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Trans-Fat Food has More Risk to Cardiovascular Disease than Having Effects as Causative Factors of Cancer

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Abstract

In this generation among the fast killing diseases, cancer is not a small factor. There has been and still intensive study on the occurrences and mechanism of cancer. Due to the fact that there has not been any scientifically proven treatment that specific to the various forms of cancer, the controversies as to what cause this cancers are exponentially high. One of this is the concept of trans-fat containing foods are causing cancer. Trans-fat foods up to date are believed by many that is a causing cancer instead of a risk to cardiovascular diseases.

In this review, some concrete facts are further looked into to defeat the idea of trans-fat as carcinogens. Cancer itself is thoroughly explained and types of cancers in relations to the sources of foods that are claimed high risk. The chemistry of saturated and unsaturated fatty acids was also dealt with and foods that are proven to be rather protective to causing cancer are also highlighted. None the less, the reasons why trans-fats were term carcinogens was explained and disproved.

Among the review article, there has not any scientific proof as to trans fats as carcinogenic instead a risk to heart diseases and for this, extensive use of these food items are advised to be less consumed.

Keywords: Carcinogens; Industrial trans-fatty acids (ITFA); Trans-fatty acids (TFA); Coronary heart disease (CHD)

Introduction

Food is among the sources of energy that we cannot go without. These foods are prepared and served in many different ways to fulfil their purposes. Since nature is perfect, food sources in their original states are generally less harmful to human. However, due to the ways these foods are handled especially during processing or storage, can lead to some chemical transformations of their major ingredients like protein, lipid, antioxidants or other additives. The extent of these alterations can be as serious as changing the taste or flavour of the food or in most cases can just be a mere changes in the structural components of the major ingredients thereby producing an unnoticeable effect that may not be compatible with the normal physiochemical processes of the human system. This causes an abnormal cellular function which is prerequisite to some health complications like cancer, diabetes, cardio vascular diseases and other foodborne health problems.

Some of these altered edible foods can even form a favourite yummy diet for many healthy individuals for example the trans-fat foods. Trans-fat foods basically are defined as foods that are composed of a meaningful percentage of unsaturated fatty acids with trans configuration. Naturally occurring unsaturated fatty acids generally occur in the cis configuration. The way we handle food and food products and the processing methods can lead to some health threats in which heart diseases and risk of having cancer is paramount [1-6]. Although products from plants for example seeds, meat products, eggs and vegetables at their pre-cooked form are harmless, some of these have reported risk of heart and heart related diseases due to post processing methods [1,2,4]. Industrial trans-fatty acids (ITFA) from industrially-produced hydrogenated vegetable oils are also believed to increase the risk of having various forms of cancer and for this reason; these products are advised to be taken in low quantity [2].

Dietary and food choices are mostly dictated by the geographical location of individuals. Sometimes we are forced by certain factors as to what type of food to be consumed and some key factors for this especially in the developing world include the availability and affordability of food. For some, it's the lifestyle that has a long history of consumption of certain types of food and food preparation methods. However, there is insufficient data or scientific findings linking cancer to the varieties of food preferences. In addition, other confirmed non-dietary related carcinogens are on the rise as a result, it is still premature to identify dietary habits as the major or sole risk factors for cancer in any particular geographical location [2,4].

Based on the restriction of US trans-fat policy on industrially manufacture kinds of food, an update on some of the food items can turn out without containing trans-fats and the fat contents are vehemently labelled on each of the items as seen in (Table 1) [4].

Although still in debate, there is a high believed by many that trans-fat foods (Figure 1) are carcinogenic, meaning they can cause cancer.

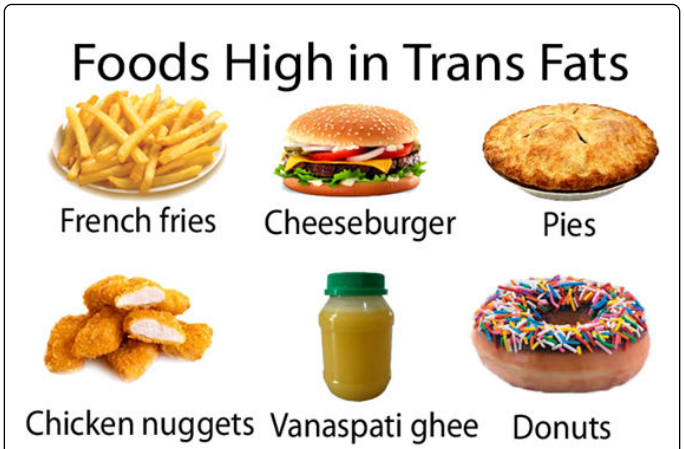

Figure 1: Some example of foods with added (industrial) Trans-fats.

Food	Trans fats (g)
French fries (1 serving)	0-6.1*
Vegetable shortening (1 tbsp, 13 g)	2-5.5
Breaded chicken nuggets (1 serving)	0-5*
Partially hydrogenated oil (1 tbsp, 14 g)	0.5-4.5*
Pies (1 serving)	2-4.7*
Vanaspati ghee [vegetable ghee used in South Asia] (1 tbs, 14 g)	0.5-4
Margarine, hard (stick) (1 tbsp, 14 g) [22,23]	0.5-3.5
Cheeseburger, hamburger (200-400 g)	1-3*
Pancakes (1 serving)	0.1-3
Doughnuts (1 serving)	0.1-2.7
Cake (1 piece, 144 g)	2
Other:	
Spreads, nondairy coffee cream, salad dressings	0-2 g/serving
Commercially baked products: biscuits, brownies, cakes, cookies, crackers, muffins	
Deep-fried fast food products and packaged snack foods: fried chicken, microwave popcorn, potato chips, tortilla chips, granola bar	
Candies, confectioner coating, peanut butter	
Burrito	
Frozen products: breaded fish sticks, cinnamon rolls, meatballs, pie crusts, pizza dough, ready-made frosting, waffles	
Dry mixes: Cake, pancakes, mac mixes	
Soft (tub) margarines	
Sunflower seeds (oil roasted)	

Table 1: Some common foods rich in trans-fats and their composition (in grams).

However, there is more organic chemistry research that needs to be done on trans-fat foods as carcinogenic or a risk to heart diseases before coming to the conclusion while declaring our favourite diets as non-fit for consumption [1,3]. Cancer as identified by medical personnel is an excess growth of abnormal cells in a specific part of a body. They can either be malignant or tumor cells [2,3]. Since cancers biochemistry entails the abnormal growth of the cell, the defects that can trigger these into our bodies requires more than an assumptions based of dietary habits.

Trans Fat Foods and their Sources

Trans-fat foods are those food items whose cis bonds are modified into trans bond in the process of partial hydrogenation of the food. These are needed normally for commercial purposes in the food industries to produces semi fat foods like margarine, crackers, deep-fried fast foods, pancakes, omelette, etc. and can also be obtained from local restaurants [4]. In the United States, it is estimated that 2 to 3% of total calories are as a result of the industrial produced trans-fat foods. However a small percentage of natural occurring trans-fats are the fatty deposits we consume from meat products. These are formed by the bacterial reactions in the stomach of ruminants [4,5].

If trans-fat are inducing cancer, by now the half of the US population would have been diagnosed with cancer.

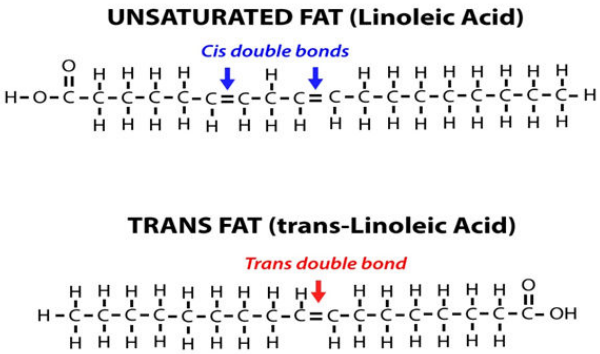

Figure 2: A comparison of a saturated fatty acid (stearic acid, found in butter) and an unsaturated fatty acid (linoleic acid, found in vegetable oil).

From the Figure 2, it can be seen clearly that both stearic (oleic acid) and linoleic acid are singly bonded and has 18 carbon-structures. The difference comes in with regards to their arrangements of bonds; while cis bonds in stearic acids lies on both sides, opposite sided bonds can be seen in trans-fat double are found in vegetable oil [4]. This molecular structure is reflecting directly to their physiological properties.

Food Derived Carcinogens

Carcinogens are basically any substance, radionuclide or radiations that are direct agents for causing cancer in cells. The exposure of cells to these substances for a long period of time either causes damage to the genome or disruption of the cellular metabolic processes thereby leading to generation of cancer cells. There are diverse sources of carcinogens and the components that are of public health importance include both synthetic and natural sources found in food substances. Some carcinogens found in food include Trans-fats, heterocyclic amines, food preservatives like AF2 etc. [7-11]. The intake of certain types of foods can serve as an agent for development of cancer. In many scientific studies, certain diets have been implicated as causative agents for different forms of cancer. Excessive intake of total calories and high fat content foods were reported to be enhancing factors for cancer development [11-21]. Trans-fatty acids (TFA) are simply a group of fatty acids with one or more double bonds in the Trans configuration. Trans-fats are major ingredients in some food products like butter, margarine and some fried food products [9].

Chemistry of Trans Fats in Dietary Products

Fats and oils are bio-products found in plants and animals as energy reserves. These biomolecules in combination with other molecules play a very important role in maintaining the healthy life of organisms. Fats can be classified as saturated or unsaturated depending on the presence or absence of a double bond. Saturated fats have no double bond hence they are solid at room temperature. Unlike the saturated fats, unsaturated fats have one or many double bonds and are liquid at room temperature. The chemistry of unsaturated fats is such that they exist in two isomeric configurations (Cis and Trans forms). In the cis isomers, the hydrogen atoms are in the same orientation while in Trans isomers, the hydrogen atoms are in opposite orientation. Studies have first suggested that the natural forms of unsaturated fats are in cis configuration but in recent years, there have been an indication that some unsaturated fats also exist in the Trans configuration [22]. This other group of unsaturated fats is mostly found in ruminant animals.

The introduction of TFAs into commercial food products is mostly through partial hydrogenation of vegetable oils [22]. Industrially hydrogenated TFAs (iTFA) are mostly added to commercial solid edible fats in order to increase the self-life of the food products. Other sources of TFA are the ruminant animals. Fats from ruminant animals are also rich in Trans-fatty acids (rTFA). These are a product of bacterial bio-hydrogenation of unsaturated fats found in those ruminant animals like sheep, goat etc. TFAs have received intense interest as risk factors to public health in recent years. Epidemiological studies linking TFAs to certain diseases like cancer and coronary heart diseases have been undertaken in different geographical locations. Although majority of those studies have indicated a positive correlation between TFA intake and coronary heart disease (CHD), the reports about TFA intake in association with cancer are still inconsistent [19]. Among the two subgroups of TFAs are, industrially obtained TFA (iTFA) and TFA obtained from ruminant animals (rTFA), coronary heart diseases and cancer are strongly linked with iTFAs as reported by many studies. iTFAs have also received further implications like increasing inflammatory markers, lipid and lipoproteins content of plasma [10].

Why Trans-Fat Food are Thought to be Carcinogenic

Cancer is a broad term engulfing the various neoplastic diseases that in general involve rapid or irregular growth of cells leading to tumor formation in a particular part of the body. Many different types of cancer have been reported namely breast, brain, colon, pancreas, prostate, ovary cancer etc. Different causative agents are responsible for different types of cancer and each of these types are also linked with different protective elements. A good number of reported cancer cases are linked with life styles while in few cases some are related to genetic mutation or microbial infestation [20].

Nutritional habits are the leading life style cancer related factors with trans-fat food and saturated fats mainly from meats [20]. Despite the increased implication of trans-fat foods in causing cancer, there are still discrepancies as to whether these groups of fats are the major causative agents of cancer in humans. Different epidemiological studies have indicated that the highest cancer risk has been recorded among people who eat saturated and unsaturated trans-fats mainly from fried meats. A laboratory study in opposition to these findings was also published stating that saturated fats were found to have zero enhancing cancer effects in rats but indicated that ω-6-polyunsaturated oils like sunflower oil and corn oils showed strong link while ω-3-polyunsaturated oils in fact showed a protective link against cancer in rats [12].

It is reported a very important finding that stated that the surface of fried fish and meats contained potential mutagens and these chemicals were further investigated by a Japanese group which identified them to be heterocyclic amines (HCA) [21]. HCAs are among confirmed mutagens and carcinogens due to the fact that these chemicals were tested to induce different types of cancer in rats and monkeys. Fried fish and meats served as the main sources of HCAs, saturated fats and TFA, therefore the epidemiological findings that show positive correlation between saturated fats, TFAs and cancer can be associated with a combination of consuming fried meats rich in TFAs and HCAs. This hypothesis suggested that trans-fats alone cannot be implicated in causing cancer but a combination with cooked meats and fried fish rich in HCAs is the risk factor for nutritionally derived cancers [21]. Another convincing study was conducted by Dr. Lisa C. Vinikoor of the University of North Carolina in Chapel Hill. In his findings, it was concluded that a high intake of trans-fats could increase colon cancer risk. Based on this, it is still not scientific. He concluded that people who are fond of eating trans-fats are more likely to have pre-cancerous growths or polyps in their colons than those who consumed the least (American Journal of Epidemiology, August 1, 2008).

Evidence Based on the Chemistry of Trans Fat Foods as Non-Carcinogens

In a study conducted in Utah, US, among men and women who are fond of consuming either cis or trans form of fatty acid shows an increased trend for the risk of having colon cancer in those who are taking Trans fatty acid. This is though not evidently enough to conclude that trans-fats are carcinogenic but it can however increase the risk of having cancer [1,3]. Since Trans-fat foods in fatty acids come in two forms; natural and man-made, natural occurring trans fats are confirmed to be cis bonded protein molecules and those whose structures are manipulated through secondary processing like cooking and frying (from cis bonds to trans bonds through re-heating) are modified into trans-fat [1,3].

Positive Health Implications in Avoiding Trans Fat Foods

For the fact, that there are inconsistent findings regarding trans-fat intake and cancer in humans, there have been strong establishments linking trans-fat foods to cardiovascular diseases. In line with these findings, many western countries have set up regulations to minimize the intake of trans-fat foods. This is geared towards reducing the daily intake of trans-fats in order to facilitate healthy diet habits among their citizenry [15].

Other studies have also indicated that trans-fats are positively linked with major diseases that are of public health concerns like diabetes, coronal heart diseases (CHD), inflammation, sudden death due to cardiac failure etc. [15].

In the bid to drastically or eliminate these diseases in totality, countries like USA, Canada, and Denmark have set up laws that were meant to prevent high intake of trans fat foods [19]. Therefore, avoiding trans-fats food like margarine, partial hydrogenated vegetable oils, cheese, etc. will save the population from many trans-fat related diseases as per the success stories from many developed countries with anti-trans fats food laws. A study in the United States indicated that healthy dietary habits could prevent about 30% of cancers [19].

Recommended Cancer Preventive Non-Trans Fat Foods

The most promising tools for cancer control is through cancer prevention programs with many studies emphasizing the need to modify dietary habits or nutritional components [8]. Many western countries have enacted laws that put emphasis on the production of healthy food stuffs like low trans-fat foods, putting trans-fat content labels on food products, elimination of partial hydrogenated oils in foods etc. [14].

Despite the general notion that saturated and unsaturated fats are among the key causative agents of cancer, there are still scientific evidences that proved that not all the fat components are bad for the body but in fact some group of unsaturated fats like ω-3-polyunsaturated oils have a known cancer protective effects [12]. Healthy diet behaviours can serve as a protective tool against different types of cancer. There are epidemiological evidences that indicated a negative relationship between intake of certain types of food and cancer risk notably fruits, vegetables and their constituents. A study by WCRF/AICR reported that fruits were negatively associated with different types of cancer namely esophageal cancer, stomach cancer, and lung cancer. A suggestive but yet non-consistent evidences about preventive role of fruit intake against colorectal cancer were also reported [19].

Vegetable intake was reported to have a negative link with both colorectal and lung cancer. Many different types of vegetables were investigated about their potential cancer protective effect and reports indicated that green, leafy, cruciferous and allium vegetables and carrots have the strongest cancer protective potentials. Other food products rich in carotenoids, beta- carotene, vitamin C, Vitamin D, dietary fibres are known reported cancer protective food components [13]. Naturally occurring antioxidants like Vitamin E and Selenium are suggested to exhibit anti-cancer potentials due to their ability to scavenge free radicals that may cause DNA damage or lipid oxidation thereby causing cancer. These compounds are readily found in fruits [18,24,25].

Coffee and milk were also reported to show great potential in protecting against cancer. The components of coffee are suggested to have antioxidant effects, inflammation and apoptosis and play a role during DNA repair [6].

Conclusion

Although there is a significant epidemiological facts and biochemical hypothesis on the excessive use of trans-fat in the diets that we consume are risk to cardiovascular diseases instead of carcinogenic, care and extra monitoring of the amount of trans-fat foods we consume should be in a place. No matter how low we take in trans-fat, there is exponential increasing risk to cardiovascular diseases. While there are number of identified food items that are hoped to be among the fast driving factors in causing cancer, there are some among the list that instead are very protective to cancer cell growth in the body. On this ground, alcoholic drinks, animal fats, iron containing foods should not be confused with their corresponding cancer protective foods like, fruits, vegetables and their constituents.

The dangers of trans-fats are mostly related to number of health manipulations. These partially hydrogenated oils or trans-fatty acids are health risks. It can cause obesity, heart diseases, and clogged arteries, depression, and endometriosis however, their ability to cause cancer is still not clear or approve scientifically. Although there are statistics based on trans-fats with number of heart disease, this is as a result of increasing the bad cholesterol however; cardiovascular diseases are independent of cancer.

In American diet, trans-fats means a lot, this is due to the eating and diet habits of many. Trans-fats of course are not just safe to be taken every time. Everyone wants to be health and one way to gain this; our diets play a very big role.

In a bid to ensure the world population healthy, U.S. Food and Drug Administration on Tuesday, June 16th 2015 has announced that after three years, food industries should remove artificial trans-fats from countries food supply.

References

1. Slattery ML, Benson J, Ma KN, Schaffer D, Potter JD (2001) Trans-fatty acids and colon cancer. Nutr Cancer 39: 170-175.
2. Stepien M, Chajes V, Romieu I (2016) The role of diet in cancer: the epidemiologic link. Salud Publica Mex 58: 261-273.
3. Thompson KA, Shaw DI, Minihane AM, Williams CM (2008) Trans-fatty acids and cancer: the evidence reviewed. Nutr Res Rev 21: 174–188.
4. Mozaffarian D, Martijn B K, Alberto A, Stampfer MJ, Walter CW (2006) Trans Fatty Acids and Cardiovascular Disease. N Engl J Med 354: 1601-1613.
5. Abnet CC (2007) Carcinogenic food contaminants. Cancer Invest 25: 189-196.
6. Aune D, Lau R, Chan DS, Vieira R, Greenwood DC, et al. (2012) Dairy products and colorectal cancer risk: a systematic review and meta-analysis of cohort studies. Ann Oncol 23: 37-45.
7. Bøhn SK, Blomhoff R, Paur I (2014) Coffee and cancer risk, epidemiological evidence, and molecular mechanisms. Mol Nutr Food Res 58: 915-930.
8. Cohen JT (2014) FDA's proposed ban on trans fats: How do the costs and benefits stack up? Clin Ther 36: 322-327.
9. Costa N, Cruz R, Graça P, Breda J, Casal S (2016) Trans fatty acids in the Portuguese food market. Food Control 64: 128-134.
10. Abnet CC (2007) Carcinogenic food contaminants. Cancer Invest 25: 189-196.

11. Aune D, Lau R, Chan DS, Vieira R, Greenwood DC (2012) Dairy products and colorectal cancer risk: a systematic review and meta-analysis of cohort studies. Ann Oncol 23: 37-45.
12. Bøhn SK, Blomhoff R, Paur I (2014) Coffee and cancer risk, epidemiological evidence, and molecular mechanisms. Mol Nutr Food Res 58: 915-930.
13. Gebauer SK, Chardigny JM, Jakobsen MU, Lamarche B, Lock AL, et al. (2011) Effects of Ruminant trans Fatty Acids on Cardiovascular Disease and Cancer? A Comprehensive Review of Epidemiological, Clinical , and Mechanistic Studies. Adv Nutr 11: 332-354.
14. Haven N, Tada L, War AW (1975) Mutagens, Carcinogens, and Tumor Promoters in our Daily Food. Can Fam Physician 1970-1984.
15. Hu FB, Manson JE, Willett WC (2013) A Critical Review Types of Dietary Fat and Risk of Coronary Heart Disease. J Am Coll Nutr 20: 5-19.
16. Huncharek M, Muscat J, Kupelnick B (2009) Colorectal cancer risk and dietary intake of calcium, vitamin D, and dairy products: a meta-analysis of 26,335 cases from 60 observational studies. Nutr Cancer 68: 47-69.
17. Remig V, Franklin B, Margolis S, Kostas G, Nece T, et al. (2010) Trans fats in America: a review of their use, consumption, health implications, and regulation. J Am Diet Assoc 110: 585-592.
18. Mozaffarian D, Katan MB, Ascherio A, Stampfer MJ, Willett WC (2006) Trans fatty acids and cardiovascular disease. N Engl J Med 354: 1601-1613.
19. Ralston RA, Truby M, Palermo CE, Walker KZ (2013) Critical Reviews in Food Science and Nutrition review and meta-analysis of prospective studies 61: 37-41.
20. Riboli E, Norat T (2003) Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. Am J Clin Nutr 78: 559-569.
21. Stender S, Skeaff M, Tavella M, Abbe L (2009) Approaches to removing trans fats from the food supply in industrialized and developing countries 32: 50-67.
22. Stepien M, Chajes V, Romieu I (2016) The role of diet in cancer: the epidemiologic link. Salud Publica Mex 58: 261-273.
23. The New England Journal of Medicine (1993) Massachusetts Medical Society.
24. Wakabayashi K, Nagao M, Esumi H, Sugimura T (1992) Food-derived mutagens and carcinogens. Cancer Res 52: 2092-2098.
25. Willett W, Mozaffarian D (2008) Ruminant or industrial sources of trans fatty acids?: public health issue or food label skirmish? 1: 515-516.