, or the plant-based cholesterol that give these foods their cholesterol-lowering properties.

Step 8 – eat plant phytosterols (plant cholesterol).

Plant phytosterols have a similar structure as cholesterol, and in fact, some people consider them to be plant-based cholesterol. But these plant-based phytosterols actually compete with cholesterol for absorption into the blood stream, decreasing the amount of cholesterol that is absorbed. And when the plant phytosterols are absorbed into the bloodstream, they are typically dumped back into the digestive tract and do not increase cholesterol levels. Some good sources of these plant-based phytosterols are avocado, flax seed, and peanuts.

Step 9 – exercise.

Studies show that more exercise leads to lower cholesterol levels. In fact, exercise is one of the few things that can raise the “good” cholesterol (HD), and lower the “bad” cholesterol (LDL). So get out there every day and walk, bike, hike, swim, lift weight, and in general be physically active. I recommend that you should exercise between 30 and 60 minutes daily (minimum) if your cholesterol is elevated.

Step 10 – eliminate stress from your life.

There is a condition called stress-induced hypercholesterolemia. Under the influence of stress, your body can increase its production of cholesterol, and your cholesterol levels rise. As long as you remain under that stress, your cholesterol levels remain high. And once that stress is relieved, your cholesterol levels start going down. So managing that stress is vitally important.

In summary, to decrease your cholesterol levels, you should:

1. Stop eating animals & their byproducts
2. Eat a diet high in fiber (lots of fruits, vegetables, whole grains, and legumes)
3. Avoid fried or high-fat foods
4. Include a small amount of nuts/seeds daily
5. Avoid processed carbohydrates
6. Avoid oils and too many nuts
7. Eat cholesterol-lowering foods

8. Eat Plant phytosterols
9. Exercise
10. Eliminate Stress



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