REVIEW ARTICLE

FACTS ABOUT TRANS FATTY ACIDS

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Introduction

Fatty acids constitute the main class of lipids in the human diet, being found in nature mainly as glycerol esters that originate triacylglycerols. In the vegetal and animal kingdoms, fatty acids generally have *cis* unsaturations. In this form, the hydrogens bound to the double bond carbons are on the same side. In another possible configuration, called *trans*, the hydrogens are bound to un saturations, carbons on opposing sides. Fatty acids with one or more un saturations in the *trans* configuration are called *trans* fatty acids (TFAs).[1-4]

There are two major sources of TFA, those that come from ruminant animals and those that are industrially produced.

The majority of TFAs are found in partially hydrogenated vegetable oils, which contain 10–40% as TFA.[5] Hydrogenation is based on the reaction of unsaturated fatty acids of either vegetable or marine oil in the presence of a catalyst, in general nickel. The objective is to increase the oxidative stability of oils by reduction of the concentration of more unsaturated fatty acids and changing their physical properties, thus extending their application. Hydrogenation depends mainly on oil temperature, hydrogen pressure, stirring speed, reaction time, and the catalyst type and concentration. According to the process conditions, hydrogenation is classified as either partial or total and either selective or nonselective.[6] It has been estimated that dietary TFAs from partially hydrogenated oils may be responsible for between 30,000 and 100,000 premature coronary deaths per year in the United States.[7]

The concentration of TFA in meat and milk from ruminants (i.e., cattle, sheep, goats, etc.) contain 3 to 8% of total fat.[5] It is hypothesized that ruminant TFAs, or certain TFA isomers from ruminant sources, may confer some health benefits; however, since TFA from animal sources accompany saturated fatty acids (SFA), an increase in a single ruminant TFA in the diet is not appropriate because it will increase SFAs.[8] In addition, processes such as edible oil refining, meat irradiation, food frying, also contribute to increase the daily intake of TFA.[9,10]

Intake of TFAs has been consistently shown in multiple and rigorous randomized trials to have adverse effects on blood lipids, most notably on the LDL: HDL cholesterol ratio, which is a strong cardiovascular risk factor.[11-13] When a mixture of TFA isomers, obtained by partial hydrogenation of vegetable oils, is used to replace oleic acid, there is a dose-dependent increase in the LDL: HDL ratio. The relationship between amount of TFA as the percent of energy and the increase in the LDL: HDL ratio appears to be approximately linear (figure 1),[12] with no evidence of a threshold at low levels of intake, and with slope twice as steep as that observed by replacing oleic with saturated fats. The average impact of TFA induces changes in the LDL: HDL ratio corresponds to tens of thousands premature deaths in the US alone. Although dramatic, this effect is substantially smaller than the increase in cardiovascular mortality associated with TFA intake in epidemiological studies, suggesting that other mechanisms are likely to be contributing in the toxicity of TFA.[11]

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