

THE DANGERS OF TRANS FATTY ACIDS

Though *trans* fatty acids occur abundantly in industrially processed fats, they also exist naturally. The mono-unsaturated 16 carbon fatty acid *trans*-3-hexadecenoic acid is found in chloroplasts of all green plants and eukaryotic algae. Two mono-unsaturated 18 carbon fatty acids are produced by anaerobic bacteria in the rumens of cows, sheep and other ruminants: *trans*-9-octadecenoic acid (also called **elaidic acid**) and *trans*-11-octadecenoic acid (also called **trans-vaccenic acid**). One poly-unsaturated 18 carbon acid (called **eleostearic acid**) is found in some seed oils, especially in tung oil (extracted from seeds of the tung tree or *Vernicia fordii*).

Two of these, elaidic acid and *trans*-vaccenic acid, can be routinely assessed through usual fatty acids profiles in order to evaluate their abundance in the patient's phospholipids. If so, it would not only reflect their intake as natural forms produced by **biohydrogenation** in rumen microorganisms, even if dairy products and beef fat contain small amounts of *trans* fatty acids. As a matter of fact, this biohydrogenation is mimicked by catalytic hydrogenation in industrial food processing. The goal of **industrial hydrogenation** is to reduce the degree of unsaturation in fatty acids from vegetable origin, this being done purportedly for two main reasons.

One reason is improving stability, as more unsaturated fats show a bigger susceptibility to oxidation. The second reason is modifying their physical properties. Highly unsaturated oils have low melting points and, as such, do not suit most food uses when a solid texture is desired, which happens often. Let's imagine what would occur when you open the plastic bag containing your favorite chocolate bar! Hydrogenation of vegetable oils produce "harder" fats, as "**hardening**" raises the melting point, thereby giving better textural properties to many food fats.

Industrial hydrogenation is carried out in enclosed tanks by adding a small quantity of a finely powdered **catalyst**, usually **nickel** (to be removed after by filtration), at temperatures of **180° C**. Chemically, this process **1)** tends to reduce the total number of double bonds in the fatty acid; **2)** isomerizes some of the *cis* double bonds present in the original oil into the *trans* form; **3)** may shift some double bonds along the hydrocarbon chain from their original position. Besides increasing the melting point, these physical modifications of the fatty acid render it much more rigid, in fact close to the molecular configuration of saturated fatty acids. Another mechanism by which *trans* fats may harm human health lies in the disruption that they might cause to all desaturases and elongases, the enzymes designed to naturally process our fatty acids.

Structural changes resulting from industrial hydrogenation have sound nutritional significance, as several studies published in major medical journals suggest. "The contribution of dietary *trans* fatty acids on the risk of **ischemic heart disease (IHD)** has recently [article published in 2004] gained further support due to the results from large, prospective, population-based studies. Compared to saturated fats, [they] are, gram to gram, associated with a considerably (2.5- to 10-fold) higher risk for IHD." Further studies are needed about multiple negative effects on human fetus and newborns, colon cancer risk, allergic disease in children and type-2 diabetes risk in adults. Additional concerns - all published in 2005 - are: increased risk of **gallstone disease**, decreased adipocyte **membrane fluidity** and decreased **insulin sensitivity** (in rats fed *trans* fatty acids), adverse effect towards **endothelial function** adding up to the cardiovascular risk.

Among the processed foods providing those undesirable fatty acids, **margarines** have been heavily criticized, even if major improvements have taken place in recent years in order to reduce their content in *trans* fatty acids; **crisps** come close behind. Then, we must mention **dressings, shortenings, doughnuts, fried foods** (including **French fries**), **popcorn, mayonnaise, biscuits, cakes, fast food**, most processed **snacks** and **bars**. Beyond these exclusions, we emphasize the need to discard any food which label mentions the presence of "**partially hydrogenated vegetable oils or fats**". Unfortunately, European laws do not make this label obligatory, though it has recently been made compulsory by the United States of America.