

Editorial

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The Basic of Trans-Fatty Acids in Foods: An Update to Prevent Diseases

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Most of naturally occurring Fatty Acids (FAs) in humans are found in *cis* (Z) configuration. The change of *cis*-FAs (e.g. monounsaturated and polyunsaturated FAs) in *trans* (E)-FAs is made by isomerization, which could be geometric and/or positional according to a given carbon chain.¹⁻³ In the *cis* configuration, the two hydrogen atoms are on the same side of the carbon chain with respect to the double bond, a situation that produces a bend in the FAs, whereas in the *trans* configuration, the two hydrogen atoms are diagonally opposed to each other, straightening the carbon chain.^{1,2} (Figure 1).

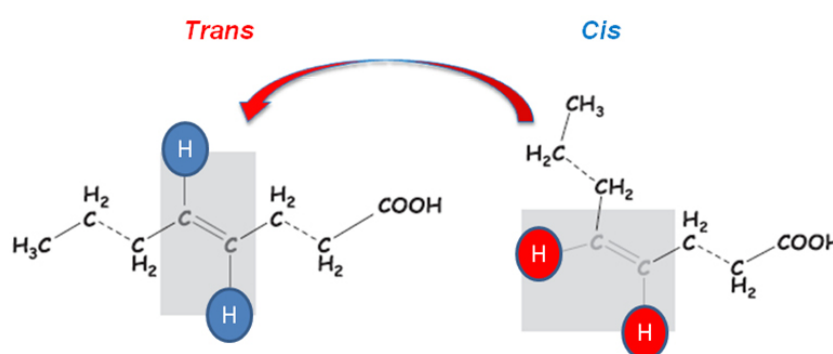


Figure 1: Cis- and trans-configurations of fatty acids.¹

TFAs mainly arise from hydrogenation either through: (i) naturally occurring enzymatic process involving desaturases (i.e. enzymatic transformation) in the rumen of animals (e.g., bacterial flora in cows, sheeps, goats) in mammalian breasts;^{4,5} (ii) partial (or total) industrial catalysis of vegetables or fish oils requiring hydrogen gas or a metal catalyst (e.g. nickel) to replace saturated FAs, solidify vegetal fat products (e.g. pizzas, cakes, chocolates, shortenings such margarines), decrease their oxidation sensitivity, and enhance their taste;^{2,6} or (iii) extreme thermal treatments (e.g., deep-fat frying, barbecue, deodorization during oil refining), although these are considered as a minor source.^{1,2}

While too little information is available about the effects of natural TFAs on human health,^{1,7,8} most experimental and experimental studies, *albeit* sometimes controversial, report that industrial TFAs are neither essential nor salubrious, and could even predispose to important pathologies, including fetal malformations, Cardiovascular diseases (CVDs), and other inflammatory-state diseases (e.g., cancers, diabetes, metabolic syndrome, obesity), especially when consumed chronically or at high doses.^{1,7,9} Interestingly, certain TFA isomers (e.g. Conjugated Linolenic Acids (CLAs), which are polyunsaturated FAs in mixed configuration *cis/trans*) would be beneficial for health,^{1,10} and so, should not be banned.

Prevention modalities should be based on finding alternative industrial approaches and preventive actions. Thereby, two relevant industrial approaches can be used to reduce or

eliminate TFAs in food^{1,2,11,12}: (i) food reformulation (e.g. replacement of TFAs with edible base stock FAs, such palm oil, although some of the fat replacers might run the risk of increasing SFA levels); and (ii) modification of FA composition through valuable innovative processes (e.g. chemical or enzymatic fat interesterifications, which usually display interesting physico-chemical features that minimize SFA levels). Furthermore, the production of healthier shortenings by these industrial processes, along with reforms for greater transparency in labeling (i.e. specifications of TFA composition and amount on prepackaged foods) and/or active consumer educational campaigns to substantially reduce TFA production and consumption, have been successfully applied in some countries but remain a challenge in many others, despite the growing evidence of their impact on health.^{1,2,13-15}

Therefore, it becomes clear that both individual- and policy-level initiatives to decrease TFA consumption should continue, particularly in population subgroups (e.g. young individuals), and recent findings provide further evidence to support the concerted effort to minimize or even ban TFAs in the diet.¹⁶

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REFERENCES

1. Menaa F, Menaa A, Menaa B, Tréton J. Trans-fatty acids, dangerous bonds for health? a background review paper of their use, consumption, health implications and regulation in France. *Eur J Nutr.* 2013; 52: 1289-1302. doi: [10.1007/s00394-012-0484-4](https://doi.org/10.1007/s00394-012-0484-4)
2. Menaa F, Menaa A, Tréton J, Menaa B. Technological approaches to minimize industrial trans fatty acids in foods. *J Food Sci.* 2013; 78: R377-R386. doi: [10.1111/1750-3841.12055](https://doi.org/10.1111/1750-3841.12055)
3. Ratnayake WM, Galli C. Fat and fatty acid terminology, methods of analysis and fat digestion and metabolism: A background review paper. *Ann Nutr Metab.* 2009; 55: 8-43. doi: [10.1159/000228994](https://doi.org/10.1159/000228994)
4. Kraft J, Hanske L, Möckel P, et al. The conversion efficiency of trans-11 and trans-12 18:1 by delta9-desaturation differs in rats. *J. Nutr.* 2006; 136: 1209-1214.
5. Mosley EE, Wright AL, McGuire MK, McGuire MA. Trans fatty acids in milk produced by women in the United States. *Am. J Clin Nutr.* 2005; 82: 1292-1297.
6. Ratnayake WMN, Pelletier G, Hollywood R, Bacler S, Leyle D. Trans fatty acids in canadian margarines: Recent trends. *J Am Oil Chem Soc.* 1998; 75: 1587-1594. doi: [10.1007/s11746-998-0098-4](https://doi.org/10.1007/s11746-998-0098-4)
7. Brouwer IA, Wanders AJ, Katan MB. Effect of animal and industrial trans fatty acids on hdl and ldl cholesterol levels in humans-a quantitative review. *PLoS One.* 2010; 5: e9434. doi: [10.1371/journal.pone.0009434](https://doi.org/10.1371/journal.pone.0009434)
8. Jakobsen MU, Overvad K, Dyerberg J, Heitmann BL. Intake of ruminant trans fatty acids and risk of coronary heart disease. *Int J Epidemiol.* 2008; 37: 173-182. doi: [10.1093/ije/dym243](https://doi.org/10.1093/ije/dym243)
9. Mozaffarian D, de Oliveira Otto MC, Lemaitre RN, et al. Trans-Palmitoleic acid, other dairy fat biomarkers, and incident diabetes: the multi-ethnic study of atherosclerosis (MESA). *Am. J. Clin. Nutr.* 2013; 97: 854-861. doi: [10.3945/ajcn.112.045468](https://doi.org/10.3945/ajcn.112.045468)
10. Gebauer SK, Chardigny JM, Jakobsen MU, et al. Effects of ruminant trans fatty acids on cardiovascular disease and cancer: A comprehensive review of epidemiological, clinical, and mechanistic studies. *Adv. Nutr.* 2011b; 2: 332-354.
11. Mozaffarian D, Jacobson MF, Greenstein JS. Food reformulations to reduce trans fatty acids. *N. Engl. J. Med.* 2010; 362: 2037-2039. doi: [10.1056/NEJMc1001841](https://doi.org/10.1056/NEJMc1001841)
12. Hayes KC, Pronczuk A. Replacing trans fat: The argument for palm oil with a cautionary note on interesterification. *J Am Coll Nutr.* 2010; 29: 253S-284S.
13. Ballesteros-Vásquez MN, Valenzuela-Calvillo LS, Artalejo-Ochoa E, Robles-Sardin AE. Trans fatty acids: Consumption effect on human health and regulation challenges. *Nutr Hosp.* 2012; 27: 54-64. doi: [10.1590/S0212-16112012000100007](https://doi.org/10.1590/S0212-16112012000100007)
14. Mozaffarian D, Katan MB, Ascherio A, Stampfer MJ, Willett WC. Trans fatty acids and cardiovascular disease. *N Engl J Med.* 2006; 354: 1601-1613. doi: [10.1056/NEJMra054035](https://doi.org/10.1056/NEJMra054035)
15. PAHO/WHO Task Force. Trans fats free Americas. Conclusions and recommendations. Washington, DC, USA: Pan American health organization; 2007.
16. Kiage JN, Merrill JD, Judd SE, et al. Intake of trans fat and incidence of stroke in the reasons for geographic and racial differences in stroke (REGARDS) cohort. *Am J Clin Nutr.* 2014; 99: 1071-1076. doi: [10.3945/ajcn.113.075713](https://doi.org/10.3945/ajcn.113.075713)