Navigating the Fatty Acid Maze

U.S. recognizes *trans*- fat dangers

In 2003, the United States Food and Drug Administration (FDA) announced new regulations that will require food companies to add the amount of *trans*- fat to their product labels. U.S. Food manufacturers already must show the total amount of fat and the amounts of saturated and unsaturated fats on the label.

There will be no Daily Value or Percent Daily Value for *trans*- fats, since there is no available data on how much *trans*- fat is safe for humans to ingest.[1] However, some consumer groups have stated that avoiding *trans*- fats completely may be virtually impossible because they are included in so many common products and from some natural sources. They recommend, instead, reducing intake as much as possible.

In Canada, however, this detailed labelling of the trans-fats content of foods is optional. Products sold in Canada are required to show total saturated and *trans*- fat contents but not a breakdown of each type of fat. New regulations are forthcoming; however, the proposed changes are currently in the public discussion stage and may or may not include directives on the labelling of *trans*- fats. Canadian consumers must watch for other telltale signs of *trans*- fats, such as avoiding products containing hydrogenated or partially hydrogenated oils.

The new labelling requirement in the U.S., mandatory by January 2006, is a major step forward for the FDA. Once implemented, it will allow consumers to make much wiser choices when shopping. Of course, we need to know what to look for to make wise choices.

What is a *trans*- fat, anyway? Is it more harmful than other kinds of fat? Let's begin answering those questions with a look at the major types of dietary fats, which are sources of fatty acids, both essential and non-essential. The terms fat and fatty acid are frequently, though somewhat incorrectly, used interchangeably.[2]

Types of Fat

Most fats fall into one of three camps: monounsaturated, polyunsaturated and saturated fats. The differences lie in the chemical bonds between the carbon atoms that make up the backbone of the molecules and cause them to behave differently in our cells.

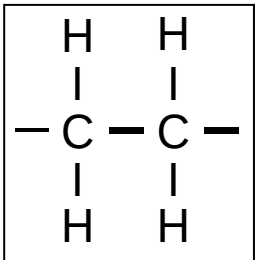


Figure 1: Carbon-Carbon Single Bond

Fats are chemically composed of one, two or three fatty acid molecules joined to a glycerol molecule and are described by the terms *monoglyceride, diglyceride* and *triglyceride*. Like all organic compounds, fats are made up of strings of carbon atoms with hydrogen atoms joined, or bonded, to them (hence the term, *hydrocarbon)*. If a fat molecule has the maximum number of hydrogen atoms attached to each carbon atom, it is saturated or full. A single carbon-carbon bond joins all of the carbon molecules (see figure 1).

In unsaturated fats, a double bond joins one or more pairs of carbon atoms in the backbone of the molecule. Each double bond eliminates the need for one pair of hydrogen atoms to complete the bonding requirements of each carbon. Such molecules are called *unsaturated* hydrocarbons, because they are not completely filled with the maximum allowable number of hydrogen atoms. Monounsaturated fats (from the Greek mono, or one) have a single missing hydrogen pair across the carbon-carbon double bond, while polyunsaturated fats (poly is Greek for many) have more than one missing hydrogen pair and several resulting carbon-carbon double bonds (figure 2).

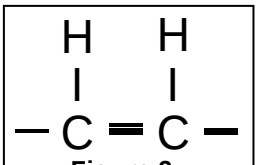


Figure 2: Carbon-Carbon Double Bond

Now it gets interesting! Each carbon-carbon double bond has two possible configurations: one where the hydrogen atoms lie on the same side of the double bond (*-cis* configuration) and one where the hydrogen atoms lay on opposite sides of the double bond (*trans-* configuration). Thus, *trans-* fats have hydrogen atoms on *opposite* sides of the carbon chain (figure 3).

Small amounts of *trans-* fats occur naturally, most commonly in animal products such as red meats and dairy products; but North Americans ingest the majority of *trans-* fats from food manufactured using a process called hydrogenation (meaning *to add hydrogen to*). Hydrogenation of vegetable oils allows manufacturers to convert these oils, normally a liquid at room temperature, into solids. However, it also converts healthier polyunsaturated fats to saturated and *trans-* fats.[3] Margarine and shortening, along with the many processed foods made using these ingredients, are the most common sources of hydrogenated and trans- fats. Crackers, sweetened cereals, candies, cookies, baked goods, salad dressings, deep-fried foods and other processed foods are laden with *trans-* fats, in addition to other fats and salts.

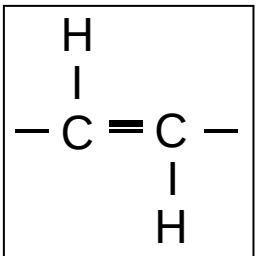


Figure 3: Trans- Fat (across chain)

The problem with trans-fats, from a biological perspective, is that Nature has not provided us with the ability to deal effectively with them. Consequently, your body has a difficult time metabolizing or converting these substances to other chemical forms. This simple difference in the way hydrogen attaches to the carbon chains is, therefore, what makes some fats beneficial and others extremely harmful.

Fat Isn't All Bad

Some dietary fat is essential. In addition to aiding in the absorption of many vitamins and phytonutrients, fats are involved in many vital metabolic processes. They also provide the consistency and flavour of many foods. The key is to avoid harmful fats and consume helpful fats.

Omega-3 and omega-6 fatty acids, also known as essential fatty acids (EFAs), have shown beneficial effects for many disorders. Omega-3 fatty acids, for example, help to reduce atherosclerosis[4] and reduce deaths from sudden heart attacks for cardiovascular disease patients.[5,6] Studies indicate EFAs may also help in the treatment of cystic fibrosis,[7] major depression,[8]

schizophrenia[9] and age-related macular degeneration.[10] Weekly meals including omega-3 fatty acid-rich fish may even help prevent Alzheimer's disease.[11] Antihypercholesterolemic agents, found in Omega-6 fatty acids, are a key component in preventing heart disease due to elevated cholesterol levels.[12] Regulation of cholesterol levels is one key way EFAs help prevent the development of — and reduce the consequences of — cardiovascular disease.

Fats provide an external source of cholesterol, a waxy substance that the body requires in moderate amounts. While the body can withstand a low intake of cholesterol from foods, it does not require any dietary cholesterol since the cells of the body can produce all they need. Low-density lipoprotein (LDL or "bad") cholesterol helps manufacture and repair cell membranes and helps produce vitamin D, some hormones and other tissues.[13] Unfortunately, LDL cholesterol is also known to cause a build-up of fatty deposits on the artery walls. Conversely, its companion, high density lipoprotein (HDL or "good") cholesterol helps control excess LDL cholesterol levels by removing it from the bloodstream.[14]

Trans- fats are "Public Enemy Number One" of the fatty acid community because they have the nasty habit of lowering HDL cholesterol levels. Saturated and *trans*- fats also provide very high levels of harmful LDL cholesterol to the body, while unsaturated fats do not.[15] That's why substituting unsaturated fats for saturated and *trans*- fats in the diet significantly reduces risk of coronary artery disease.[16] High cholesterol levels, particularly LDL cholesterol, are a potent indicator of increased risk of coronary heart disease.[17,18] It is this dual action, increasing LDL cholesterol while reducing helpful HDL cholesterol, that makes *trans*- fats such a potent contributor to the development of cardiovascular disease.

High LDL cholesterol levels can become even more dangerous when high levels of free radicals are present. If interaction with homocysteine (an oxidative compound present in the bloodstream) or another free radical agent oxidizes LDL cholesterol, a complex immune-system response begins. Macrophages consume the cholesterol and become bloated, foamy cells that attach themselves to the arterial walls. This eventually leads to fatty deposits known as atherosclerotic streaks or hardening of the arteries.[19,20]

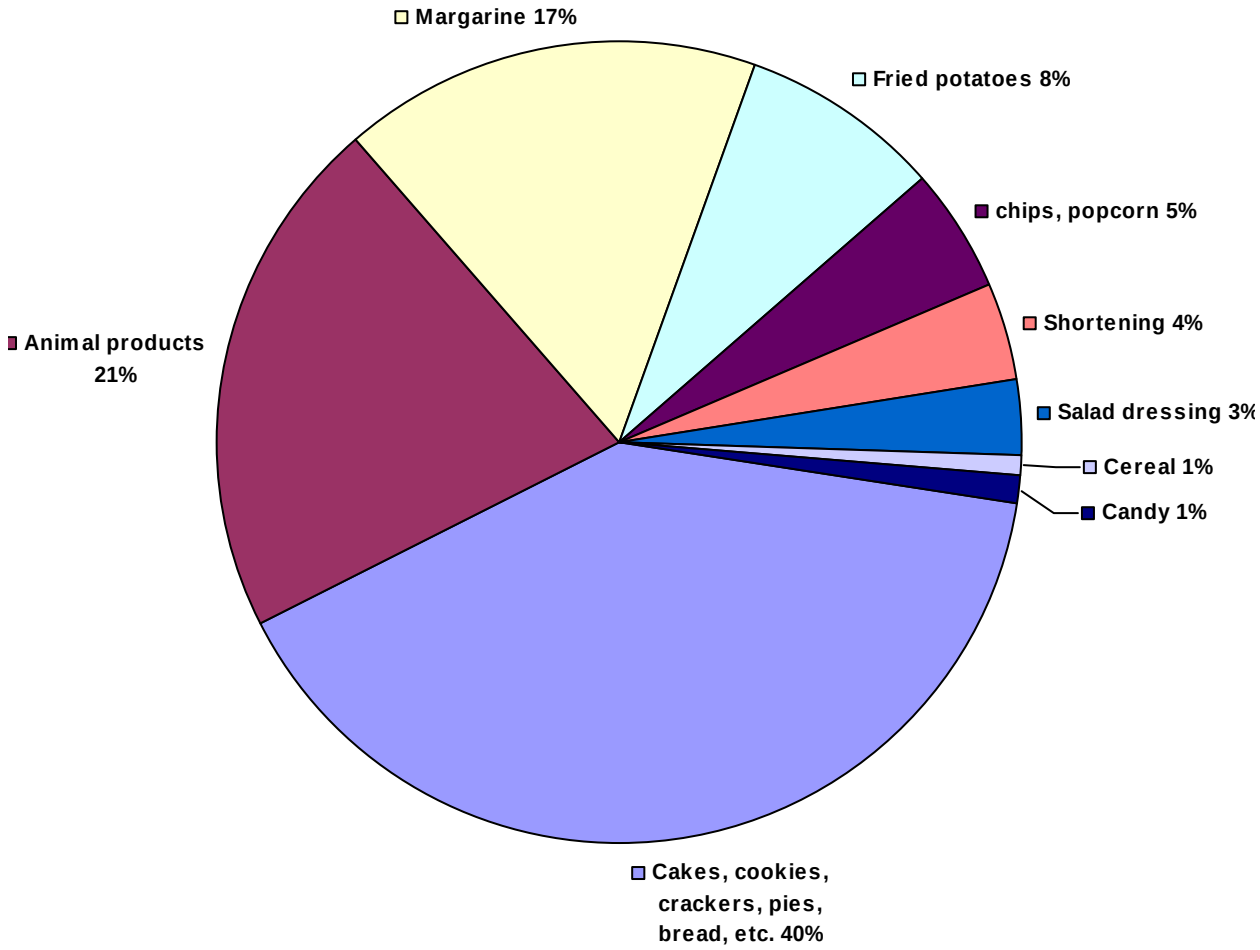
In diabetics, this process is even more insidious. The oxidized LDL cholesterol can become glycosylated (complexed with sugar), accelerating the development of atherosclerotic streaks.[21,22]

Consequences

Trans- fats have been linked to cardiovascular disease[23,24,25] and diabetes,[26,27] and may even affect breast-feeding infants if their mothers are eating a diet rich in *trans*- fatty acids.[28] The FDA estimates that its efforts to require manufacturers to declare the amount of *trans*- fats in their products could prevent up to 1200 heart attacks and 500 lives each year, resulting in a net savings of approximately $1.8 billion in medical costs and lost productivity.[29]

The FDA's analysis for the trans- fatty acid labelling rule shows that Americans consume over half of their intake of trans- fats in the form of avoidable foods such as margarine, cakes, cookies, crackers, pies and breads.[30] Only 21 percent comes from animal products, eight percent

Figure 4: Source of dietary *trans*- fat[30]



from fried potatoes, five percent from potato chips and other snack foods, and 7 percent from shortening and salad dressings (see figure 4).

Saturated and trans- fats are often found together in the same foods, including those mentioned above. A few simple lifestyle changes and wiser food choices can dramatically improve your odds of preventing cardiovascular disease, diabetes and even some forms of cancer. While it may be impossible to eliminate *trans*- or saturated fats from your diet, simply choosing foods with the *lowest amounts* of these harmful fats will make a very big difference.

Substitute foods with monounsaturated or polyunsaturated fats.

- Instead of high-fat, high-cholesterol butter or high *trans*- fat-containing margarine, consider extra virgin olive oil (which also contains high levels of extremely potent antioxidants), canola oil, soybean oil, corn oil and sunflower oil;
- To reduce saturated and trans fat intake from meats, eat more fish, particularly those rich in omega-3 fatty acids such as mackerel, sardines and salmon;
- Limit intake of high cholesterol foods, including egg yolks, dairy products and organ meats like liver and kidney;
- Choose low-fat versions of popular foods, such as skinless poultry, fat-free or one percent dairy products and lean meats;
- Eat more vegetables, fruit and whole grain foods.

Using the existing labels on U.S. and many Canadian products, the FDA recommends consumers look for saturated fat levels below five percent of the daily value.[31] Also avoid products with hydrogenated or partially hydrogenated ingredients, as these will have much higher levels of *trans*- fats.

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[1] "Questions and Answers about *Trans*- Fat Nutrition Labelling," U.S. Food and Drug Administration, July 09 2003, http://www.cfsan.fda.gov/~dms/qatrans2.html
[2] ibid
[3] "Trans Fatty Acids," American Heart Association, http://www.americanheart.org/presenter.jhtml?identifier=4776
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