



Dietary Fat and Cholesterol

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Fats

The basic units of fats are fatty acids and glycerol. There are over forty different types of fatty acids. Fatty acids can be divided into three groups:

- Saturated fatty acids
- Monounsaturated fatty acids
- Polyunsaturated fatty acids

Fatty acids are long chains of carbons with hydrogens attached. Fatty acids can be saturated or unsaturated. A saturated fatty acid has all the carbons in the chain filled with hydrogens. An unsaturated fatty acid is missing hydrogens, and as a result the carbons bond to each other twice, forming what is called a double bond. If there is one place in the fatty acid missing hydrogens (or one double bond), the fatty acid is monounsaturated. If there are two or more places in the fatty acid missing hydrogens (two or more double bonds), the fatty acid is polyunsaturated.

The body can make all but two fatty acids. The body can make saturated fatty acids, and the body can change some saturated fatty acids into monounsaturated fatty acids if the body needs them. However, our body is not able to make two polyunsaturated fatty acids, linoleic acid (omega-6) and linolenic acid (omega-3). These two polyunsaturated fatty acids are therefore essential and must be provided from the diet. From these two polyunsaturated fatty acids the body can make other polyunsaturated fatty acids in the body.

Fats are made up of two substances, fatty acids and glycerol. Glycerol is a water-soluble compound that can bind up to three fatty acids. When one fatty acid is attached to a glycerol the compound is called a monoglyceride. When two fatty acids are attached to a glycerol the compound is called a diglyceride. And when three fatty acids are attached to a glycerol, the compound is called a triglyceride. Most fats in food and in our bodies are in the form of triglycerides.

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Foods contain combinations of the three types of fatty acids. Completely saturated fats and completely polyunsaturated fats are very rare in nature. Whether a fat is solid or liquid depends of the relative amounts of the different types of fatty acids and the temperature. Unsaturated fats tend to be liquid at room temperature and contain more unsaturated fatty acids. Most saturated fats tend to be solid at room temperature and contain more saturated fatty acids. Exceptions are tropical oils, such as palm oil, palm kernel oil, coco butter, and coconut oil. Even though these fats are liquid at room temperature, they are very saturated.

In food processing, polyunsaturated fats may be modified because unsaturated fats tend to go rancid. When oils have been hydrogenated, they become more solid. Margarine is an example of liquid polyunsaturated oil that is hydrogenated to become more solid. In the process of hydrogenation, hydrogens are added to the unsaturated carbons in a double bond making the fatty acid more saturated. In addition, after hydrogenation some fatty acids that remain unsaturated change shape from a cis to a trans configuration. The relationship between trans fatty acids and heart disease has been the subject of much recent research.

The main fatty acids in the fat determine whether the fat is referred to as saturated or unsaturated. The following table shows the fatty acid composition of some common fats, oils, and foods. Lard, for example, contains over one-third saturated fatty acids. Even though the other fatty acids are monounsaturated or polyunsaturated, it is referred to as a saturated fat. Corn oil contains large amounts of both saturated and monounsaturated fatty acids. However, since about half of the fatty acids in corn oil are polyunsaturated, it is referred to as a polyunsaturated fat.

Percentage of different fatty acids in some common fats.

Common Fats/Oils	Saturated Fatty Acids (%)	Monounsaturated Fatty Acids (%)	Polyunsaturated Fatty Acids (%)
Corn	13	25	55
Olive	17	71	10
Palm	52	38	10
Rapeseed (Canola oil)	7	53	22
Soybean	15	23	51
Butter	65	26	1-3
Lard	42	46	6-8
Tallow	53	42	2

Dietary fats are necessary for a healthy body. Fats have many functions in our bodies. Fats along with protein are a basic part of cell membranes. Fats are part of many body compounds that help regulate blood pressure, blood clotting, blood lipids, and immune response to injury and infection. Body fat cushions internal organs and protects them from being damaged. The fat layer below the skin insulates the body from heat loss. Fats also are important sources of the fat-soluble vitamins. Fats are a concentrated source of energy. One gram of fat provides 9 calories. Our bodies use this energy or store it as fat for later use. It is efficient to store energy as fat instead of carbohydrate because fats are calorie dense. Almost half the weight of fat compared to carbohydrate is needed to provide the same amount of calories. In addition, water is also stored with carbohydrates, further increasing stored carbohydrate weight. Storing fat means the body has less weight to carry. Plants do not move around so the weight of stored energy is not a problem. Plants can easily store energy as the bulkier carbohydrate. Excess fat, carbohydrate, and protein, beyond what our body needs, are converted into fats and stored for later use.

Although fat is important in the diet, many adults eat more fat than they should. High fat diets are a risk factor for heart disease, cancer, and obesity. By increasing the risk of obesity, high fat diets may indirectly increase risk of diabetes and high blood pressure.

Sterols

Sterols are compounds that have a multiple-ring structure. Cholesterol is one of the best-known sterols. Both plant and animal foods contain sterols, but only animal foods contain cholesterol.

The body needs cholesterol every day. Cholesterol serves as the starting material for many important body compounds including bile acids, sex hormones, adrenal hormones, and vitamin D. Cholesterol is also needed to form cell membranes and the myelin sheath around nerve fiber. The liver makes about 800 to 1500 mg of cholesterol each day, much more than the cholesterol provided in the diet, out of fragments from fats, proteins, and carbohydrates. Cholesterol is made in many cells, but liver cells make the majority of cholesterol. In a healthy body, if we eat more dietary cholesterol, the body makes less cholesterol. If we eat less dietary cholesterol, the body makes more cholesterol. Dietary fats can affect blood cholesterol levels. Saturated fats increase blood cholesterol levels in responsive people. Dietary cholesterol has a fairly small effect on blood cholesterol level.

Cholesterol is carried in the blood in lipoproteins to body tissues where it is used. LDL lipoproteins carry cholesterol from the liver through the body. HDL lipoproteins are released from the liver and circulate in the blood to pick up excess cholesterol from the body and carry it back to the liver to be removed from the body.

Recommended Blood Cholesterol and Triglyceride Concentrations

Total blood cholesterol measurements include cholesterol in both the LDL and HDL lipoproteins. However, LDL and HDL lipoproteins have different functions in the body. LDL lipoproteins carry cholesterol from the liver into the body. HDL

lipoproteins are released from the liver and circulate in the blood to pick up excess cholesterol from the body and carry it back to the liver to be removed from the body. Higher LDL cholesterol increases your risk of heart disease. Higher HDL cholesterol decreases your risk of heart disease. Measuring LDL cholesterol and HDL cholesterol is a better indicator of heart disease risk than just total cholesterol alone.

Total cholesterol concentrations below 200 mg/dl are desirable. Total cholesterol concentrations between 200 and 239 mg/dl are considered borderline, and concentrations over 240 mg/dl are high. LDL-cholesterol concentrations below 100 mg/dl are desirable. LDL-cholesterol concentrations between 130 and 159 mg/dl are considered borderline, and LDL-cholesterol concentrations over 160 mg/dl are high. Triglyceride concentrations below 150 mg/dl are desirable. Triglyceride concentrations between 150 and 199 mg/dl are considered borderline. Triglyceride concentrations over 200 mg/dl are considered high. HDL-cholesterol concentrations equal to or above 60 mg/dl are desirable, HDL-cholesterol concentrations between 40 to 59 mg/dl are acceptable, and HDL-cholesterol concentrations below 40 mg/dl are considered low. Exercising, losing excess weight, and not smoking promote higher HDL-cholesterol concentrations.

Recommended Dietary Fat, Saturated Fat, and Cholesterol Intakes

High dietary fat, saturated fat, and cholesterol intakes are associated with increased risk for many diseases. The Dietary Reference Intakes (DRI) recommends a diet low in saturated fat, trans fat, and cholesterol and one which provides 20 to 35 percent of the daily calories intake from fat. The top end of this range is slightly higher than previous recommendations. This revision recognizes that diets with up to 35 percent of calories from fat can be compatible with good health if calorie intake is reasonable and saturated fat intake is low. The 2005 Dietary Guidelines for American recommendations for fat intake are:

- Consume less than 10 percent of calories from saturated fatty acids and less than 300 mg/day of cholesterol, and keep trans fatty acid consumption as low as possible.
- Keep total fat intake between 20 to 35 percent of calories, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.
- When selecting and preparing meat, poultry, dry beans, and milk or milk products, make choices that are lean, low-fat, or fat-free.
- Limit intake of fats and oils high in saturated and/or trans fatty acids, and choose products low in such fats and oils.

Fat, Saturated Fat, and Cholesterol on the Food Label

The Nutrition Facts Panel on food labels lists the number of grams of total fat and saturated fat and milligrams of cholesterol in one serving of food. The Nutrition Facts Panel also lists the percent Daily Value one serving provides for fat and cholesterol based on a 2,000-calorie reference diet. You can use the Nutrition Facts Panel to compare the fat and cholesterol content of foods. The following terms are used

Total Cholesterol, LDL-Cholesterol and Triglyceride Concentrations (mg/dl).

	Total Cholesterol	LDL Cholesterol	Triglycerides
Desirable	Less than 200	Less than 130	Less than 200
Borderline	200 - 239	130 – 159	200 – 399
High	Greater than 240	Greater than 160	Greater than 400

on food labels to describe the fat and cholesterol content of foods.

- Fat free: less than 1/2 gram of fat per serving.
- Saturated fat free: less than 1/2 gram of saturated fat and 1/2 gram trans fat per serving.
- Low fat: 3 grams or less fat per serving.
- Low saturated-fat: one gram or less saturated fat per serving and less than 1/2 gram saturated fat per serving.
- Reduced or less fat: at least 25 percent less fat per serving compared to a similar food.
- Reduced or less saturated fat: at least 25 percent less saturated fat and trans fat per serving compared to a similar food.

Guidelines for Lowering Fat Intake

Lowering dietary fat intake does not mean you have to omit all fat from your diet. You do need some fat in the diet, but just not too much. Some general guidelines for fat intake in the diet are:

- Choose lower fat alternatives more often.
- Use lower fat cooking methods
- Eat smaller portions of high fat foods.
- Eat high fat foods less often.
- Balance foods higher in fat with foods lower in fat.

Healthy Choices to Lower Fat through the USDA MyPyramid

Grain Group:

- Most breads are low in fat. However, some breads and bread products such as cheese bread, croissants, quick breads, and biscuits have added fat.
- Add variety by including naturally low-fat breads such as bagels, English muffins, pita bread, and tortillas.
- Many commercial bakery goods such as muffins and bakery desserts have added fat.
- Substitute applesauce or other fruit purees for oil to lower the fat when baking at home.
- Granola type cereals are higher in fat than many other ready-to-eat cereals.
- Pasta is low in fat. Use low-fat sauces and low-fat cheese to keep the fat down.
- Snack foods are typically high in fat. However, there are many low-fat and reduced-fat snacks available.
- Pretzels, air-popped popcorn, and rice cakes are low fat.
- Low-fat crackers include saltines, rye crackers, crisp breads, Melba toast, and bread sticks. Reduced-fat or fat-free snack crackers are available.
- Ginger snaps, animal crackers, and graham crackers are traditional low-fat cookies. Many reduced-fat and fat-free cookie choices are available
- It is important to remember that reduced-fat or fat-free does not mean calorie-free.

Vegetable and Fruit Groups:

- Almost all vegetables and fruits are low in fat. Exceptions are avocados and coconut.
- Season vegetables without margarine, butter, or high fat sauces to keep the fat down. Herbs and spices can provide a tasty alternative.
- Plain frozen vegetables contain less fat than those frozen with butter, cream, or sauces.

Meat and Bean Group:

- Choose lean cuts of meat, poultry, and fish.
- Trim visible fat from meat and remove the skin from poultry.
- Use low fat preparation methods such as broiling, grilling, roasting, poaching, or steaming instead of deep fat frying or pan-frying.
- Refrigerate meat drippings, stews, and soups and remove the solidified fat before serving.
- Limit sauces and gravies that are high in fat.
- Ground turkey without the skin has less fat than ground turkey with the skin. Look for the words “ground turkey meat.”
- Many types of fish are low in fat, but fish with white meat such as flounder, sole, and orange roughy tend to have less fat than fish with darker meat such as salmon or mackerel.
- Tuna packed in water has less fat than tuna packed in oil.
- Ham, deli beef, and turkey breast contain less fat than regular processed luncheon meats and hot dogs or frankfurters. Very low-fat luncheon meats and hot dogs are available.
- Two egg whites or a quarter-cup of egg substitute can be used for each whole egg in a recipe.
- Many frozen dinners, convenience foods, and packaged mixes are high in fat. Check the Nutrition Facts Panel to compare the fat content.

Milk Group

- Fat free milk (skim or non-fat) and low-fat (1%) milk have the least amount of fat. Try gradually lowering the fat content by switching to reduced fat milk (2%), and then low fat (1%) and finally to fat free milk (skim or non-fat).
- Cheeses naturally lower in fat include part-skim mozzarella and ricotta cheese. However, there are many reduced-fat or fat-free cheeses, cottage cheese, and cream cheeses available.
- Choose low-fat and fat-free yogurts.
- Lower the fat in recipes by substituting plain fat-free yogurt for sour cream or mayonnaise.
- There are many low-fat frozen dairy desserts. Choose low-fat ice creams, low-fat or fat-free frozen yogurts, and ice milks.

Fats, Oils, and Sweets

- Lard, shortening, coconut oil, and palm oil are high in saturated fats. Safflower, sunflower, corn, and soybean oils are high in polyunsaturated fats. Canola oil and olive oil are high in monounsaturated fats.
 - Choosing a polyunsaturated or monounsaturated oil does not mean it's okay to use unlimited amounts. For good health it is important to use less of all types of fats and oils. Polyunsaturated and monounsaturated fats have the same number of calories as saturated fats.
 - Regular stick margarine contains less saturated fat than butter, but the same amount of total fat and calories.
 - Tub and soft-spread margarine are lower in saturated fat than stick margarine. Reduced-fat and fat-free margarine have less total fat and calories.
- Use non-stick pan and vegetable sprays instead of margarine or oil for browning, sautéing, or frying foods.
 - Regular salad dressings and mayonnaise are high in fat. There are several reduced-fat and fat-free salad dressings and mayonnaise available.

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