

EDITORIAL

Health Hazards From Trans Fatty Acids Ban of Artificial Trans Fats Long Overdue

Antonis S. Manolis, MD

*Evangelismos General Hospital
of Athens*

Although we are all abundantly aware of the health risk of saturated fat, not much attention and proper warning is given to the even more hazardous effects of unsaturated **trans fatty acids**.¹⁻³ Most unsaturated (mono- or poly-unsaturated) fatty acids in foods have the *cis* configuration. *Trans* fatty acids (TFA) are created by the partial hydrogenation of vegetable oils, a process converting them into semisolid fats for use in margarines, commercial cooking (e.g. cooking oils for frying in restaurants), and manufacturing processes (e.g. processed foods like commercial baked products such as cookies, cakes and crackers, or even bread). Hydrogenated vegetable oils are preferred by the food industry because they have longer shelf life, are more stable during deep-frying, and their semisolid status renders them more suitable to customize and enhance the palatability of baked goods and sweets, being an inexpensive alternative to other semi-solid oils. However, the process of hydrogenation, adding hydrogen atoms to *cis*-unsaturated fats, eliminating a double bond and making them more saturated, frequently has a side effect that turns some *cis*-isomers into *trans*-unsaturated fats instead of hydrogenating them completely. In addition to industrial hydrogenation, TFA in foods are also produced during heating and frying of oils at high temperatures. The major fatty acids found in food are the saturated palmitic and stearic acids and the unsaturated oleic (mono-), linoleic and linolenic (poly-unsaturated) acids. The major dietary sources of *trans* fatty acids are traditional vegetable shortenings and solid margarines, crackers, candies, cookies, snacks, fried foods, baked goods, and other processed foods (Table).

The TFA content is usually 3-6% in dairy and beef products and a bit higher in lamb and mutton. In margarines and fat spreads TFA may vary from 1% up to 17% (data from the TRANSFAIR study, 1995-96), although more recent analyses show that TFA levels in most edible fats are <1-2%, albeit in favor of an increase in saturated fat.³ In bakery products (crackers, pies, pirogues, cookies, biscuits, wafers, etc), and in some breakfast cereals with added fat, French fries, soup powders and some sweets and snacks, the TFA content may vary from <1% up to 30% of total fatty acids depending on the type of fat used. Vegetable oils and liquid margarines have a low proportion of TFA (usually <1%).³

Major concern has been raised for the artificial TFA (from partially hydrogenated oils or oil overheating) which are more harmful and not for the naturally occurring TFA found in small amounts in pomegranates, cabbage, peas, or in the meat and milk of ruminants (cows, sheep and goats). Like saturated fat, the primary health risk identified for trans fat consumption is an **elevated risk of ischemic heart disease (IHD)**.¹⁻⁶ However, gram for gram, trans fat is far more potent than saturated fat in increasing the risk for IHD, probably because it has more adverse effects. Trans fat

Correspondence to:
Antonis S. Manolis, MD
Professor & Director of Cardiology
First department of Cardiology
Evangelismos General Hospital of
Athens
Athens, Greece
e-mail: asm@otenet.gr

TABLE. Foods containing large amounts of trans fatty acids (TFA)

Food	Tfa Content
Margarine spreads	0.3-4.2 g/tablespoon
Fast Food	
French fries	5-15 g/serving
Breaded burger	5-6 g/serving
Breaded chicken	2-7 g/serving
Snacks/Baked Goods	
Pie	4 g / serving
Danish	3 g / piece
Donut	3-5 g/piece
Chips & Crackers	1.5-3 g/serving
Cookies & candy	1.5-3 g /serving
Soups	lots of TFA
Breakfast Food (Cereal/energy bars)	0.5-1.5 g/serving
Frozen Food	1-4 g/ serving
Toppings & Dips	lots of TFA

behaves similarly with saturated fat by **raising LDL levels**, but furthermore, it has the additional effect of **decreasing HDL levels**. Trans fat also has proinflammatory properties, it increases CRP levels and has other harmful effects on vascular endothelium.^{7,8}

Health authorities worldwide recommend that consumption of trans fat be reduced to trace amounts. Unlike other dietary fats, trans fats are not essential. The National Academy of Sciences indicates that dietary trans fatty acids are more deleterious with respect to coronary heart disease than saturated fatty acids (www.nap.edu/openbook.php?isbn=0309085373&page=504). In addition to being prime risk factors for ischemic heart disease, trans fats may be potent carcinogens (e.g. prostate, colon or breast cancer), suppressors of immune function, and promoters of type 2 diabetes, Alzheimer's disease, obesity and liver dysfunction. However, epidemiological evidence for a possible relationship of TFA intake with cancer, diabetes, or allergy remains controversial.³ The World Health Organization recommended in 2003 that trans fats be limited to less than 1% of overall energy intake.⁹ In 2006, the American Heart Association recommended that daily intake of trans fats be limited to 1% of total calories, which is equivalent to roughly 2 to 2.5 grams of trans fat per day.^{10,11} On a similar note, they also recommended that saturated fat be limited to about 15 to 19 grams per day.

The exact biochemical mechanism by which trans fats produce health harm is a topic of continuing research. A prevailing suggestion is that the human lipase enzyme is specific to the cis configuration, rendering the human body unable to metabolize or remove trans fat, so trans fat remains in the blood stream for a much longer period of time and is more prone to arterial deposition and subsequent atheromatous plaque formation. It appears that TFA are atherogenic on their own, beyond the atherogenic properties of dietary cholesterol.⁴ The most important piece of evidence for the effect of trans fat on IHD comes from the Nurses' Health Study, following 120,000 nurses since 1976. Data analyzed from 900 coronary events over 14 years, a nurse's IHD risk was estimated to be roughly double (relative risk of 1.94) for each 2% increase in trans fat calories consumed.⁵ By contrast, a >15% increase in saturated fat calories is needed to produce a similar increase in risk. On the other hand, replacing 2% of food energy from trans fat with non-trans unsaturated fats more than halves the risk of IHD (53%). By comparison, replacing a larger 5% of food energy from saturated fat with non-trans unsaturated fats reduces the risk of IHD by 43%. In an ensuing updated analysis comprising 20-year follow-up, it was reported that a higher intake of trans-fat was associated with an increased risk of IHD, independent of other dietary factors and cardiovascular risk factors, whereas a higher intake of polyunsaturated fat was associated with a decreased risk of IHD.⁶ The relations of polyunsaturated fat and trans-fat intake with IHD risk were stronger among women younger than 65 years of age. In general, prospective epidemiological studies consistently support the findings from intervention studies for an association between higher intakes of TFA and increased risk of IHD. In the prospective cohort studies that compared the effects of TFA and saturated fatty acids, the effects of TFA were stronger than those of a mixture of saturated fatty acids.

Denmark was the first country to introduce laws strictly regulating the sale of many foods containing trans fats in March 2003, imposing a limit of 2% of fats and oils destined for human consumption.¹⁰ Switzerland followed Denmark's trans fats ban, and implemented its own beginning in April 2008. Tiburon, California was America's first trans fat-free city in 2004.² On December 5, 2006, the New York City Health Department ruled on restricting "service of unhealthful artificial trans fat by food service establishments". On February 8, 2007, the Philadelphia City Council passed a trans fat ban. Over the last few years, several other American cities and states have followed up on ruling against the use of TFA.¹² Dietary surveys indicate that the intakes of TFA have decreased in a number of EU countries,³ mainly due to reformulation of food products, but apparently much larger scale effort is needed to implement stricter health regulations regarding use of TFA. Elimination of partially hydrogenated oils from foods appears feasible, albeit challenging, for restaurants and food manufacturers. Fats should be replaced by cis unsaturated fats

and this can be done without increasing the cost or reducing the quality or availability of foods. Health authorities should be advising the public to minimize the intake of trans fats, to recognize and avoid foods containing trans fats, and take measures all aiming to limit the use of TFA in the industry and restaurants in an effort to afford significant health benefits all culminating in the prevention of thousands of IHD events each year worldwide.

Unfortunately, the problem with excessive trans fats does not only lie with fast-food chains. Many other restaurants, including “quality” or “elite” restaurants, fry their food in partially hydrogenated oil and serve baked meals containing partially hydrogenated fat. With regards to shopping, we can know whether a food contains trans fat by looking at the ingredient list on the food label. If the ingredient list includes the words “shortening,” “partially hydrogenated vegetable oil” or “hydrogenated vegetable oil,” the food contains TFA. In restaurants or bakeries one should ask whether they use partially hydrogenated oil for frying or baking or in salad dressings. They may respond that they use vegetable oil, but one should ask whether it is partially hydrogenated. One assumes that all unlabeled baked and fried goods contain partially hydrogenated oil, unless one knows otherwise. Because trans fatty acids produced in the partial hydrogenation of vegetable oils account for more than 80% of total intake, the food industry has an important role in decreasing trans fatty acid content of the food supply. Health authorities need to apply such rules and regulations restricting TFA that all concerned parties conform with.^{3,9-12} This is definitely feasible as there are many alternatives for TFA which can lead to a significant reduction in trans fatty acids in the world food supply.¹⁰ Food manufacturers need to reformulate their products and restaurants should use TFA alternatives in order to address the need to remove artificial trans fat from the food supply for the sake of everybody’s health. Subsequent to New York trans fat restriction, which was in full effect by November 2008, estimated restaurant use of partially hydrogenated oils/fats for frying, baking, or cooking or in spreads had decreased from 50% to <2%, resulting in products with more healthful fatty acid profiles.¹² This is an example worth following!

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