Cholesterol and Health

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Steroids occur widely in both plants and animals; the important steroids however, are found in animals where they have various essential biological functions. The most abundant steroid is cholesterol. Cholesterol exists in all tissues of the mammalian body. It is particularly abundant in the spinal cord, in the brain and in the gallstones if they are present. The total cholesterol content of a 165 pound man averages about 250 gm. It was the first steroid to be isolated and identified by Chevreul in 1812. Because of its complicated structure, however, more than 160 years intervened between its discovery in 1770 and the realization of its structure in 1932. Another 23 years elapsed before its total three dimensional structure was fully elucidated as shown in *Figure* 1.

Mammals have an ability to absorb cholesterol from dietary sources. Early studies have showed that animals excrete more cholesterol than they consume. Therefore, animals must be able to synthesize cholesterol. It actually turns out that all tissues in the body have the ability to synthesize cholesterol to some extent. Biochemical studies have shown that cholesterol is important because it is one of the first intermediates that the body synthesizes during the production of steroid hormones.

Cholesterol, for example, is the precursor of all bile acids. Cholic acid and deoxy-cholic acid are the most important bile acids.

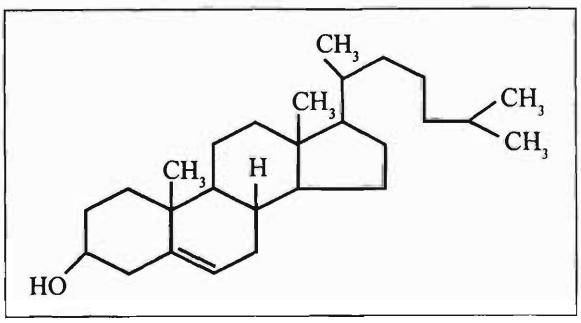

Figure 1. Structure of cholesterol.

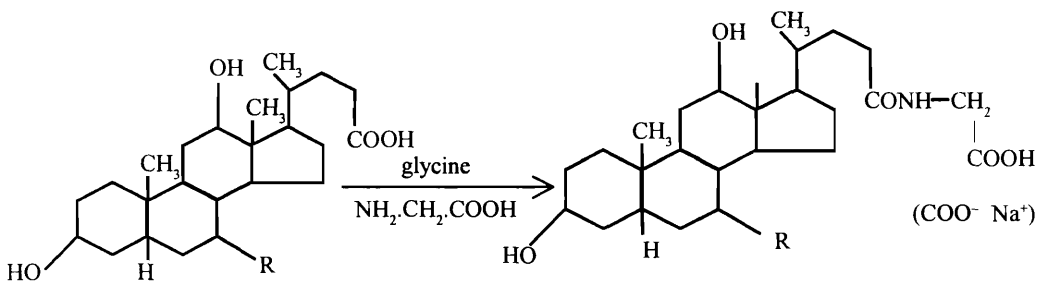

Figure 2.

The bile acids are synthesized from cholesterol in the liver and converted into conjugates with simple peptides and amino acids, i.e., glycholic acid and deoxyglycholic acid. The bile acid conjugates are secreted as liver bile into the intestine as their sodium salts, as shown in *Figure* 2. They are natural detergent like substances and their main purpose is to emulsify fats and oils. Thus fats and oils can then be more easily digested and transported across the intestinal cell wall into the blood stream. Because of this, cholesterol is inextricably involved in the metabolism of fats and oils.

Two diseases are commonly associated with an improper balance between cholesterol and the bile acids on the one hand and fats and oil in the diet on the other hand. Gallstones result from the condition in which the bile becomes supersaturated with cholesterol. In the gall bladder cholesterol crystalizes from the bile producing large crystalline aggregates. The causes of gallstones are too complex for us to go into, but it can be stated that such factors as high levels of estrogens, multiple pregnancies, obesity, genetic factors and certain drugs influence the degree to which the bile becomes supersaturated with cholesterol.

The second disease called atherosclerosis, results from an elevated level of cholesterol in the blood. Atherosclerosis is the hardening of the arterial walls with deposition of cholesterol

Bile acid conjugates to emulsify fats and oils. This is the cause of gallstones.

Consumption of cholesterol-rich food fosters the development of atherosclerosis.

which is present in the form of patches that accumulates in the aorta and the vessels of the heart and brain. Hence the name of the disease – atherosclerosis or atheromatosis (in Greek, word *athere* means thin gruel). The loss of elasticity and the narrowing of the channel in the arteries lead to the strain on the heart and a likelihood of heart disease. When some of the cholesterol deposits break loose they could either block the flow of blood to the heart, causing a heart attack or block the flow of blood to the brain causing a stroke.

According to Anichkov's theory, a disturbance in cholesterol metabolism leads to deposition of cholesterol in the walls of blood vessels and is the basic cause of atherosclerosis. Consumption of cholesterol-rich food fosters the development of atherosclerosis. Sedentary life leads to obesity and also predisposes to early atherosclerosis. To prevent atherosclerosis, it is important to keep to an appropriate diet, lead an active life and remove such factors that cause exhaustion of the nervous system.

A far more likely possibility is that these deposits will simply grow in place until they occlude the artery altogether, thus stopping blood flow. For these reasons, determining the level of cholesterol in the blood has become routine in medical examinations. Cholesterol along with some other types of fats cannot be dissolved in the blood. In order for them to be transported to and from cells, they have to be specially carried out by molecules called *lipoproteins*. These molecules consist of an outer layer of protein with an inner core of cholesterol and triglycerides. Lipoproteins are essential for cholesterol to move around the body. There are two types of lipoproteins.

i) Low Density Lipoprotein (LDL)
ii) High Density Lipoprotein (HDL)

Lipoproteins are essential for cholesterol to move around the body.

Low density lipoproteins carry fats to different parts of the body. LDLs carry about 60-70 percent of the cholesterol around the body and are thus called 'bad cholesterol'.

High density lipoproteins transport cholesterol from cells back

LDL cholesterol level	
Less than 100mg/dL	Optimal.
100 to 129 mg/dL	Near optimal / above optimal
130 to 159 mg/dL	Border
160 to 189 mg/dL	High
190 mg/dL and above	Very high
Healthy levels of cholesterol :	
Less than 200 mg/dL	Desirable
200 to 239 mg/dL	Border line high risk
240 mg/dL or more	High risk.

Table 1. The level of LDL and cholestrol in blood.

to the liver. At this point they are reused or converted to bile acids and disposed. Therefore HDL is called 'good cholesterol'. HDLs actually help fight the risk of heart attack or stroke because they consist of more protein than triglycerides or cholesterol. They work hard to remove cholesterol from artery walls.

A recent finding has shown that vitamin C will reduce the level of cholesterol in the blood and that it is also a required cofactor for production of bile acids from cholesterol. A person who is deficient in vitamin C usually has high cholesterol levels. Thus vitamin C is very important in preventing and arresting the development of atherosclerosis.

Conclusion

There are several options available to control cholesterol level through traditional treatments, natural and herbal treatments and changing to a healthy lifestyle. The important factor is to understand the risk factors by identifying both cholesterol levels (HDL and LDL) and how they may affect the overall health. It is extremely important to work with one's doctor and nutritionist to create a regimen that encompasses traditional or natural treatment.

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