NUTRITION

Innocent until Proven Guilty: The Facts about Fats

If you've heard conflicting information about saturated fat and trans-fatty acids and felt a bit confused about the terminology and its applications to health, this may be the time to get it all straight. Life was much simpler when cholesterol was the only villain that you hunted for on food labels. Now there's new terms that have replaced cholesterol as the "bad guy" on food labels and unless you have a scorecard it may be hard to know the winners from the losers.

Basic Truths:

The only nutrients in food that supply energy are carbohydrates, proteins and fats. Fats are the most concentrated source of energy at nine kilocalories per gram. Functionally, fat aids in the absorption and utilization of many of the essential vitamins and minerals needed for health maintenance. Fat adds flavor to food and gives a sustained feeling of satisfaction from hunger. When stored in the body, a layer of fat protects body organs from trauma and provides insulation to maintain a stable body temperature. Avoiding fats altogether is dangerous since two fatty acids are essential for health and must be supplied in the diet daily.

Breaking the Code:

Fat is only part of a larger group of substances that are insoluble in water, known scientifically as lipids. The majority of lipids are categorized as either; triglycerides, phospholipids or sterols, based on their chemical properties. Triglycerides, including fats and oils, are the most abundant group of dietary fats and are the predominant storage form of fat in your body. Structurally, triglycerides are three fatty acids attached to a glycerol backbone. The predominate fatty acid component of the triglyceride will determine whether it is known as a saturated fat, monounsaturated fat, polyunsaturated fat, or hydrogenated fat.

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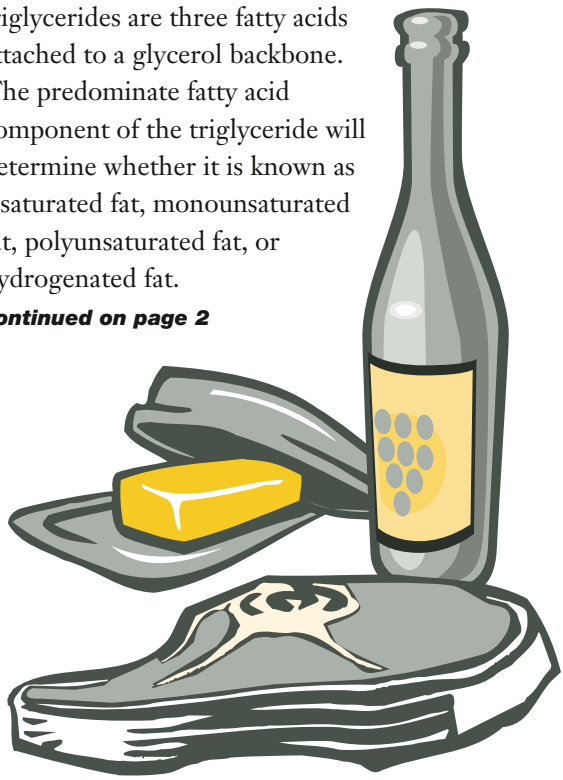

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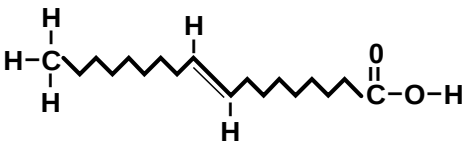
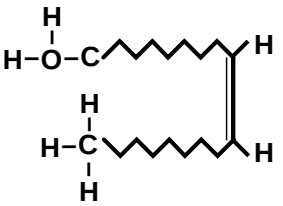
Triglycerides revealed:

All lipids contain atoms of carbon, hydrogen and oxygen. When a fatty acid has all single bonds and all the carbon, hydrogen and oxygen it can hold, it is considered saturated. When the majority of fatty acids in a trigylceride are saturated, the fat is generally solid at room temperature and usually comes from an animal source like beef or pork. When a fatty acid has double bonds between two carbon atoms, it is liquid at room temperature and more unsaturated. If the fatty acid contains many double bonds, it is known as a polyunsaturated fatty acid. If the fatty acid contains only one double bond, it is known as a monounsaturated fatty acid. Since polyunsaturated fats are liquid at room temperature as vegetable oil for example, they don't have the same applications in the food industry as a solid saturated fat such as butter or lard. Food scientists were able add hydrogen to some of the double bonds in a process known as hydrogenation, to make a hydrogenated fat. Hydrogenation gives liquid fat a creamier texture in spreads like margarine or shortening. It also stabilizes the oil making it less likely to deteriorate in deep fat frying and packaged foods. During the process of hydrogenation, the fatty acids in the triglyceride can take on a new spatial orientation. The new structural orientation produces a type of fat different from the natural cis-fat form and generates a trans-fat. Current research indicates negative health implications associated with trans-fat consumption. Concern by health authorities has led to recommendations that trans-fat content of foods appear on the Nutrition Facts Label.

***trans*-fatty acid**



***cis*-fatty acid**

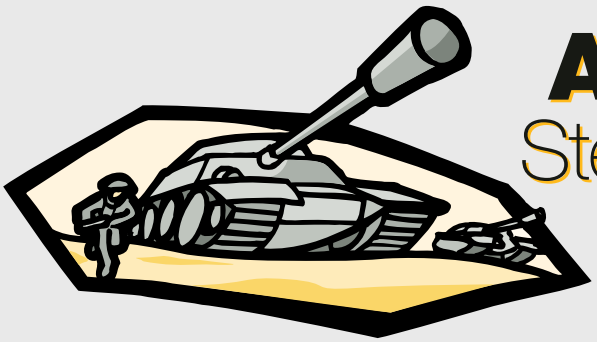


Get Them Daily: Essential Fatty Acids

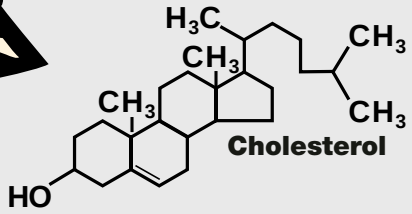
Most fats can be made by the body when dietary intake is adequate. The body only requires two essential polyunsaturated fatty acids to be supplied in the diet. The body uses these essential fatty acids to maintain the structural integrity of cell membranes and as a component of eicosanoids; hormone-like compounds that help regulate blood pressure, clot formation, maintenance of immune response and vision. The essential fatty acids are:

Linoleic Acid 19:2Δ9,12 (omega-6 fatty acid) the major essential fatty acid in the diet. Most commonly, found in vegetable oils such as corn, soybean, safflower and sunflower and meats. An intake of 1% to 2% of total energy is recommended to be an adequate intake of linoleic acid. Omega-6 fatty acid's major function is to promote blood clotting and inflammatory response. The American diet generally provides enough omega-6 fatty acids to meet daily needs.

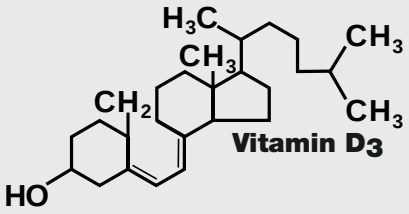
Alpha-Linolenic Acid 18:3Δ9,12,15 (omega-3 fatty acid) the other essential fatty acid. Although linolenic acid cannot be produced by the body, two products of linolenic acid metabolism appear to provide cardiovascular benefits; they are the omega-3 fatty acids: eicosapentaenoic acid (EPA) and docosahezaenoic acid (DHA). Omega-3 fatty acids tend to decrease blood clotting and inflammatory response in the body. (Note this is the opposite effect of omega-6 fatty acid). Recommendations to eat at least two fish meals a week are based on findings that diets high in omega-3 fatty acids may protect against heart disease. A target of 1 gram of EPA plus DHA per day has been suggested to be both safe and prudent. Oils from coldwater fish are rich in omega-3 fatty acids as well as certain vegetable oils including canola, soybean, flaxseed and wheat germ. Generally, the American diet lacks appreciable amounts of omega-3 fatty acids compared to its omega-6 content.



Allies, Not Enemies:
Sterols including *Cholesterol*



Cholesterol



Vitamin D_3

Through research, we are learning that eating too much saturated fat can increase the level of lipids in the blood and contribute to an increased risk of heart disease. Another type of lipid produced by animals often associated with saturated fat because it is generally found in the same foods, is cholesterol. Cholesterol is a sterol and, unlike triglyceride, has no fatty acids. It is the precursor of some important hormones such as corticosteroids, estrogens, testosterone and a form of the active vitamin D hormone. Cholesterol is also the precursor of bile acids, which are required for digestion and absorption of other lipids. In addition, cholesterol is a structural component of cell membranes and plays a part in transporting lipids within the blood.

Cholesterol is made by the liver and other body tissues. Normally the body maintains a constant plasma level by slowing production when it senses a rise in blood cholesterol. Genes control how much cholesterol the body makes and how much cholesterol is absorbed from the intestines. People are often unaware that less than one fourth (25%) of the cholesterol in the body is from dietary sources. The body makes most of the cholesterol, about 800-1500 mg/day, that ends up in the blood. The body tissues can make cholesterol from carbohydrates, proteins and fats. Body synthesis of cholesterol begins with acetate (a product of protein, fat and carbohydrate metabolism), in the presence of a cellular enzyme, HMGCoA reductase. The availability of the enzyme HMGCoA reductase is a limiting factor that helps the body control the amount of cholesterol produced. Once cholesterol is produced it has 3 different fates: it can be used as a substrate for bile acids, it can be added to bile and sent to the intestine to aid in fat digestion, or it can enter the blood serum attached to a protein carrier (lipoprotein).

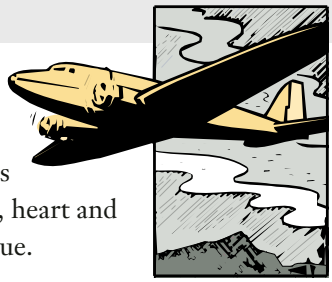
About 55% of the cholesterol that enters the intestine in the bile is reabsorbed and returned to the liver while the other 45% is excreted in the stool. The amount that is returned to the liver controls the activity of the HMGCoA reductase enzyme in the liver. An increased return of biliary cholesterol from the intestine suppresses HMGCoA reductase activity and liver cholesterol production.

About 97% of the bile acids are reabsorbed in the intestine, while 3% is excreted in the stool. Once bile acids are reabsorbed, they are extracted by the liver. In the liver, the bile acids regulate their own synthesis rate by feedback regulation. About 300-500mg of cholesterol are converted into bile acids daily.

Unfortunately, when tissue cholesterol production is not slowed or excess lipoprotein cholesterol is not cleared by the liver, cholesterol continues to build up in the blood. This has been shown to increase heart disease risk. Excess cholesterol causes harm to the body when it deposits on arterial walls leading to a narrowing of blood vessels and diminishing blood flow to body organs.

All cholesterol that is transported to the body tissues must be carried by proteins to keep it in solution within the blood. Receptor sites on the cell surface recognize and bind the lipoprotein and begin the process of utilizing the cholesterol.

Blood cholesterol can be divided into three major categories by their association with protein carriers known as lipoproteins.



Transport Agents: *Lipoproteins*

1. **Chylomicrons-**the largest and least dense carrier molecule that circulates newly digested fatty acids or triglycerides from the intestine to the liver and body tissues. As they flow through the lymph and blood, cells remove lipids from the chylomicrons leaving little more than a remnant that the liver removes from the circulation.

2. **Very Low Density Lipoproteins (VLDL)-** synthesized in the liver from protein and triglycerides, VLDL transports mainly triglycerides from the liver to the body tissues. As the triglycerides are removed from the VLDL, they pick up cholesterol and become low-density lipoproteins.

3. **Low Density Lipoproteins (LDL)-** Often considered the "bad" cholesterol because of its correlation with heart disease risk. LDL is a carrier molecule produced from the remnants of VLDL after the body cells have removed the triglycerides. LDL becomes loaded with cholesterol and travels through the blood distributing cholesterol to body organs like muscle, heart and adipose tissue.

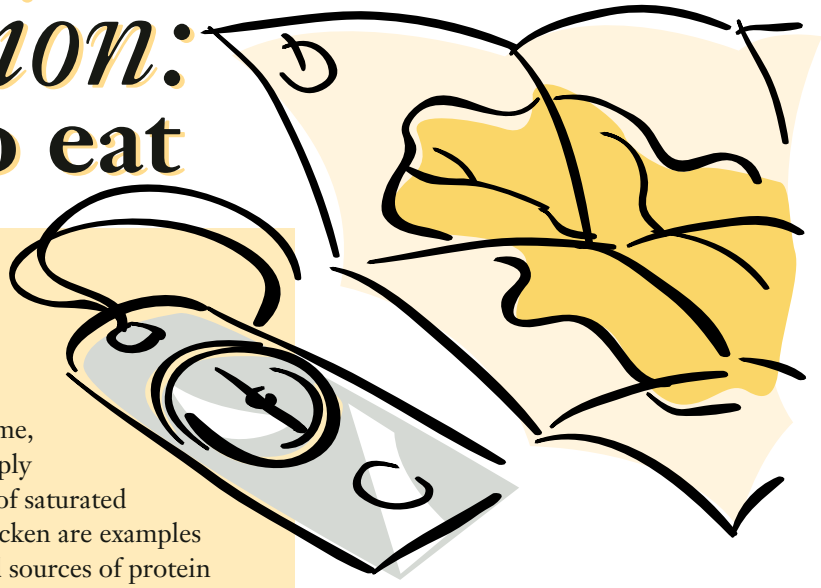
4. **High Density Lipoproteins (HDL)-** Consists mostly of protein and is often considered the "good" cholesterol. It's role is to collect and carry cholesterol and phospholipids back from the body cells to the liver for recycling or excretion. Maintaining a high HDL is believed to be an indication of lowered risk for heart disease.

Double Agents That Keep it Together:

Phospholipids Including Lecithin

Phospholipids are another class of lipid, able to dissolve in both water and fat and therefore can act as an emulsifier to keep fats suspended in body fluids and blood. An example of this property is the ability of egg yolk lecithin, to keep oil and vinegar together in solution when preparing salad dressing. Phospholipids play an important role in transporting fat-soluble vitamins and hormones through the cell membranes from sites of production to sites of utilization.

Course of Action: Knowing what to eat



Eating sensibly is one way to reduce the amount of cholesterol in your blood. For some, controlling the amount of saturated fats and cholesterol that you eat can help lower your blood cholesterol. For others exercise, which increases body production of HDL, is most helpful. Still others find eating more foods that contain whole grain fiber helps to reduce their blood cholesterol. The role of trans-fats and cholesterol in heart disease risk are still confusing for many.

The good news is that certain lifestyle changes are helpful for everyone and can decrease the risk of heart disease. These changes are to stop smoking, keep your weight within a healthy range, increase daily exercise to at least 30 minutes, and keep your blood level of fat and cholesterol within a normal range.

To minimize the amount of saturated and trans-fats in your diet here are some healthful tips:

- ✔ It is wise to trim meat before cooking it.
- ✔ When shopping or eating out of your home, choose foods that supply protein without a lot of saturated fat. Fish, eggs and chicken are examples of foods that are good sources of protein and are moderately low in saturated fat.
- ✔ Avoid using gravies and sauces unless the fat has been skimmed. To skim the fat from a soup, stew or gravy just cool it in the refrigerator and remove the fat that collects on the top.
- ✔ Choose low fat dairy products such as low fat cheese and low fat milk and try to avoid using butter or cream in sauces or toppings.
- ✔ Try to use olive or canola oil when cooking because these fats are monounsaturated and considered to be the most beneficial.
- ✔ To avoid trans-fats, replace coffee creamers with low fat milk, choose to use liquid oils such as canola or olive oil instead of stick margarine or shortening.

Generally, eating sensibly means keeping serving sizes small, choosing moderately low fat meat, fish, eggs or poultry, including whole grains, fruit and vegetables and making enjoyment the focus of your meal.

Although we have been hearing about saturated, hydrogenated and polyunsaturated fats for years, it's often confusing and difficult to understand how to use these terms to improve our personal health outlook. Scientific research continues to support what we all have known for generations: All foods are good in moderate amounts and all foods are a gift from nature.

QUESTIONS FROM the clinic

Q: How do I explain to my patients that it's okay to eat an egg everyday?

a: Consumers seem to appreciate that scientific research is a step-wise process and that through technological advancement our understanding of health and nutrition has improved.

They will understand that before we had today's scientific evidence demonstrating the minimal effect dietary cholesterol intake has on blood cholesterol levels (2mg/dl increase in blood cholesterol when dietary cholesterol intake is increased 100 mg), and the lack of significant association between egg consumption and heart disease risk, it was prudent to advise a tightly controlled dietary cholesterol intake.

Now many years later, we recognize the many nutritional benefits of egg consumption. Rather than cholesterol, research has made the link between saturated fat intake and heart disease much clearer. In fact, the American Heart Association has stopped recommending any specific limitation on daily egg intake. To learn more about the American Heart Association's total dietary approach to healthy eating visit their website: http://www.americanheart.org/presenter.jhtml?identifier=4547

Q: What quick advice can I offer my patients who need to reduce their saturated fat intake?

a: It's wise to suggest a gradual approach to reducing one's saturated fat intake. Rather than cutting out all fat intake, it is more realistic to advise patients to lower their saturated fat intake by becoming more familiar with certain terms when selecting prepared foods or foods from a menu:

LIMIT: Alfredo sauce, au gratin, battered, cheese sauce, cream sauce, crispy, deep fried, fried, prime cut, scalloped.

CHOOSE: Preparation methods for favorite foods that are steamed, boiled, poached, baked, broiled or roasted.

In addition, suggest that they substitute onions, mushrooms or peppers on their pizza in place of sausage, pepperoni or extra cheese. Choose baked or grilled chicken or leaner cuts of beef such as round, loin or sirloin. Instead of avoiding all rich desserts, top a sliver of a rich dessert such as ice cream or pie with fresh fruit to get a very similar experience.

Q: What are other sources of omega-3 fatty acids for patients who don't like fish?

a: Although certain fishes are potent sources of those heart healthy omega-3 fatty acids, there are other food sources:

DIETARY SOURCES OF OMEGA-6 AND OMEGA-3 FATTY ACIDS

Food Item (per 100 gms.)	Omega-6 Fatty Acids (g)	Omega-3 Fatty Acids (g)
Salmon, Atlantic	0.7	0.2
Tuna, albacore	0.3	0.2
Cod, Atlantic	Trace	Trace
Mackerel, Atlantic	1.1	0.1
Lake trout	1.4	0.4
Canola oil (Rapeseed)	22.2	11.1
Butter	1.8	1.2
Egg yolk, chicken, raw	4.2	0.1
Wheat germ oil	54.8	6.9
Walnut oil	52.9	10.4
Walnuts, black	34.2	3.3
Flaxseed oil	12.7	53.5
Mayonnaise, comm.,	16.0	2.0
Broccoli, raw	.03	0.1

Source: The Omega Plan, Artemis Simopoulos and Jo Robinson, Harper Collins, 1998.

COMPARISON OF DIETARY FATS

Saturated fats | Monounsaturated fats | Polyunsaturated fats

Dietary Fat	Cholesterol (mg/tbs)
Coconut oil	0
Butter	33
Beef tallow	14
Palm oil	0

• *Animal fats and the tropical oils of coconut and palm are mostly saturated*

Olive oil	0
Canola oil	0
Peanut oil	0
Lard	12

• *Some vegetable oils, such as olive and canola, are rich in monosaturated fatty acids*

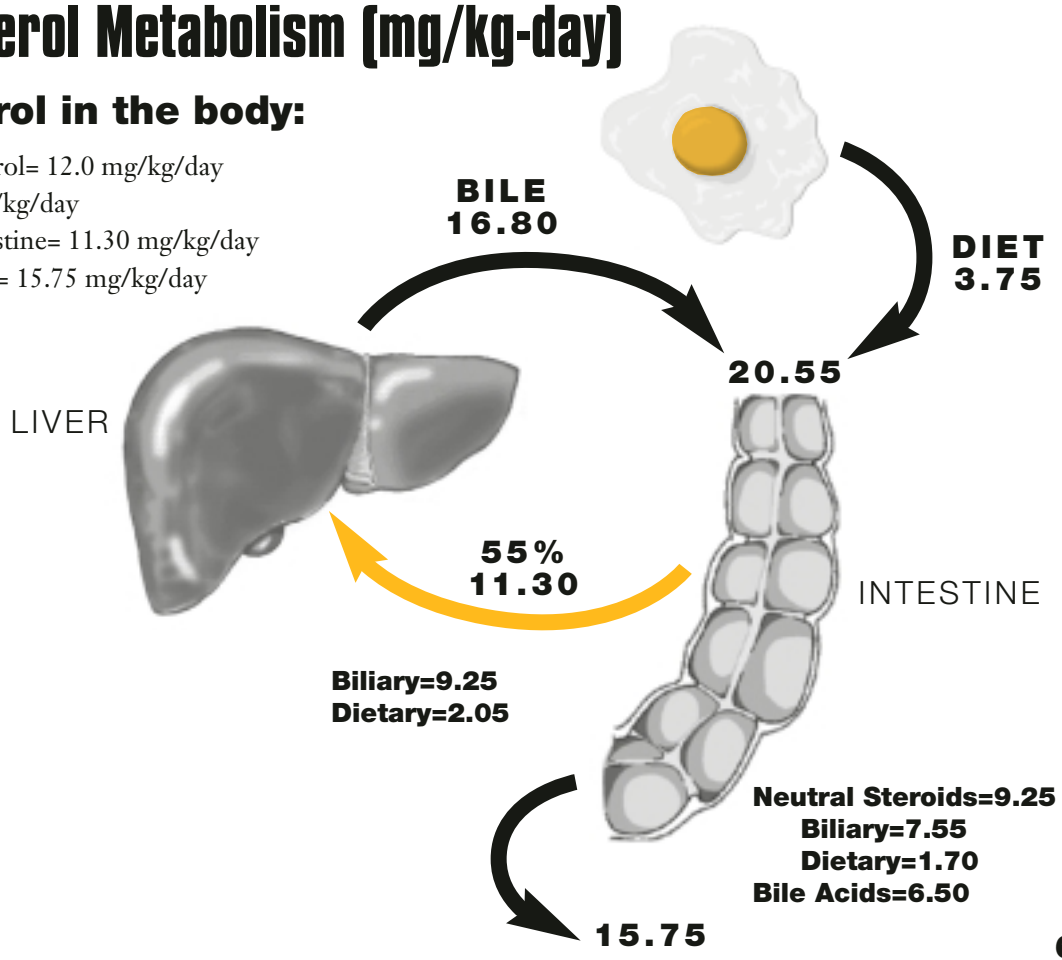
Safflower oil	0
Sunflower oil	0
Corn oil	0
Soybean oil	0
Cottonseed oil	0

• *Many vegetable oils are rich in polyunsaturated fatty acids*

Endogenous Cholesterol Metabolism (mg/kg-day)

The Fate of Cholesterol in the body:

Liver and cellular synthesis of cholesterol= 12.0 mg/kg/day
Dietary intake of cholesterol= 3.75 mg/kg/day
Re-absorption of cholesterol from intestine= 11.30 mg/kg/day
Excretion of cholesterol from intestine= 15.75 mg/kg/day



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