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### **Eating for Your Health -- Trans Fats What Are They and Why Are They Dangerous?**

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**Your Life Your Health *The Examiner***

**March 6, 2003**

Over the past sixty-years studies have shown that there is a correlation between the increase in dietary fat intake and total cancer mortality. Surprisingly, there is a positive correlation between vegetable fat and cancer and a negative correlation between animal fat and cancer. This means that the cancer rate is higher when the amount of vegetable fat or total fat is higher in the diet, but the cancer rate is lower when there there is more animal fat in the diet. It is convenient to blame everything on red meat and animal fat, and believe that vegetable oil is the great dietary salvation- even if it is partially hydrogenated.

No one argues that lots of dietary fat is good for you and that vegetables are not good. Eating vegetables, fruits and other whole foods is very desirable.

**However, that is not the same as eating partially-hydrogenated vegetable oils.** In fact, Americans eat too much fat (especially partially hydrogenated vegetable oils) and not enough fruits and vegetables.

The problem is that the typical American is not eating enough whole foods -- unaltered and unprocessed foods -- but is eating too much partially hydrogenated vegetable oil, such as margarine or mayonnaise. Such "funny foods" are far different than real whole foods.

### **Hydrogenation is the culprit**

Hydrogenation ruins the nutritional value of vegetable oils! The purpose of hydrogenation is to solidify an oil so that it can be made to resemble real foods such as butter. The hydrogenation process imparts desirable features such as spreadability, texture, "mouth feel," and increased shelf life to naturally liquid vegetable oils. In doing so, the "real" foods are turned into "funny" foods which are harmful to your health.

In the hydrogenation process, vegetable oil is reacted under pressure with hydrogen gas at 250 to 400 degrees Fahrenheit for several hours in the presence of a catalyst such as nickel or platinum. Unfortunately, this process cannot control where the hydrogen atoms are added to the "unsaturated" double bonds. Randomly adding hydrogen atoms to polyunsaturated fats converts natural food components into many compounds, some of which have never seen before by man until partially hydrogenated fats were manufactured.

### **Trans Fats**

Some of the several dozens of altered compounds created in the manufacture of partially-hydrogenated fats are "**trans**" fatty acids. Fatty acids are the building blocks of fats, much like amino acids are the building blocks of proteins. Other new compounds accidentally synthesized include fatty acids having double bonds translocated to new and un-natural positions. Many of these altered

compounds are detrimental to health.

### **A brief and important chemistry lesson**

"**Cis**" and "**trans**" refer to how identical atoms are added to double bonds in naturally occurring substances. When the atoms are added to the same side of the double bond, the compound is called "**cis**" and the molecule is bent because of the crowding of the atoms on one side.

When the atoms are added on opposite sides of the double bond, the compound is called "**trans**" and the molecule is "space-balanced" and straightened. The shape of a molecule is important because enzymes and their substrates -- the molecules enzymes act upon -- must fit together like a key in a lock. Natural polyunsaturated fatty acids are "**cis**" compounds and are bent. Partial hydrogenation produces many un-natural "**trans**" fats which are straight and not intended for use in the human body.

You don't have to understand the difference between "trans" and "cis," but it is important that you know that there is a difference because it can affect your health.

### **How are trans fats harmful to us?**

Consumption of **trans** fatty acids from partially hydrogenated (a process that adds hydrogen to solidify or harden) vegetable fats and oils had many adverse effects in health areas such as heart disease, cancer, diabetes, immunity, reproduction and lactation, and obesity.

### **Cholesterol and Heart Disease**

1. **Trans** fats lower the "good" HDL cholesterol in a dose response manner (the higher the **trans** fat level in the diet, the lower the HDL level in the blood) and
2. **Trans** fats raise the atherogenic lipoprotein(a) in humans
3. **Trans** fats raises the "bad" LDL cholesterol and total blood cholesterol levels by 20-30 milligram-percent.

Perhaps the most significant event in our understanding of the detrimental effects of **trans** fats though was the report from researchers at Harvard University, who evaluated more than 85,000 women in a long-term prospective study and found that there was a significantly higher intake of **trans** fatty acids in those individuals who developed heart disease.

### **Cancer**

**Trans** fatty acids induce adverse alterations in the activities of the important enzyme system that metabolizes chemical carcinogens and drugs (medications), i. e., the mixed-function oxidase cytochromes P-448/450. Several groups around the world reported a higher intake of partially hydrogenated fats in those individuals who have developed cancer.

### **Diabetes**

**Trans** fatty acids decrease the response of the red blood cell to insulin, thus having a potentially undesirable effect in diabetics.

### **Immune response**

**Trans** fatty acids adversely affect immune response by lowering efficiency of B cell response and increasing proliferation of T cells. This still needs to be evaluated in humans, but in animal models increasing **trans** fats in the diet decreases the strength of the host immune system.

### **Reproduction and Milk Production in Women**

Recent research from outside the U. S. has indicated that **trans** fatty acids interfere with reproductive attributes and of concern is the finding that **trans** fatty acids lower the amount of cream (volume) in milk from lactating females in all species studies including humans, thus lowering the overall quality available to the infant.

In reality, **trans** fatty acids cause alterations to numerous physiological functions of biological membranes that are known to be critical for cell health and stability, e.g., appropriate membrane transport and membrane fluidity. And, these **trans** fatty acid isomers produce alterations in fat cell size, cell number, lipid class and fatty acid composition.

### **More Chemistry about Fatty Acids**

Fatty acids are basically chains of carbon molecules with a carboxyl group (Carbon, Oxygen, Oxygen, Hydrogen) at one end that can combine with another molecule. When fatty acids are in fats or oils they are combined with glycerol in the proportions of three fatty acid molecules to one glycerol molecule and they form **triglycerides**.

### **Classification of Fatty Acids**

Fatty acids come in different chain lengths ranging from three carbons long (propionic acid) to 24 carbons long (lignoceric acid). These fatty acids are either:

1. "Saturated" are chemically stable. Saturated fatty acids have an adequate number of hydrogen atoms and have a straight configuration and can pack into a solid crystal at normal temperatures.
2. "Unsaturated" are chemically unstable. If the fatty acid is missing four or six or more hydrogens, it is called a polyunsaturated fatty acid, and it is even more unstable than the monounsaturated fatty acid. Because the double bonds in naturally occurring plant oil fatty acids are curved with a "cis" configuration, the fatty acids cannot pack into a crystal form at normal temperatures so their presence produces a liquid oil.
3. "Monosaturated" fatty acids are missing two hydrogens. In place of the two hydrogens, the adjacent carbons "double" bond to each other. Olive oil is the most commonly known and used

monounsaturated fatty acid. It has even been found to be heart-protective, which means that it is good for your heart and arteries.

### **Altering unsaturated fatty acids**

If the unsaturated fatty acids are altered by partial hydrogenation to straighten the chains so that they have some of the physical packing properties of saturated fatty acids they have had their "cis" double bond changed to a "**trans**" double bond and they turn a technically mostly unsaturated oil into a solid fat.

The trans fatty acids are the same length and weight as the original "cis" fatty acid they were formed from, and although they have the same number of carbons, hydrogens, and oxygens they are shaped differently in space.

The problem arises when a large number of the **trans** fatty acids are consumed from foods and are deposited in those parts of the cell membranes that are supposed to have either saturated fatty acids or "cis" unsaturated fatty acids; under these circumstances the **trans** fatty acids essentially foul up the "machinery."

### **Why are trans fats a problem?**

The various mechanisms through which the **trans** fatty acids disrupt function are related in part to the ability of trans fatty acids to inhibit the function of membrane related enzymes such as the delta-6 desaturase resulting in decreased conversion of e.g., linoleic acid to gamma-linolenic acid or arachidonic acid; interference with the necessary conversion of omega-3 fatty acids to their elongated tissue omega-3 fatty acids; and escalation of the adverse effects of essential fatty acid deficiency.

### **What Should I Do?**

While it is not necessary to "know" this information having read it once will help you make the decision to avoid **trans** fats. You can do this by avoiding processed, solid vegetable oils and many altered, liquid vegetable oils.

In order to increase the shelf life of foods, almost all processed foods have **trans** fats in them. Avoid these. At present, it is not necessary for food processors to identify the presences of **trans** fats in their products. Therefore, you need to read the label for "partially hydrogenated fatty acids." These will have **trans** fats in them.

Eating "whole" foods -- that is, foods which are in the same form as they are found in nature -- will help you avoid **trans** fats. Whether fruits, vegetables, nuts, meats, flour or other foods, processing almost always alters foods in an unnatural way. Avoid these.

As the old axiom states, "You are what you eat," so eat healthily. Remember, it is your life and it is your health.