

# Dietary Fat and Cholesterol

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## Cholesterol

Cholesterol is a waxy, fat-like substance found in all animals including humans and is essential to every cell in the body. Cholesterol is used to make certain hormones, like estrogen and testosterone, and it is part of a chemical called bile, which helps to digest fats. A special form of cholesterol found 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 and beverages of animal origin.

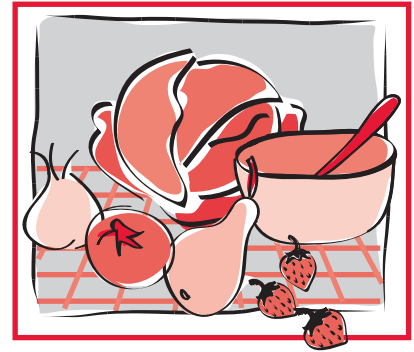
**How is blood cholesterol transported by the body?** Cholesterol is transported in the blood by different carriers. The relative amounts of cholesterol transported by each carrier can affect one's risk for heart disease. The two major blood cholesterol carriers are LDL (low density lipoprotein) and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

**Where do we get cholesterol?** Our bodies have the ability to make all of the cholesterol needed for proper function-

ing once we reach childhood, but most people also get cholesterol from foods. Different foods vary in the amount of cholesterol they contain. Only animal products have cholesterol; plant based products may contain fat, but they do not contain cholesterol.

**Is cholesterol harmful?** Cholesterol is necessary for a healthy body, but 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](#).

While the 2010 Dietary Guidelines for Americans recommended limiting consumption of dietary cholesterol to 300 mg per day, this recommendation is not included in the updated 2015-2020 edition of the Dietary Guidelines. This change reflects new research that suggests that dietary cholesterol, consumed in moderate amounts, does not affect health risks, including heart disease, for the majority of people unless a person has diabetes. Consuming solid fat (saturated fat), not cholesterol, is what increases heart disease risk for most people. Still, the healthy eating patterns highlighted in the 2015 Dietary Guidelines contain approximately 100 to 300 mg cholesterol per day, in keeping with the previous 2010 recommendations. The Institute of Medicine also recommends individuals eat as little dietary cholesterol as possible as a part of a healthy eating pattern. In general, foods that are higher in dietary cholesterol, such as fatty meats and high-fat dairy products, are also higher in saturated fats.



## Quick Facts

- In healthy amounts, fat and cholesterol help our bodies function properly. However when consumed in excess, they may promote disease.
- Overweight, obesity, and high intake of saturated fats are major risk factors for elevated LDL ('bad') cholesterol levels.
- Saturated fats and trans fats have a significant effect in raising 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, prepackaged foods, 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 <b>increase</b> risk.	High amounts <b>reduce</b> risk.
Nickname:	"Bad" cholesterol.	"Good" cholesterol.

Table 2: Classifications of a Fasting Lipoprotein Profile.

Total Cholesterol (mg/dL) <sup>1</sup>	
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 <sup>2</sup>	> 60
Triglycerides	
Normal	< 150
Borderline High	150 – 199
High	200 – 499
Very High	> 500

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

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 are also a type of fat found in the blood. The results of the blood test, along with other factors such as age, gender, family history, smoking, hypertension, diabetes, and obesity, can help determine one’s overall risk for heart disease.

### Fats

**What is dietary fat?** Fat is a necessary component of a healthy diet. It is a part of every cell in the body and makes up about 60% of the brain. Fat is essential in the absorption of fat-soluble vitamins A, D, E and K and also makes up parts the hormones that regulate important body functions. Dietary fat provides essential fatty acids, such as linolenic (omega-3) and linoleic (omega-6) acids, which the body cannot produce on its own. Essential fatty acids are necessary for brain and eye development in infants and children and the maintenance of healthy skin in children and adults.

Dietary fat may improve the taste of food, aid in cooking, and increase satiety. Yet, eating too much fat may lead to increased weight, as it has more than twice as many calories per ounce as sugar, starch or protein. Consuming fatty foods in excess may increase total and LDL cholesterol levels, while increasing 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 in the body and in foods. Most of the fat in the body is stored as triglycerides, but triglycerides circulate in the blood as well. Triglycerides are made of three fatty acids and one glycerol molecule. These three fatty acids may include any combination of saturated fatty acids, monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs). Triglycerides in the blood stream trigger the liver to make more cholesterol, so high triglyceride levels are often associated with high levels of total and LDL cholesterol.

**Saturated Fatty Acids (SFAs):** 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 as well as other plant based foods, though in smaller amounts. The 2015 Dietary Guidelines for Americans suggests limiting saturated fats in the diet to less than 10% of daily calories. See Table 3 for the health effects of saturated fats in the diet.

**Monounsaturated Fatty Acids (MUFAs):** Liquid at room temperature, monounsaturated fats are missing one pair of hydrogen atoms. Monounsaturated fats are primarily derived from plants and include olive oil, canola oil, peanut oil, and avocados. See Table 3 for the health effects of monounsaturated fats in the diet.

**Polyunsaturated Fatty Acids (PUFAs):** Liquid at room temperature, polyunsaturated fats are missing two or more pairs of hydrogen atoms. Many common vegetable oils, such as

Table 3: How dietary fat affects blood lipid levels.

	Monounsaturated (fats, oils)	Polyunsaturated (fats, oils)	Omega 3	Saturated (fats)	Trans
Effects on Blood Lipid Levels	Lowers LDL*  Maintains or raises HDL*	Lowers total cholesterol*  Lowers LDL*  Lowers HDL	Lowers triglycerides*	Raises total cholesterol  Raises LDL	Raises total cholesterol  Raises LDL  Lowers HDL
Sources	Mostly from plants: olive oil, peanut oil, canola oil, avocados, nuts, and seeds.	Mostly from plants: safflower oil, corn oil, soybean oil, cottonseed oil, sesame oil, walnuts, flax seed, and fish.	Salmon, tuna, marine and fish oils, walnuts, and flaxseed.	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.	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 these fats to the diet may not provide health benefits.					

corn, soybean, safflower and sunflower oil as well as fish are high in polyunsaturated fats. See Table 3 for the health effects of polyunsaturated fats in the diet.

**Essential Fatty Acids:** Fatty acids that are essential to human health but not produced in the body must be obtained through food. Only two types of fatty acids are considered essential; omega-3 fatty acids and omega-6 fatty acids, both polyunsaturated fats. The 2015 *Dietary Guidelines for Americans* emphasize vegetable oils (mono- and polyunsaturated fats) as part of healthy eating pattern because they are the major source of essential fatty acids and vitamin E.

- Omega-3 Fatty Acids: Omega-3's are a group of polyunsaturated fatty acids that include alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). DHA and EPA are mainly found in higher-fat, cold-water fish, such as salmon, mackerel, sardines and herring. ALA is found in canola oil, chia seeds, flaxseed oil, soybean oil, and walnuts, and some of that ALA can be converted into DHA and EPA by the body. Diets high in EPA and DHA may help reduce the risk of heart disease by helping to thin the blood and prevent blood platelets from clotting and sticking to artery walls, causing blockages. Research also suggests that EPA and DHA may lower levels of triglycerides in the

blood, may prevent hardening of the arteries, and may moderately reduce blood pressure. In addition, consuming DHA during pregnancy (2 servings of oily fish per week) is linked with better cognitive development and vision in infants. For more information on omega-3 fatty acids, see fact sheet [Omega-3 Fatty Acids](#).

- Omega-6 Fatty Acids: Omega 6 fatty acids are found in meats and vegetable oils, such as, soybean, corn, and safflower. Polyunsaturated omega 6's, such as linoleic acid (LA), are thought to promote heart health by lowering LDL cholesterol levels, especially when replacing saturated fats and trans fats in the diet. Linoleic acid (LA) can be converted to a long chain omega-6 fatty acid called arachidonic acid (AA), which in excess, may be linked to inflammation and other chronic health conditions. Another type of omega 6 fatty acid, called conjugated linoleic acid (CLA), found in dairy foods, beef, and lamb, may be associated with a decrease in certain types of cancers and improved body composition. Research is still exploring these connections.

**Hydrogenated Fats:** These are unsaturated fats that are processed to become solid at room temperature. Hydrogen atoms are added to unsaturated fat through a process called hydrogenation. This turns unsaturated fats into saturated fats. Hydrogenated

fats can either be fully or partially hydrogenated, and are used in foods to enhance texture, extend shelf life, and prevent rancidity. Packaged and processed foods such as cookies, crackers, and margarine most commonly contain these types of fats.

**Trans Fatty Acids (TFAs):** Trans fats occur naturally in some foods derived from cattle and sheep, but generally, this type of fat is formed during the process of hydrogenation. Only partially hydrogenated fats contain trans fats, where fully hydrogenated fats do not. Trans fatty acids mimic the properties of saturated fats in the body, and have been shown to increase LDL cholesterol and lower HDL cholesterol, which may increase the risk for heart disease. The 2015 Dietary Guidelines for Americans suggest limiting trans fats in the diet. Trans fat may be found in partially hydrogenated margarines, peanut butters, and snack foods.

In 2015, the Food and Drug Administration (FDA) stated that partially hydrogenated oils were no longer recognized as safe for use in foods, as they are the primary source of dietary trans fatty acids. The food industry was given 3 years to comply with the ruling and remove TFA's from food products. The FDA stated that removing partially hydrogenated oils from processed foods could prevent thousands of heart attacks and deaths each year.

## The Relationship Between Fat and Cholesterol

**How are fats related to blood cholesterol?** Research shows that the amount and type of dietary fat consumed can affect blood cholesterol levels. Dietary fat, especially saturated and trans fats, may raise blood levels of total and LDL cholesterol. Replacing some saturated fats with polyunsaturated and monounsaturated fats (especially olive and canola oil) can help lower blood cholesterol. 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, like noticeably greasy, fried or oily foods, or meats with visible marbling. In other foods, such as dairy, eggs, and some meats, fat and cholesterol is harder to see. Fats are found in both plant and animal foods, but cholesterol is only found in foods of animal origin. A food can be high in fat and cholesterol (fried egg), high in fat but low in cholesterol (peanut butter and avocado), low in fat and high in cholesterol (shrimp), or low in both (fruit). The nutrition facts label is a useful tool to determine the amount of fat or cholesterol in a particular food item.

## 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 to the body and increase one's risk for obesity, atherosclerosis, and heart disease. Keep in mind, however, that dietary cholesterol does not have as much of an effect on blood cholesterol as saturated fat. It is important to regulate one's intake of dietary fat in order to regulate blood LDL, HDL, and triglyceride levels.

## Summary

- The two types of cholesterol in the blood are LDL (bad) and HDL (good) cholesterol. Excessive 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 (SFAs), polyunsaturated fatty acids (PUFAs), or monounsaturated fatty acids (MUFAs).
- Essential fatty acids cannot be produced by the body and must be obtained from the diet; these include omega-3 and omega-6 fatty acids.
- *Trans* fats are derived from partially hydrogenated fats and mimic the function of saturated fatty acids in the body. 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 USDA's 2015 Dietary Guidelines for Americans to ensure proper intake of fats in the diet.
- Follow the 2010 USDA Guidelines to ensure proper intake of fat and cholesterol.

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