

Dietary Fat and Cholesterol

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Cholesterol

What is cholesterol? Cholesterol is a waxy, fat-like substance found in all animals including people. It is an essential part of cells in the body and is used to make certain hormones and digest fats. A special form of cholesterol in the skin has the ability to change into vitamin D when exposed to sunlight. There are two different types of cholesterol:

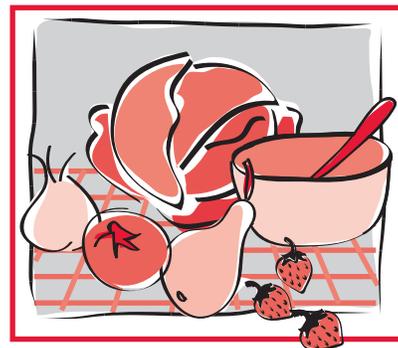
1. *Blood, or serum, cholesterol*—This type circulates in the blood and is mostly made by the body.
2. *Dietary cholesterol*—This type comes from foods of animal origin.

How is blood cholesterol transported by the body? Cholesterol is transported in the blood by different carriers. The relative amounts of cholesterol transported by each carrier can affect one's risk for heart disease. The two major blood cholesterol carriers are LDL (low density lipoprotein) and HDL (high density lipoprotein). LDL cholesterol is known as “bad” blood cholesterol, and delivers blood cholesterol throughout the body, depositing it as “plaque” on artery walls. HDL cholesterol is known as “good” blood cholesterol, and functions as a vehicle in the blood to remove waste from the body (Table 1).

Where do we get cholesterol? Our bodies have the ability to make all of the cholesterol needed for proper functioning, but most people also get it from foods. Different foods vary in the amount of cholesterol they contain. Only animal products have cholesterol, as opposed to plant based products which may contain fat but do not contain cholesterol.

Is cholesterol harmful? Cholesterol is necessary for a healthy body. A moderate intake of dietary cholesterol is not harmful. However, it may only be a problem when LDL blood cholesterol levels are elevated, and HDL levels are too low. When consumed in excess, a high blood level of total cholesterol is a major risk factor for atherosclerosis (hardening of the arteries), heart disease, and high levels of LDL cholesterol. The risk continues to increase as blood cholesterol levels elevate. For more information on cardiovascular disease, see fact sheet [Heart Health: Managing Heart Disease through Diet](#).

The National Cholesterol Education Program (NCEP) recommends a blood test known as a “lipoprotein profile” every five years for those ages 20 and older. This test reveals information about the total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels in the blood (Table 2). Triglycerides, along with the different forms of cholesterol, are also a type of fat found in the blood. The results of the test, along with other factors such as



Quick Facts

- In healthy amounts, fat and cholesterol help our bodies function properly. However when consumed in excess, they may promote disease.
- Overweight and obesity are major risk factors for elevated LDL (“bad”) cholesterol levels.
- Saturated fats and *trans* fats have a significant effect in raising blood cholesterol levels.
- Some people are cholesterol sensitive, and a diet high in cholesterol may increase total blood cholesterol levels.
- Elevated blood cholesterol levels are a risk factor for heart disease and atherosclerosis (hardening of the arteries).
- Most Americans consume too much fat and cholesterol—mostly from animal fat, pre-packaged, and processed foods.

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Table 1: Characteristics of HDL and LDL blood cholesterol carriers.

	LDL	HDL
Full Name:	Low Density Lipoprotein.	High Density Lipoprotein.
What it does:	Takes cholesterol from the liver to the rest of the body.	Primarily takes cholesterol from body tissue back to liver.
Effect on the risk for heart disease:	High amounts increase risk.	High amounts reduce risk.
Nickname:	"Bad" cholesterol.	"Good" cholesterol.

Table 2: Classifications of a Fasting Lipoprotein Profile.

Total Cholesterol (mg/dL) ¹	
Desirable	< 200
Borderline High	200 – 239
High	> 240
LDL Cholesterol	
Optimal	< 100
Borderline High	100 – 129
Borderline High	130 – 159
High	160 – 189
Very High	> 190
HDL Cholesterol	
Low	< 40
High ²	> 60
Triglycerides	
Normal	< 150
Borderline High	150 – 199
High	200 – 499
Very High	> 500

¹Milligrams per Deciliter (mg/dL).
²An HDL of 60 mg/dL and above is considered protective against heart disease.

age, gender, family history, smoking, hypertension, diabetes, and obesity, can help determine ones overall risk for heart disease.

Fats

What is dietary fat? Fat is necessary for a healthy diet. It is an important source of essential fatty acids such as linolenic (omega-3) and linoleic (omega-6) acids, and concentrated energy—it has more than twice as many calories per ounce as sugar, starch or protein. Fats help carry fat-soluble vitamins A, D, E and K throughout the body in to perform many important functions. Fat can improve the taste of food, aid in cooking, and help with satiety. Yet, eating too much fat may lead to increased weight, which is unhealthy. It also may increase the risk of heart disease and some forms of cancer.

Types of Fat

Are all fats the same? There is not a single type of fat. Rather, the word “fat” is often used to refer to all of the fatty substances found both in food and in the body.

Lipids: Scientific term referring to fat, cholesterol and other fat-like substances.

Triglycerides: Scientific name for the main form of fat found in the diet and in the body. Most of the fat in the body is stored as triglycerides which are made of three fatty acids. These fatty acids may include any

combination of saturated fatty acids, monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs).

Saturated Fats: Usually solid at room temperature, saturated fats have all of the hydrogen atoms they can hold (saturated with hydrogen). Saturated fats are primarily from animal products, but are also found in tropical plant oils, such as coconut and palm.

Monounsaturated Fats (MUFAs): Liquid at room temperature, monounsaturated fats are missing one pair of hydrogen atoms. Monounsaturated fats are primarily from plants and include olive oil, canola oil and peanut oil.

Polyunsaturated Fats (PUFAs): Liquid at room temperature, polyunsaturated fats are missing two or more pairs of hydrogen atoms. Many common vegetable oils, such as corn, soybean, safflower and sunflower oil, are high in polyunsaturated fats.

Essential Fatty Acids: Types of polyunsaturated fatty acids that cannot be made by the body. One must eat foods rich in essential fats, as they are the building block for other important fatty acids.

- **Omega-3 Fatty Acid:** Omega-3, also known as alpha-linolenic acid (DHA/EPA), is a type of essential fatty acid that is highly polyunsaturated. Omega-3 fatty acids are mainly found in higher-fat, cold-water fish,

Table 3: How dietary fat affects blood lipid levels.

	Polyunsaturated (fats, oils)	Monounsaturated (fats, oils)	Saturated (fats)	Omega-3	Trans
Effects on Blood Lipid Levels	Lowers total cholesterol Lowers LDL Lowers HDL	Lowers total cholesterol Lowers LDL Raises HDL*	Raises total cholesterol Raises LDL	Lowers triglycerides Lowers total cholesterol	Raises total cholesterol Raises LDL Lowers HDL
Sources	Mostly from plants: safflower oil, corn oil, soybean oil, cottonseed oil, and sesame oil.	Mostly from plants: olive oil, peanut oil, and canola oil.	Mostly from animals: fat in meat, butter, lard, cheese, whole milk, cream. Some from plants: coconut oil, palm oil, cocoa butter (chocolate), hydrogenated vegetable oil.	Salmon, tuna, marine and fish oils, walnuts, and flaxseed.	Pre-packaged and processed food items.
*Monounsaturated fats and polyunsaturated fats may only be beneficial when they replace saturated fatty acids in the diet. Simply adding them to the diet may increase overall dietary fat.					

such as salmon, mackerel and herring, nuts, soy oil, seeds, as well as omega-3 fortified eggs. Diets high in omega-3 fatty acids may help lower levels of LDL cholesterol and triglycerides. For more information on omega-3 fatty acids, see fact sheet [Omega-3 Fatty Acids](#).

- **Omega-6 Fatty Acid:** Also known as linoleic acid, omega-6 is a type of essential fatty acid that can be found in vegetable oils such as soybean, corn, and safflower. Omega-6 fatty acids are also thought to promote heart health by lowering LDL cholesterol levels, especially when substituted in place of saturated fat.

Hydrogenated Fats: These are unsaturated fats that are processed to become solid at room temperature in order to protect against rancidity. Hydrogen atoms are added through a process called hydrogenation. Packaged and processed foods such as cookies,

crackers, and margarine most commonly contain these types of fats.

Trans Fatty Acid: This is a type of fat formed during the process of hydrogenation. *Trans* fatty acids have been shown to increase LDL cholesterol and lower HDL cholesterol, which may increase the risk for heart disease. In the body, these fats mimic the properties of saturated fats. *Trans* fat may be found in partially hydrogenated margarines and snack foods.

Table 3 illustrates the effect of these different dietary fats on blood lipid levels.

The Relationship Between Fat and Cholesterol

How are fats related to blood cholesterol? Research shows that the amount and type of dietary fat can affect blood cholesterol levels. Dietary fat, especially saturated and *trans* fats, may raise blood cholesterol levels. Replacing some saturated fats with polyunsaturated and monounsaturated fats

(especially olive and canola oil) also can help lower blood cholesterol. Dietary cholesterol can raise blood cholesterol but generally is not as important as saturated fat and total fat in the diet. Recall that high total blood cholesterol levels and LDL cholesterol levels increase risk of heart disease while lower levels reduce risk. Higher levels of HDL cholesterol help lower the risk for heart disease.

What foods contain fat and cholesterol? In some foods, fats are obvious, such as in noticeably greasy, fried or oily foods. In other foods, they are more invisible. Cholesterol is found in animal products, such as dairy, meat and eggs, but has no tell-tale signs. It is *not* found in food products made from plants. A food can be high in fat and cholesterol (fried egg), high in fat but low in cholesterol (peanut butter), low in fat and high in cholesterol (shrimp) or low in both (fruit). Reading the nutrition facts on a food label is an essential skill in understanding the amount of fat or cholesterol in a particular

Table 4: Recommendations for adults—calories, fat and cholesterol intake*.

	Healthy individuals without Heart Disease or High LDL Cholesterol	Those with Heart Disease, Diabetes, or High LDL Cholesterol (greater than 130 mg/dL)
Total Calories	Balance calorie intake and physical activity to achieve or maintain a healthy body weight.	
Total Fat ¹	Less than 30% of total calories	20 – 35% of total calories ²
Saturated Fat ³	Less than 10% of total calories	Less than 7% of total calories
Polyunsaturated Fat	Up to 10% of total calories	
Monounsaturated Fat	Up to 20% of total calories	
Cholesterol	Less than 300 mg/day	Less than 200 mg/day
Trans Fat	Keep consumption as low as possible by limiting partially hydrogenated oils (found in processed foods such as: fried foods, fast foods, snack foods, baked foods) and solid fats.	

*By the American Heart Association and the National Cholesterol Education Program. Appropriate for adults and children.
¹Most fats should come from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts and vegetable oils.
²A higher fat intake is allowed, provided most of it is unsaturated fat, and may be needed to prevent low HDL levels from worsening.
³Replace saturated fat with monounsaturated and polyunsaturated fatty acids.

food item. For more information on label reading, see fact sheet [Understanding the Food Label](#).

Monitoring Intake of Fat and Cholesterol

Dietary fat and cholesterol are necessary components for a healthy diet. Though when consumed in excess, they may be harmful for the body and increase ones risk for obesity, atherosclerosis, and heart disease. It is important to regulate ones intake of dietary fat and cholesterol, which will regulate blood LDL, HDL, and triglyceride levels. The 2010 Dietary Guidelines for healthy individuals are found below in Table 4.

Summary

- The two types of blood cholesterol in the body are LDL (bad) and HDL (good) cholesterol. LDL deposits plaque on artery walls, while HDL acts to remove cholesterol from the body.
- Our body has the ability to make all of its own cholesterol. In the diet, it is obtained only through animal products.

- High blood levels of LDL and total cholesterol as well as low levels of HDL, are risk factors for heart disease.
- Triglycerides are the primary form of dietary fat found in the body, and may contain a combination of three fatty acids: saturated fatty acids, polyunsaturated fatty acids (PUFA), or monounsaturated fatty acids (MUFA).
- Essential fatty acids are not made by the body and must be obtained from the diet; these include omega-3 and omega-6 fatty acids.
- *Trans* fats are a form of hydrogenated fat that mimic the structure of saturated fatty acids. They may increase risk for heart disease, and are most often found in processed foods and fast foods.
- Dietary fat and cholesterol are closely related; types of dietary fat (saturated and *trans* fat) can lead to an increase in blood cholesterol levels.
- Follow the 2010 USDA Guidelines to ensure proper intake of fat and cholesterol (Table 4).

References

Advanced Nutrition: Macronutrients, Micronutrients, and Metabolism (2009). CRC Press, Taylor & Francis Group.

Duyff, ADA. American Dietetic Association: Complete Food and Nutrition Guide. Hoboken: John Wiley & Sons, Inc., 2006.

Mahan, L. K., Escott-Stump, S., Raymond, J. L., & Krause, M. V. (2012). Krause's food & the nutrition care process. St. Louis, Mo: Elsevier/Saunders.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.