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CELEBRATING TWENTY FOUR YEARS OF INFANT NUTRITION EDUCATION

The Impact of *Trans* Fats during Pregnancy and the First Year of Life

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Introduction

Trans fatty acids have been known to contribute to many health problems, such as increasing the risk of coronary heart disease. *Trans* fats may potentially pose additional risks to pregnant women and their fetus during fetal and postnatal development. This article will highlight the effects of *trans* fats during pre-pregnancy, pregnancy and post-pregnancy.

Dietary Sources of *Trans* Fat

Trans fat can be found naturally or synthetically in our diet and exists as a large family of different fatty acids that vary markedly in the position and number of the *trans* double bonds, which confers different health effects (Figure 1)¹. Naturally occurring *trans* fats, including 'conjugated linoleic acid' (CLA) and 'vaccenic acid'

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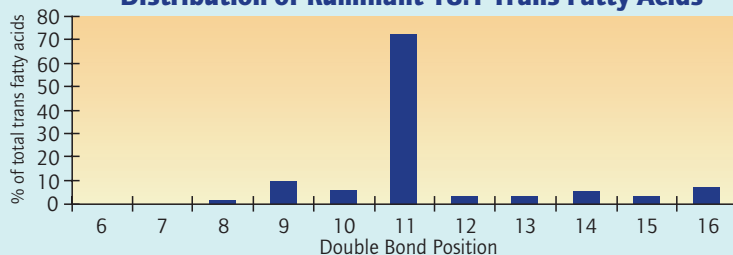
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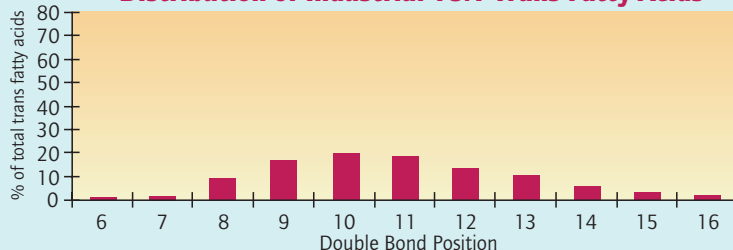
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Figure 1.

Distribution of Ruminant 18:1 *Trans* Fatty Acids



Distribution of Industrial 18:1 *Trans* Fatty Acids



The major *trans* fatty acid present in ruminant fats, such as dairy and beef fat, is vaccenic acid (*trans* 11-18:1).

In contrast, industrially synthesized *trans* fatty acids from partially hydrogenated oils contains a number of isomers.

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(18:1 *trans*11), are found mostly in ruminant products such as milk and beef. These fats can account for 2-5% of the ruminant's total fat, which have been shown to have potentially beneficial effects². In fact, CLA has been found to be anti-carcinogenic^{3,4}.

Synthetically occurring *trans* fats are produced in a process known as partial hydrogenation, in which some of the double bonds of unsaturated fats are converted to saturated bonds. In addition, *cis* double bonds are converted to *trans* double bonds. This process enables products to have an extended shelf-life due to a lower tendency towards rancidity and exist as semi-solids required for baking⁵. Synthetic *trans* fats can be found in many fried and baked foods such as French fries, cookies, and donuts, and constitute as much as 45% of the food's total fat².

Defining Dietary Fats: Saturated, Monounsaturated and Polyunsaturated

Dietary fats exist primarily in the form of triglycerides, composed of a three-carbon skeleton joined to three fatty acid tails (Figure 2). Depending on the number of double bonds, a fatty acid can be classified as, i) *saturated* (no double bonds), ii) *monounsaturated* (one double bond), or iii) *polyunsaturated* (two or more double bonds). The unsaturated fatty acids can further be classified as *trans* or *cis* according to the configuration of the hydrogen atoms on either side of the double bond (Figure 3). Predominantly, unsaturated fatty acids only contain *cis* double bonds. The *cis* double bond alters the chemical and physical properties of a fatty acid by creating a "kink" in the long carbon tail. Because of this kinked structure, *cis* fatty acids (i.e. liquid vegetable oil) do not pack as tightly together as saturated fats (i.e. hard butter). In contrast, *trans* unsaturated fats do not have a "kink" in their chemical structure and exist as linear structures, similar to saturated fats.

Figure 2.

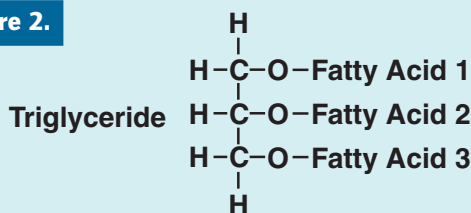
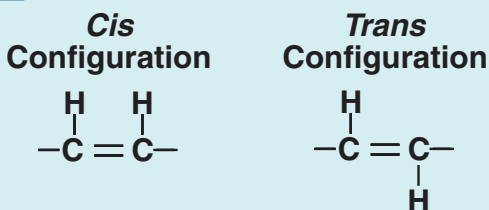


Figure 3.



Trans Fats and Pregnancy

It has been estimated that in the year 2000, the mean intake of *trans* fatty acids among pregnant women in Canada was 3.4-3.8 g/person/day, representing about 1.3% of total energy intake⁶. The major dietary sources of the *trans* fats found in these pregnant women were baked goods and fried foods.

Although mounting evidence suggests that certain *trans* fats increase the risk for developing cardiovascular disease and may potentially have other adverse effects, relatively little is known about the impact of *trans* fats during pregnancy and on the infant during breast feeding.

i) Pre-pregnant Women:

For women trying to become pregnant, *trans* fats may pose health risks. A study of 18,555 healthy women without a history of infertility who attempted to become pregnant between 1991 and 1999 reported 438 incidents of ovulatory infertility⁷. Each 2% increase in the intake of energy from *trans* unsaturated fats, as opposed to omega-3 or omega-6 unsaturated fats, was associated with a 73% greater risk of ovulatory infertility⁷. Although the mechanism of action is poorly understood, the conclusion drawn from this study suggests that consumption of *trans* fats may increase the risk of ovulatory infertility. Therefore it has been advised that women who intend to become pregnant should avoid consuming *trans* fats long before they plan to conceive, as *trans* fats are not readily metabolized and accumulate in the body over time⁸.

ii) Pregnant Women and the Fetus

Omega-3 fatty acids derived from marine oils and flax oil are essential fats that play an important role in the development of the brain, positively affecting learning ability, visual perception and behaviour. It is hypothesized that *trans* fats consumed by the mother are able to cross the placental barrier to the fetus and displace these essential omega-3 fatty acids and potentially interfere with proper development of the fetus, leading to a shorter length of gestation and lower birth weight and height of the infant^{6,9}. Another recent study has observed that pregnant women who eat the most *trans* fats are seven times more likely to experience pre-eclampsia¹⁰, a complication of pregnancy when the mother's blood pressure is elevated.

iii) Post-pregnant mother and...

a) Breast-fed Infants

In breast-fed infants, the mother's breast milk is the infant's exclusive source of nutrients, including fatty acids¹¹. Many studies have shown that the fatty acid composition of breast milk is influenced by the maternal diet¹². It has been estimated that *trans* fats comprise 7.7% of maternal total fat intake¹² and 7.2% of total breast milk fatty acids¹³. Given the potential for *trans* fats to adversely affect the metabolism of omega-3 and omega-6 fatty acids by inhibiting the conversion of the omega-3 fatty acid alpha-linolenic acid (ALA) to docosahexaenoic acid (DHA), there is the potential

Regulations and Labelling of Trans Fats

On December 12, 2005, Canada introduced mandatory labelling of *trans* fats for pre-packaged foods. Foods with a *trans* fatty acid content of 0.2 grams per serving or more cannot be considered *trans*-fat free². On January 1, 2006 the United States followed suit when the FDA (US Food and Drug Administration) issued a final rule that requires the declaration of the amount of *trans* fats present in foods on nutrition labels containing 0.5 grams or more total fat per serving². The rule stipulates that foods containing less than 0.5g but more than 0g of *trans* fats per serving are to be labelled as zero, when in fact they actually are not completely devoid of *trans* fats. It is advised to check the ingredient list for the presence of partially hydrogenated oil as a more accurate assessment of whether or not the food product contains *trans* fats. It is easy for *trans* fat to be unknowingly incorporated in one's diet.

Mandatory labelling of *trans* fats is intended to heighten consumer awareness of the potential adverse effects of *trans* fats and to assist consumers in making healthy food choices. For example, many fast food chains, such as Wendy's, KFC and Taco Bell, have opted to switch over to a zero-*trans* fat oil, while the New York City Board of Health has voted to ban the use of artificial *trans* fats in restaurant food altogether²¹.

to negatively affect infant growth and neural development^{6,9}. Hence lactating women should carefully monitor and aim to lower *trans* fat intake.

b) Formula-fed Infants

Trans fats may also be present in small amounts in infant formula depending upon whether milk fat or vegetable oil is used in the formulation. Milk fats contribute naturally occurring *trans* fatty acids. Although vegetable oils do not contain *trans* fats, small quantities of *trans* fats can be produced through processing and deodorization which occurs at high temperature¹⁴.

Trans fat content is not significantly different between powder and liquid formulas¹⁵, though both generally contain lower levels than in human milk¹⁶. However, choosing infant formula to lower *trans* fat intake is

not advisable given that breast milk contains many factors that are not present in infant formulas, such as immunoglobulins necessary for immune development.

c) Weaning

Infant cereals and baby foods are most likely devoid of *trans* fats, especially those prepared from whole foods. Trace amounts of *trans* fats were previously present in infant rice cereal, however, the source of the *trans* fatty acid was identified and removed (H.J. Heinz Company, personal communication, September 10, 2007).

Recommended and Current Intakes of Trans Fats

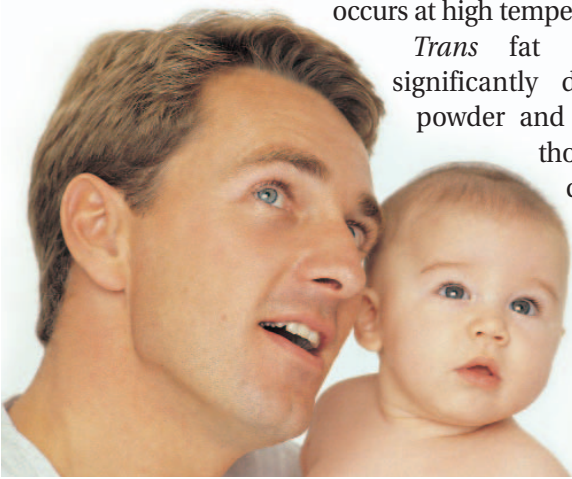
Though it has been agreed that *trans* fats from partially hydrogenated oils offer no nutritional benefit while causing adverse effects¹⁷, it has been considered impractical to completely eliminate them from the diet. Furthermore, not all *trans* fats have the same biological effects, as *trans* fats in dairy and beef may have beneficial effects for cancer prevention. It has been recommended by the World Health Organization in 2003 to restrict consumption of *trans* fats to less than 1% of total energy intake². As well, in 2002, the panel of the Institute of Medicine of the National Academies "recommended that *trans* fatty acid consumption be as low as possible while consuming a nutritionally adequate diet"¹⁸. The recent restrictions and guidelines have had positive effects, as the daily consumption of *trans* fats for Canadians has dropped from 5-13 grams to 3-9 grams¹³. Trends in Canada show that increased awareness in *trans* fats has lowered *trans* fatty acid levels in human milk, suggesting that both lactating women and breast-fed infants are consuming less *trans* fats¹¹. In comparison, daily intake of *trans* fats in the US is estimated at about 5.8 g per person per day for individuals 20 years of age and older¹⁹, while daily intake of *trans* fats in Denmark has been less than 3 grams ever since a ban was imposed on foods that contain more than 2% *trans* fats²⁰.

Conclusion

The harmful effects of *trans* fats are now well recognized, and the general recommendation would be to lower *trans* fat intake as much as possible. Although there is limited evidence, it is advisable, especially for women who plan to become pregnant, are already pregnant, or are lactating to reduce *trans* fat intake. Lower levels of *trans* fats decreases the risk of pre-eclampsia in pregnant women, and reduces the risk of developmental problems in the fetus and infant.

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Position on Dietary Fatty Acids Released

The American Dietetic Association and the Dietitians of Canada recently released a joint position paper on dietary fatty acids¹. Highlights of the position paper include:

- Total fat intake for adults should be in the range of 20% to 35% of total calories.
- The recommendation for total fat should emphasize a decrease in saturated fatty acid and *trans* fatty acid intake and an increase in n-3 polyunsaturated fatty acids.
- Saturated fatty acids in the diet should be replaced with *cis*-unsaturated fatty acids or complex carbohydrates.
- *Cis*-unsaturated fatty acids include monounsaturated fatty acids and polyunsaturated fatty acids.
- Individuals should achieve the dietary fatty acid recommendations through a diet that includes fruits and vegetables, whole grains, legumes, nuts and seeds, lean meat and poultry, low fat dairy products, fish (especially fatty fish), and nonhydrogenated margarines and oils.

The position paper includes a chart that classifies the fatty acids, and lists their structure, biological actions and food sources. In addition, research on fatty acids and health is briefly reviewed, including the effects of fatty acids on pregnancy, lactation and infancy and the effects of each class of fatty acids on coronary heart disease risk.

The position paper is addressed mainly to dietary fat recommendations for adults; however, specific guidance about total fat intake is given for children aged 1 to 3 years and 4 to 18 years. For children aged 1 to 3 years, 30% to 40% of calories as fat are recommended, while for children 4 to 18 years, a total fat intake of 25% to 35% of calories are suggested.

The special skills that registered dietitians bring to counseling individuals are discussed. In particular, the dietitians' ability to translate the fatty acid recommendations into an optimal food pattern at the appropriate calorie level for the individual is detailed. Registered dietitians can also monitor the individual's response to dietary fat and make modifications as needed.

A copy of the position paper can be viewed on the Dietitians of Canada website: <http://www.dietitians.ca/>.

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Resource on Dietary Fat Available

The Dietitians of Canada created a Fact Sheet on fats titled, "Step Right Up. Dietary Fat – The Good, the Bad and the Ugly." In the fact sheet, the different classes of fats are described along with the health effects and sources of these fats. Guidance is provided for decreasing saturated and *trans* fat, substituting monounsaturated fat, and increasing omega-3 fatty acids in the diet. The Fact Sheet is available at: <http://www.dietitians.ca/>.

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Trans Fats



DEFINITION

Trans fat is a specific type of fat formed when liquid oils are made into solid fats like shortening or margarine. This type of *trans* fat is called “industrially produced” *trans* fat. A small amount of *trans* fat is found naturally, in some animal-based foods.

MAJOR FOOD SOURCES

- Vegetable shortening
- Some margarine, especially hard margarine
- Commercially fried foods
- Baked goods made with shortening, margarine, or partially hydrogenated oil such as:
 - Cookies
 - Crackers
 - Croissants
 - Donuts
 - Muffins
 - Pastries
 - Snack foods
- Processed foods made with partially hydrogenated oils



Small amounts are also found in some animal products, where they are formed naturally

HEALTH EFFECTS

Trans fat raises the “bad” cholesterol and lowers the “good” cholesterol, increasing the risk for heart disease.



INTAKE RECOMMENDATIONS

There are no known health benefits from industrially produced *trans* fat. It is recommended that intake of this type of *trans* fat be as low as possible.

AVOIDING TRANS FAT

The Nutrition Facts table on the label of food products lists the amount of *trans* fat in a specific amount of product. A look at the ingredient list can also be helpful. Avoid or limit foods made with partially hydrogenated vegetable oil or shortening.