Trans fats dangerous

What are Trans Fats?

The fat in foods contains a mixture of saturated, monounsaturated and polyunsaturated fatty acids. In foods of animal origin, a large proportion of fatty acids are saturated. In contrast, in foods of plant origin such as liquid vegetable oils, a large proportion of the fatty acids are monounsaturated (MUFA) and polyunsaturated (PUFA). Trans fat (also known as trans fatty acids) is a specific type of fat formed when liquid oils are made into solid fats like shortening and hard margarine. However, trans fat is also found naturally, primarily in ruminant foods including dairy and beef products. Ruminant milk and fat products provide smaller quantities of trans fat, which result from partial biohydrogenation of feed MUFA and PUFA by rumen bacteria. FDA estimates that the average daily intake of trans fat in the U.S. population is about 5.8 grams or 2.6% of calories per day for individuals 20 years of age and older.
Industrially produced trans fat is made when hydrogen is added to vegetable oil--a process called hydrogenation. Hydrogenation increases the shelf life and flavor stability of foods containing these fats. In most unsaturated fatty acids the hydrogen atoms at double bond are positioned on the same side of the carbon chain, a position called the cis-configuration (Latin, on this side). However, partial hydrogenation of vegetable oils reconfigures some double bonds of unsaturated fatty acids and the hydrogen atoms end up on different sides of the chain. This type of configuration is called "trans" ("across" in Latin)

During the past 20 years, there has been a tremendous interest in the nutritional characteristics of trans fatty acids (TFAs). There are two primary reasons for this activity. First, several human feeding studies have consistently observed that TFAs from partially hydrogenated vegetable oils (PHVO), at sufficiently high levels, raise blood LDL-cholesterol (LDL-C) to a similar degree as saturated fatty acids and, unlike saturated fatty acids, which raise plasma HDL-cholesterol

(HDL-C), TFAs do not. Second, conjugated linoleic acid (CLA), a form of TFA containing a cis and trans double bond, has been shown to exhibit multiple health-related benefits.

Trans fatty acids are present in foods containing traditional stick margarine (3.04 g trans fatty acids/serving) and vegetable shortenings (2.54 g/serving) that have been subjected to hydrogenation, as well as in milk (0.22 g/serving), butter (0.40 g/serving), and meats (0.01 to 0.21 g/serving. Therefore, foods that are contributors of trans fatty acids include:

Pastries, fried foods (e.g., doughnuts and French fries), dairy products, and meats. Human milk contains approximately 1 to 5 percent of total energy as trans fatty acids.

There is a positive linear trend between trans fatty acid intake and total and LDL cholesterol concentration, and therefore increased risk for CHD, thus suggesting a Tolerable Upper Intake Level UL of zero. Because trans fatty acids are unavoidable in ordinary diets, achieving such a UL would require extraordinary changes in patterns of dietary intake. Such extraordinary adjustments may introduce other undesirable effects, e.g. elimination of foods such as dairy products and meats, that contain trans fatty acids may result in inadequate intakes of protein and certain macronutrients, and unknown unquatifiable health risks may be introduced by any extreme adjustments in dietary pattern.

For these reasons, no UL is proposed. Nevertheless, it is recommended that trans fatty acid consumption be as low as possible while consuming nutrionally adequate diet.

It should also be noted (it was mentioned in the report but with little emphasis) that the trans fatty acids found in meat and dairy are the naturally occurring result of the bacterial fermentation of polyunsaturated fats that ruminants (cows, sheep, goats, deer, etc) consume in grasses and grains. These ruminant trans fatty acids are

primarily vaccenic acid. On the other hand, the trans fatty acids created during the partial hydrogenation of vegetable oils is primarily elaidic acid, a relative rarity in the human diet prior to industrialization.

Studies that have shown adverse health effects from trans fatty acids have primarily focused on the trans fats from partial hydrogenation. In addition, the contribution in the average diet today from naturally occurring vaccenic acid from things like meat and dairy is approximately 10% or less of that contribution from elaidic acid, which is found in things like margarine, shortening, and the majority of processed foods.

The above quote even states that human milk is approximately 1-5% trans fats, which is approximately the same percentage as that found in dairy and meat products, compared to 20%-50% trans found in stick margarine and shortening. This does not mean that mothers should not nurse their babies. Naturally occurring trans vaccenic acid converts in tissues to the isomer conjugated linoleic acid (CLA) which has been shown in several studies to have anti-carcinogenic properties.

In addition to clinical studies showing the effects of TFAs on plasma LDL-C and HDL-C, several epidemiological studies have reported positive associations between the intake of TFAs and the risk of coronary heart disease (CHD). This effect was primarily accounted for by industrially produced PHVO whereas ruminant derived TFAs were not associated with an increase in CHD risk.
The consistent findings from metabolic and epidemiological studies have resulted in dietary recommendations by government agencies to decrease the intake of TFAs to levels as low as possible while others have recommended TFA intake goals of <1% of total energy intake. In addition, food labeling legislation has been enacted in many countries, including the U.S. and Canada, that require the amount of TFAs to be declared on the nutrition label.

http://www.iom.edu/iom/iomhome.nsf/WFiles/TransFattyAcids/$file/TransFattyAcids.pdf . You need an acrobat reader for that site but Yahoo, MSNBC and most others that report health news have articles about it.

Trans fats, worse for our hearts than saturated animal fats. Now, as consumers increasingly turn to food that is trans-fat-free and manufacturers pull them from more and more processed foods, comes a twist. Some trans fats, ones that exist naturally, may be good for you.

A diet enriched with vaccenic acid -- a naturally occurring trans fat found in milk and yogurt -- had significant reductions in total cholesterol, LDL (or "bad") cholesterol and triglycerides.
A key benefit of vaccenic acid is its ability to reduce the production of chylomicrons -- small particles of fat, protein and cholesterol formed in the gut that transport fats to various tissues of the body. Chylomicrons, raises lipids in the bloodstream. After 16 weeks of consuming vaccenic acid-enriched food given to rats, the levels of chylomicrons in their blood serum dropped by more than half.

It is not clear what this finding means for humans. First, the study was done in rats -- the researchers say they're planning some human clinical trials with vaccenic acid supplementation. Second, because the study diets were supplemented with vaccenic acid, the amounts the rats ate relative to their body weight was more than we would naturally eat in our usual diet.

The study however, is in line with other reports that natural trans fats have different effects on the body than the industrially created ones.

Most of the trans fats we eat -- by far -- come from partially hydrogenated vegetable oils, produced from liquid oils by industrial processing to create a firmer fat. This kind has to be avoided. Others occur naturally in milk products, formed in the rumen (or first

stomach) of ruminant animals such as cows, goats, sheep and yaks when they're fed a grass-rich diet. Should bee taken in moderation.

Several studies of large populations have looked at the link between trans fatty acid intake and risk of developing atherosclerosis, and all have shown that the risk goes up only with the intake of "industrial" trans fatty acids, not the natural ones.

Several clinical trials -- in which people were fed special diets for weeks or months -- have shown that manufactured trans fats raise LDL cholesterol levels to the same degree as saturated fats, and also lead to lower levels of the good, or HDL, cholesterol. It has been estimated that it takes only about 12 grams of manmade trans fats to see this effect.

Trans-fat-free foods are big business, and today the majority of margarines, cookies, snack cakes and chips are devoid of the stuff. The change was fueled by the fact that, two years ago, it became law that food labels disclose industrial trans fat content.

Even if all the partially hydrogenated vegetable oil disappeared from our foods, we would still consume about 1% to 5% of our calories from naturally occurring trans fatty acids, mostly vaccenic acid.

At this point, it is not known how much vaccenic acid we would need to consume to reap benefits. But in the meantime, anyone wanting to increase their natural-trans-fat intake might want to develop a taste for exotic cheese.

A study published in February in the Journal of Agriculture and Food Chemistry reported that yak cheese, from animals grazing in alpine grassland, contains more than four times the vaccenic acid of conventional cheddar cheese from grain-fed dairy cows. (The study did not investigate the levels in cheese from grass-fed cattle.) It also contains three times more beneficial omega-3 fatty acids. The authors conclude that a daily serving of 3 ounces of yak cheese might

promote health.

Yak cheese is not easy to find -- but the bottom line seems to be that the fatty acid composition of milk, cheese and yogurt from grass-fed animals may be more healthful than we knew -- and perhaps, when the clinical trials are done, vaccenic acid-rich milkfat may join the ranks of other healthful fats along with those found in fish oil and nuts.

A study was conducted to identify exogenous factors that would depress synthesis of saturated fats and enhance synthesis of unsaturated fats in the dairy cow's mammary gland.

Certain long-chain exogenous fatty acids are known to modulate endogenous fat synthesis within tissues. We analyzed the effects of two different long-chain monounsaturated fatty acids, namely oleic acid and trans-vaccenic acid (TVA), on activities of acetyl-CoA carboxylase (ACC), fatty acid synthetase (FAS) and stearoyl-CoA desaturase (SCD) in bovine mammary epithelial cell cultures. The study was done using an established bovine mammary epithelial cell line, the MacT cells. ACC (EC 6.4.1.2) and FAS (EC 2.3.1.85) are two major enzymes involved in biosynthesis of saturated fatty acids in eucaryotic cells. SCD (EC 1.14.99.5) is the enzyme catalyzing the critical committed step in biosynthesis of unsaturated fatty acids from their saturated precursors.

Data indicated depression of activity of enzymes responsible for mammary synthesis of saturated fatty acids (ACC and FAS), along with a simultaneous enhancement of mammary desaturase activity, by TVA.

The health benefits of cutting down on dietary saturated fatty acids and including higher levels of unsaturated fatty acids are well documented. Nutritional research is focusing on the effects of incorporating these healthier fatty acids, such as conjugated linoleic acid (CLA), into animal and human diets. CLA is present in dairy

products and meat from ruminants and in very low amounts in our bodies.

Health benefits of conjugated linoleic acid (CLA)

Dr Helen Roche, a senior lecturer in molecular nutrition in Trinity College Dublin, has been studying CLA and its biological properties for several years. "CLA seems to protect cells programmed to become diabetic against development of diabetes and it also prevents disease processes that lead to atherosclerosis, chronic inflammation and colon cancer," says Dr Roche.

Classified as a nutriceutical or nutritional supplement, CLA is thought to change the balance between fat cells and muscle cells in the body and is currently on sale in health shops as a supplement to help people improve their body tone.

"The problem is that commercially available supplements contain two forms of the compound known as isomers," explains Dr Paul Evans, a researcher with the Centre for Synthesis and Chemical Biology (CSCB). "Isomers are molecules that have the same molecular formula but the atoms are arranged differently in space. In the case of CLA one isomer known as cis-9-trans-11 CLA has beneficial effects but the other form, trans-10-cis-12 CLA, can be detrimental and could induce a diabetic state."

In ruminant fat, the predominant monounsaturated TFA is trans vaccenic acid (11 trans-18:1), which can account for more than 60% of the TFA content of bovine milk fat (Figure 2b). Hence, although the types of monounsaturated TFAs contained in industrial-produced trans fats and ruminant fats are largely the same, there is considerable differences in the levels of the individual monounsaturated TFAs. In addition, ruminant fats contain significant amounts of CLA (i.e. predominantly 9 cis, 11 trans-18:2, also termed rumenic acid), whereas PHVO is virtually devoid of CLA. There is, therefore, a basis for potential metabolic differences between industrial and

ruminant trans fats that may be related to specific TFAs, their levels and differences in how they are metabolized in the body. For example, one major difference between PHVO and ruminant TFAs is that unlike elaidic acid, the major TFA in PHVO, trans vaccenic acid can be bioconverted to rumenic acid by ruminants as well as non-ruminants, including humans. In humans, the estimated conversion of trans vaccenic to rumenic acid ranges from 19-24%. Furthermore, unlike clinical studies with PHVO which have consistently demonstrated that TFAs from PHVO raise LDL-C to a similar degree as saturated fat, clinical studies with diets enriched in rumenic acid (cis-9, trans-11 18:2) or diets enriched in rumenic + trans vaccenic acid did not show any significant effect on plasma LDL-C, HDL-C or triglyceride levels. Additionally, epidemiological studies that have evaluated the effect of TFA from PHVO and ruminant fat sources on the risk of CHD suggest that the strength of a direct association is mainly supported by trans fat from partially hydrogenated vegetable oils and not the trans fat from ruminant dairy and meat fat. Clearly, additional clinical research is needed to determine whether the intake of ruminant trans fat and especially trans-vaccenic acid is similar or different from industrial sources of trans fat with respect to the impact on coronary heart disease risk.

Discovering a selective way to synthesise the beneficial CLA isomer

Dr Evans and his group while working at the School of Chemistry in Trinity College Dublin discovered a way to selectively synthesise the beneficial cis-9-trans-11 CLA in large quantities.

During the CLA project the group also found a method for making trans-vaccenic acid (TVA), the precursor to CLA. Evidence suggests that TVA is converted into CLA by an enzyme in the bovine mammary gland and muscle and by a bacterial enzyme in the human intestine.

"Now that we have a supply of the beneficial form of CLA and TVA we can carry out nutritional studies to determine whether the health effects ascribed to CLA are due to the fatty acid alone or attributable to the metabolic conversion of TVA into CLA," says Dr Roche.

Studying the benefits of trans vaccenic acid (TVA) in livestock

Teagasc have also conducted studies to increase the concentration of CLA in livestock. In a feeding trial conducted in Moorepark they reported that in grazing situations where the levels of CLA were already high in milk fat, they could be increased further by supplementing pasture diets with full fat rapeseeds and soybeans, which are both good sources of unsaturated fatty acids.
A Teagasc research group led by Dr Aidan Moloney in County Meath has now turned their attention to studying the conversion of TVA into CLA by livestock as this metabolic process may hold the key to explaining some of the benefits of CLA. The study aims to demonstrate the beneficial effects of CLA from beef as well as from chemically synthesised CLA.

"TVA is produced by cattle during digestion of unsaturated fatty acids. We are trying to increase TVA, and to understand how it is converted to CLA in muscle," explains Dr Moloney. "We want to investigate whether increasing TVA by manipulation of the diet of cattle will result in healthier animals and in turn produce higher quality meat and dairy products for the consumer."