



Acupuncture and Nutritional Counseling Centre

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Nutrition Information Series

Your brain is fat. No really, it is

Humans require three macronutrients for survival: carbohydrates, fats and proteins. This Nutrition Information Tipsheet discusses fats and why certain fats are essential for good health while others lead to a host of health conditions. The surprise is that scientific research indicates the current dietary guidelines are causing obesity, heart disease and strokes. Eating fat can actually keep you thin.

What is fat?

A unit of dietary fat is comprised of three fatty acids attached by a glycerol molecule and is known as a triglyceride. The fatty acids are chains of carbon atoms and can be of varying lengths (i.e. different numbers of carbon atoms). Shorter chain fatty acids are liquid at room temperature whereas longer chains are generally solid at room temperature.

Triglycerides are a form of lipid. Lipids are used in the human body for energy, signaling and insulation (particularly in the brain) and as the main structural component of cell membranes.

The carbon atoms in the fatty acid chains are bonded to each other and may also be bonded to hydrogen atoms. Saturated fat has a hydrogen atom attached to every carbon atom and the carbon atoms are attached to neighboring carbon atoms with single bonds. If a carbon is missing a hydrogen atom it will form a double bond with its neighboring carbon. If this occurs on one carbon, the fatty acid is called monounsaturated. If more than one then it is a polyunsaturated fatty acid.

Polyunsaturated fats come in two configurations, or isomers: *cis* and *trans*. *Cis* fatty acids are the configuration found in nature. *Trans* fats occur when vegetable oils are processed to create oils with higher profit potential in their use or when certain oils are heated beyond a certain temperature.

There are two fats that the body cannot synthesize from other fats and must be consumed in the diet. These Essential Fatty Acids (EFAs) are polyunsaturated and are called Omega-3 (or n-3) and Omega-6 (n-6) fatty acids. There are three different forms of Omega-3 fatty acids: alpha linolenic acid (ALA), eicosapentaenoic acid (EPA) and decosahexaenoic acid (DHA). ALA is found in plant oils, while EPA and DHA are found in fish, seafood and fish oils. The body has the ability to make EPA and DHA from ALA, but many factors block this conversion. Linoleic acid (n-6) is found in poultry, eggs, vegetable oils, avocados, nuts and grains.

Cholesterol is a lipid that is made by every animal cell and is an essential component of every animal cell membrane (the sack around a living cell). Dietary intake of cholesterol is primarily through consuming animal protein, eggs, cheese and seafood.

How the body uses fat

In the absence of carbohydrates, the body will use fat for fuel. Fats have the highest energy content of any of the macronutrients, but the body will only utilize this energy source if there is no glucose available from dietary sources (for more information on carbohydrate intake please refer to The Chi Farm's Tipsheet, *Insulin Resistance, Metabolic Syndrome, Type II Diabetes, Oh My!*).

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Eating fat causes the feeling of satiety (the feeling of being full after eating). Diets low in fat often substitute carbohydrates, which do not create satiety and lead to overeating with possible blood sugar issues. Fats, particularly saturated fats, are required to move calcium from the blood into the bones. A low-fat diet may lead to osteoporosis and other associated diseases.

The absorption of the fat-soluble vitamins (A, D, E, K) and minerals from vegetables depends on dietary fat intake. Low fat diets can lead to deficiencies in these important nutrients. Fatty acids are essential to maintaining a regular heartbeat, providing an anti-inflammatory function, regulating cholesterol and contributing to brain and eye development.

The EFAs play a major role in cardiovascular health, including blood thinning and reducing arrhythmias, inflammation, blood pressure and triglyceride levels. Neurologically, EFAs improve mood (particularly depression), general cognitive functions and ADD. EFAs also reduce the risk of Alzheimer's, MS, Parkinson's and other neurodegenerative diseases. Studies have shown eating at least one egg per day throughout one's life significantly reduces senility in the elderly. However, individuals with high n-6 intake can have a 250% greater chance of Alzheimer's disease.

Research shows the more cholesterol and saturated fat a person eats, the less they weigh, the more physically active they are and their rates of heart disease are lower. Serum cholesterol levels below 180 lead to an increase in all-cause deaths, particularly from cancer and strokes. Furthermore, there are numerous studies that indicate there is no significant evidence for concluding that dietary saturated fat intake is associated with increased risk of cardiovascular disease.

Saturated fats play a key roll in cell membrane formation along with cholesterol, each making about approximately 50% of the membrane structure. To optimally use calcium for bone formation, 50% of all fat in the diet needs to be saturated (Vitamin D aids in getting calcium from the intestines into the bloodstream, saturated fat gets the calcium into the bones). Saturated fats also protect the liver from toxins such as alcohol and acetaminophen while protecting the kidneys from high protein intake. They are the preferred food for the heart and kill harmful gut microbes.

Cholesterol in a cell membrane provides structural support and secures important proteins in the membrane. If the body does not have cholesterol it will substitute other fats instead and this leads to inflammation and other maladies. In addition to its cell membranes, the brain uses cholesterol as an insulator; approximately 60% of the brain is fat. Cholesterol is also a repair substance and is used to repair wounds, including tears and irritation in the arteries. Bile salts, which dissolve fat, are made from cholesterol. Cholesterol is also involved in hormone production, Vitamin D synthesis, fighting infection and protects against depression.

Are there dangerous fats?

Commercially produced hydrogenated oils and *trans* fats have been shown produce a variety of health issues including: lower Hdl and higher Ldl levels (the opposite of desired); raised total cholesterol; low birth weight in humans; increased insulin response; altered immune response; decreased testosterone; altered liver detox pathways; altered cell membrane transport and fluidity (because of replacing cholesterol and saturated fats in the membrane); altered fat cell size and contents; and precipitates childhood asthma. It takes the body 90 days to clear trans fat.

The correct ratio of Omega-3 to Omega-6 EFA should be 1:2 to 1:4 (2 to 4 times the amount of n-6 to n-3). Most American diets are about 1:25. The main source of this imbalance is processed vegetable oils. High Omega-6 intake can lead to a compromised immune system and increased inflammation reactions that lead increased pain and stiffness. It also inhibits Omega-3 absorption. It has also been shown that excess intake of carbohydrates and sugary foods lead to the development of artery clogging particles, not saturated fats as current medical advice indicates.

Note: this information is for educational purposes only and is not intended to diagnose, treat, or cure any diseases. Please consult a qualified healthcare professional for nutritional advice.