

Nutrition and Health Info Sheet: Trans Fatty Acids

For Health Professionals

Produced by:
Anna M. Jones, PhD
Debbie Fetter, BS
Sheri Zidenberg-Cherr, PhD
Center for Nutrition in Schools
Department of Nutrition
University of California, Davis
June 2016

What are *trans* fatty acids (TFA)?

Trans fatty acids (TFA) are unsaturated fatty acids with at least one double bond in the *trans* (hydrogen on opposite sides) position (Figure 1).

How are *trans* fatty acids produced?

Most TFA found in foods are produced commercially via the hydrogenation of unsaturated fatty acids found in vegetable oils.¹ Hydrogenation and partial hydrogenation results in a semi-solid or solid product with a higher melting point, increased stability, resistance to oxidation, and shelf life.¹

This process results in the reduction of double bonds in the fatty acids.

- Complete reduction of double bonds results in a fully hydrogenated, saturated fat.
- A reduction of only some of the double bonds creates partially hydrogenated fats and oils.
- During this process, *cis* (hydrogen on the same side) bonds can reform into *trans* bonds resulting in TFA.

What are some health concerns related to TFA consumption?

Trans fatty acid consumption has been associated with an increase in all cause mortality.² Studies suggest this is driven primarily by the impact TFA consumption has on heart health, as they have been reported to negatively impact several factors that increase risk for cardiovascular disease.²⁻⁴ The consumption of industrially-produced TFA is associated with increased low-density lipoprotein (LDL) levels and decreased high-density lipoprotein (HDL) levels. This results in a higher total-to-HDL ratio, a risk factor for cardiovascular disease. Studies have also reported that TFA may increase systemic inflammation, an independent risk factor for cardiovascular disease.⁴

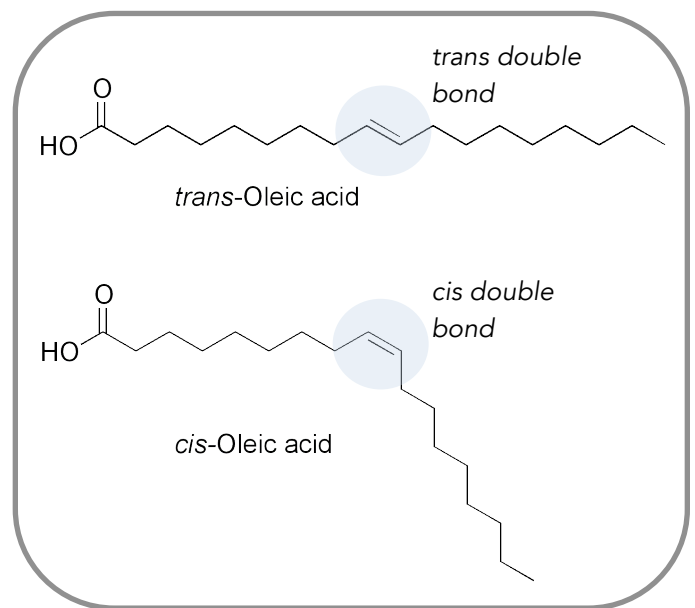
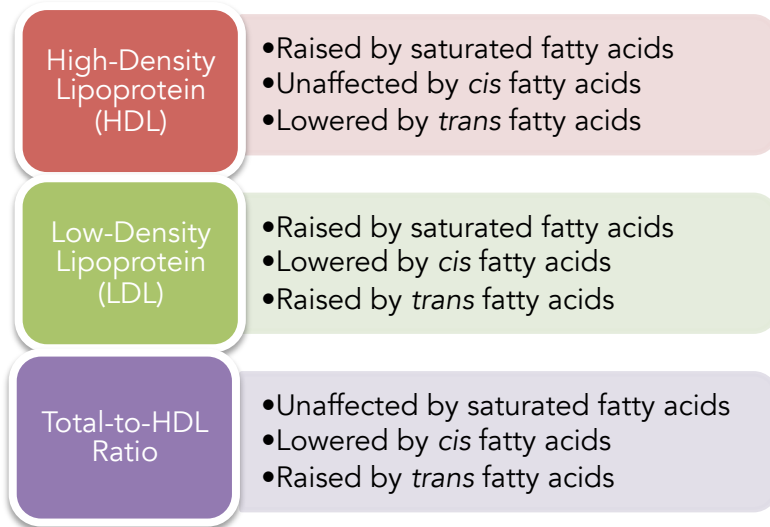


Figure 1: *Trans*- and *cis*-Oleic acid.
Image via Wikimedia Commons

How do the health impacts of TFA compare to saturated fatty acids and cis fatty acids?

Consumption of both saturated fatty acids and TFA raises LDL cholesterol; however, saturated fat also raises HDL, thereby having little impact on total to HDL ratio² (Figure 2).



Consumption of *cis* unsaturated fatty acids has been associated with decreased risk of heart disease. Studies have reported that replacing *trans* and saturated fatty acids in the diet with *cis* unsaturated fatty acids, particularly polyunsaturated fatty acids, lowers risk for coronary events.⁵⁻⁶

Figure 3: Impact of fatty acids on blood lipid markers.

What actions have the Food and Drug Administration (FDA) taken on TFA?

In 2003, the FDA ruled that manufacturers would be required to include TFA content on Nutrition Facts labels by January 2006.⁷ As increasing evidence became available regarding the negative health impacts of industrially-produced TFA, the FDA made a preliminary judgment that partially hydrogenated oils (the main dietary source of TFA) could not be considered “generally recognized as safe” (GRAS) on November 8, 2013.⁸ The preliminary judgment was open for public comment for 120 days.

Final determination was released that partially hydrogenated oils are not GRAS on June 15, 2015.⁹ Manufacturers have until June 18, 2018 to remove all partially hydrogenated oils from foods.

How has intake of TFA changed over time?

Intake of TFA has decreased significantly in the U.S. in the last decade. In 2004, it was estimated that the average consumption of industrially-produced TFA was 4.6 grams per day.⁷ A study published in 2012 estimated that average consumption of industrially-produced TFA had dropped to 1.3 grams per day.¹⁰

What foods contain TFA?

The major source of TFA in the diet are commercially-produced hydrogenated oils found in many processed foods. The foods that contribute the most partially hydrogenated oils to the diet include:¹⁰

- Cookies, pastries, and desserts

- Savory snacks and crackers
- Bread and refrigerated dough products
- Frozen pizza
- Fast food
- Margarine and refrigerated spreads

How have manufacturers reduced TFA content in foods?

Since the FDA began requiring manufacturers to include TFA content on Nutrition Facts labels, many have reduced the TFA content in their products. Methods that have been used include improved hydrogenation process, interesterification of mixed fats, selective breeding and genetic modification of oil seed plants, and replacement of partially hydrogenated oils with tropical oils (Figure 3).¹¹

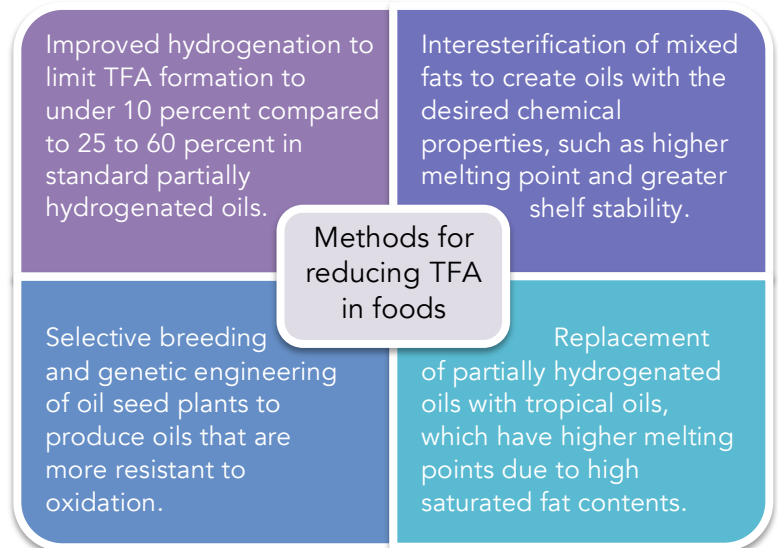


Figure 3: Common methods for reduction of TFA in foods. .

References:

1. Tarrago-Trani MT, et al. New and Existing Oils and Fats Used in Products with Reduced *Trans*-Fatty Acid Content. *J Am Diet Assoc*; 2006; 106: 867-80.
2. de Souza, et al. Intake of saturated and *trans* unsaturated fatty acids and risk of all cause mortality, cardiovascular disease, and type 2 diabetes: systematic review and meta-analysis of observational studies. *BMJ*; 2015; 351: h3978.
3. Remig V, et al. *Trans* fats in America: A review of their use, consumption, health implications, and regulation. *J Am Diet Assoc*; 2010; 110: 585-592.
4. Mozaffarian D. *Trans* fatty acids – Effects of systemic inflammation and endothelial function. *Atheroscler Suppl*; 2006; 7: 29-32.
5. Jakobsen MU1, O'Reilly EJ, Heitmann BL, et al. Major types of dietary fat and risk of coronary heart disease: a pooled analysis of 11 cohort studies. *Am J Clin Nutr*. 2009 May;89(5):1425-32. doi: 10.3945/ajcn.2008.27124. Epub 2009 Feb 11.
6. Vafeiadou K, Weech M, Altowaijri H, et al. Replacement of saturated with unsaturated fats had no impact on vascular function but beneficial effects on lipid biomarkers, E-selectin, and blood pressure: results from the randomized, controlled Dietary Intervention and VAScular function (DIVAS) study. *Am J Clin Nutr*. 2015 Jul;102(1):40-8. doi: 10.3945/ajcn.114.097089. Epub 2015 May 27.
7. Food and Drug Administration, HHS. Food labeling: *trans* fatty acids in nutrition labeling, nutrient content claims, and health claims. Final rule. *Fed Regist*. 2003 Jul 11;68(133):41433-1506.
8. Food and Drug Administration, HHS. Tentative Determination Regarding Partially Hydrogenated Oils; Request for Comments and for Scientific Data and Information. *Fed Regist*. 2013 Nov 8;78(217):67169-7175.
9. Food and Drug Administration, HHS. Final Determination Regarding Partially Hydrogenated Oils. *Fed Regist*. 2015 Jun 17;80(116):34650-4670.
10. Doell D, Folmer D, Lee H, Honigfort M, Carberry S. Updated estimate of *trans* fat intake by the US population. *Food Addit Contam Part A Chem Anal Control Expo Risk Asses*. 2012; 29 (6): 861-874.
11. Tarrago-Trani MT, et al. New and Existing Oils and Fats Used in Products with Reduced *Trans*-Fatty Acid Content. *J Am Diet Assoc*; 2006; 106: 867-80.

The University of California prohibits discrimination or harassment of any person on the basis of race, color, national origin, religion, sex, gender identity, pregnancy (including childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (as defined by the Uniformed Services Employment and Reemployment Rights Act of 1994: service in the uniformed services includes membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services) in any of its programs or activities.

University policy also prohibits reprisal or retaliation against any person in any of its programs or activities for making a complaint of discrimination or sexual harassment or for using or participating in the investigation or resolution process of any such complaint.

University policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Equal Opportunity Director, University of California, Agriculture and Natural Resources, 1111 Franklin Street, 6th Floor, Oakland, CA 94607, (510) 987-0096.

Copyright © The Regents of the University of California, Davis campus, 2016. All rights reserved. Inquiries regarding this publication may be directed to cns@ucdavis.edu. The information provided in this publication is intended for general consumer understanding, and is not intended to be used for medical diagnosis or treatment, or to substitute for professional medical advice.