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Vegetable Oils Consumption as One of the Leading Cause of Cancer and Heart Disease

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Abstract

This review takes a deep look at increases in the incidence of cancer and heart disease after the introduction of industrial vegetable oils in the world. Most vegetable oils are highly processed and refined products, which completely lack the essential nutrients. Omega-6 Linoleic acid from vegetable oils increases oxidative stress in the body of humans, contributing to endothelial dysfunction and heart disease. The consumption of these harmful oils which are high in mega-6 polyunsaturated fats results in changing the structure of cell membrane which contribute to increasing inflammation and the incidence of cancer.

Keywords

Vegetable oils, Endothelial Dysfunction, Heart Disease, Cancer

Introduction

Fatty Acids by Saturation

1. Saturated

A fatty acid is saturated when all available carbon bonds are occupied by a hydrogen atom. These fatty acids are highly stable, since all the carbon-atom linkages are saturated with hydrogen. These fatty acids do not oxidize, even when heated for cooking purposes. They are straight in form and therefore packed together easily, so that they form a solid or semi-solid fat at room temperature. Human body makes saturated fatty acids from carbohydrates and they are found in animal fats and tropical oils. [Mary G. Enig, Know Your Fats, 2000]

2. Monounsaturated

Monounsaturated fatty acids have one double bond in the form of two carbon atoms double-bonded to each other and lack two hydrogen atoms. The human body can make monounsaturated fatty acids from saturated fatty acids and then use them in a variety of ways. Monounsaturated fats have a bend at the position of the double bond so that they do not pack together as easily as saturated fats and tend to be liquid at room temperature. Like saturated fats, they are relatively stable. They do not go rancid easily and are relatively slow to oxidize when used in cooking. The monounsaturated fatty acid most commonly found in food is oleic acid, the main component of olive oil as well as the oils from almonds, pecans, cashews, peanuts and avocados. [1]

3. Polyunsaturated

Polyunsaturated fatty acids have two or more pairs of double bonds and, therefore, lack four or more hydrogen atoms. The two polyunsaturated fatty acids found most frequently in our foods are double unsaturated linoleic acid, with two double bonds also called omega-6, and triple unsaturated linolenic acid, with three double bonds also called omega-3. The omega number indicates the position of the first double bond. Your body cannot make these fatty acids and hence they are called essential fatty acids. Humans must obtain their essential fatty acids (EFA) from the foods they eat. The polyunsaturated fatty acids have bends at the position of the double bond and hence do not pack together easily. Therefore, they are liquid. The unpaired electrons at the double bonds make these oils highly reactive. They go rancid easily, particularly omega-3 linolenic acid, and must be treated with care. Polyunsaturated oils should never be heated or used in cooking. [2]

Vegetable Oils and Omega-6 Linoleic Acid

Omega-3 and Omega-6 fatty acids are polyunsaturated, meaning that they have many double bonds in their chemical structure. Some of these are Essential Fatty Acids (EFA), since human body lacks the enzymes to produce them. These fatty acids play important roles in many biochemical pathways, including those related to inflammation, immunity and coagulation. [3]

Omega-3 and Omega-6 should be consumed in a certain balance. When this balance is disturbed, it can interrupt important biochemical pathways [4]. These two types of fatty acids compete for the same enzymes and the same spots in cell membranes [5][6].

They often have related but opposing roles. Both of them are used to produce *Eicosanoids*. Eicosanoids made from Omega-6, tend to be pro-inflammatory, while those made from Omega-3, tend to be anti-inflammatory [7][8]. Throughout evolution, humans consumed

balanced amounts of Omega-3 and Omega-6 fatty acids. The problem today, is that this balance is tipped towards Omega-6. Not only are people consuming too much Omega-6, but their Omega-3 intake is disproportionately low. Whereas historically our Omega-6 to Omega-3 ratio may range from 1: 1: 3, it is now closer to 16: 1, which compares unfavorable to the evolutionary norm [9]. Vegetable oils are the most common source of Omega-6 fatty acids in the diet and these also are particularly high in the Omega-6 fatty acid linoleic acid. This fatty acid causes a host of problems when consumed in excessive amounts, specifically when Omega-3 intake is low. Most dietary Omega-6 fats that people are eating are a fatty acid called linoleic acid. Studies show that this fatty acid actually gets incorporated into our cell membranes and body fat stores. These fats are prone to oxidation, which damages molecules (like DNA) in the body and may be increasing our risk of cancer. Sanjoy Ghosh and colleagues in 2007, Nair U and colleagues in 2007 and Simopoulos and colleagues in 2003 found the link between the consumption of polyunsaturated fatty acids and increasing the inflammation which links to cancer [48][33][34].

Materials and Methods

Cell Membrane and Linoleic Acid

Fats are more than just sources of energy. Some of them have potent biological activity, and some remain in the body where they are used for structural and/or functional purposes. Significantly linoleic acid, the main fatty acid in vegetable oils, accumulates in the fat cells of the body, as well as in cell membranes [10][11]. These observations are based on 6 different studies that measured the linoleic acid content of body fat from the years 1961 to 2008 [12][13][14][15][16][17].

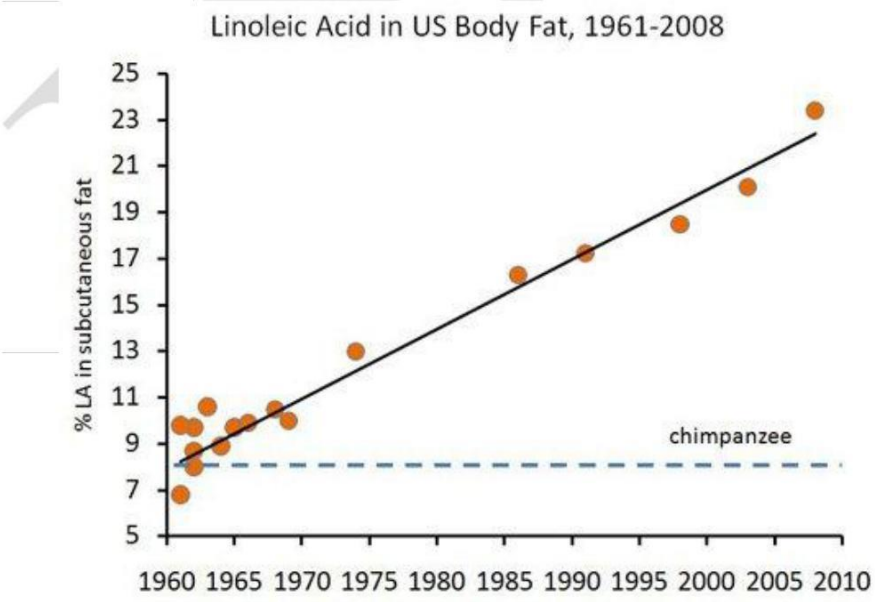

Figure (1): The Increased Vegetable Oil Consumption from 1960 to 2010 Has Changed the Fatty Acid Composition of human Bodies

The above graph also shows that excessive consumption of vegetable oils leads to actual structural changes within human tissue. The linoleic acid content of breast milk has also increased significantly which contribute to sub – optimal outcomes during breast feeding of infants [18].

Linoleic Acid and Oxidative Stress

Polyunsaturated fats like linoleic acid, have two or more double bonds in their chemical structure. This makes them sensitive to damage by free radicals ; highly reactive molecules like superoxide and hydrogen peroxide which are constantly being formed in the body and tissues [19].

Oxidative stress happens when free radicals in the mitochondria overwhelm the antioxidant defenses this result in a condition known as oxidative stress. This increase in the amounts of Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS), is significant because polyunsaturated fats are more susceptible to damage by free radicals and studies have shown that a high intake of linoleic acid can contribute to oxidative stress [20].

In one controlled trial, people were fed a diet high in Omega-6 linoleic acid, mostly from sunflower oil [21]. After 4 weeks, blood markers of oxidative stress had increased significantly. Researchers also noted that blood markers of Nitric Oxide (NO) levels had decreased. Nitric Oxide is a signaling molecule produced by the endothelium which is the thin layer of cells that lines the vascular system. It helps dilate blood vessels and keep blood pressure in a normal range. Reduced nitric oxide signals the beginning stage of Endothelial Dysfunction, where the lining of the vascular system stops working as it is supposed to function properly [22].

Michal Toborek and colleagues in a research study in 2002 showed that linoleic acid stimulated a pro-inflammatory state in endothelial cells in vitro [23].

Endothelial dysfunction is actually one of the earliest steps in the pathway towards heart disease and other serious vascular problems [24].

Vegetable Oils and Cholesterol

One of the main reasons vegetable oils are mistakenly considered healthy, is that consuming them can lower Total and LDL cholesterol levels. LDL is often referred to as the "bad" cholesterol. Numerous studies show that consuming vegetable oils can lower LDL which until recently has been assumed to be a risk factor for heart disease [25][26][27].

However, it is important to keep in mind that LDL levels may be associated with cardiovascular disease but may not be casual. What really matters is how vegetable oils affect hard end points like heart disease itself, as well as other diseases and the risk of death. That said, vegetable oils have also been shown to mildly lower HDL levels, which is undesirable given that higher levels of HDL are associated with a lower risk of heart disease [28][29].

Vegetable Oils and ox-LDL Lipo-proteins

LDL stands for Low Density Lipo-protein. These proteins carry cholesterol in the bloodstream. One of the crucial steps in the heart disease process, is the oxidation of Low Density Lipoprotein , forming what are called oxidized LDL particles (ox-LDL) [30].

These are the LDL particles that build up inside the walls of the arteries [31]. Polyunsaturated fats from vegetable oils find their way into LDL lipoproteins, making them more likely to become oxidized and form ox-LDL particles [32].

Vegetable Oils and Cancer

There is a great deal of evidence that industrial vegetable oils can raise the risk of cancer. Since vegetable oils contain highly reactive fatty acids that are incorporated into cell membranes they can contribute to oxidative damage and the increase of Reactive Oxygen Species in cells. When fatty acids in membranes get oxidized, they can cause chain reactions. These reactions can harm important molecules in the cell. Including cell membranes as well as other structures like proteins and DNA. They can also form various carcinogenic compounds within the cells [37].

By damaging DNA, these oils can raise the risk of cumulative damage in turn contributes and increased risk of cancer over the lifespan. In one 8-year controlled trial, the group that replaced saturated fats with vegetable oils was almost twice as likely to die from cancer. The difference was very close to statistically significant [38].

Additionally, numerous research studies have found strong correlation between vegetable oil consumption and cancer in humans. In 2012, Michel De Lorgeril concluded that increasing the omega-6 polyunsaturated fats in the diet can increase the risk of cancer in humans. [39] In 2003, Gago Dominguez and colleagues found a strong association between the consumption of n-6 fatty acids and mammary carcinogenesis. [40] In 2011, Shu XO and colleagues conducted a controlled trial and concluded that there was an association between the consumption of dietary polyunsaturated fats and breast cancer risk on Chinese women. [41] In 2012 and 2008, Chajès V. and Sonestedt E. found that omega-6 polyunsaturated fat consumption increases the risk of breast cancer in women. [42][43]

This is supported by a plethora of studies in test animals, showing that vegetable oils drive cancer in these animals, especially breast cancer which is the most common type of cancer in women. In 1993, David P. concluded that diets containing different amounts of linoleic acid increase the incidence of human breast cancer. In their research conducted on naked mice, they also found a relationship between linoleic acid consumption and lung cancer metastasis. [44] In 1986 one study found a relationship between consumption of polyunsaturated fats and mammary carcinogenesis in rats.[45] In 1987, Hubbard and colleagues concluded that mice consuming polyunsaturated fats, had a higher incidence of cancerous tumors.[46]

Sonestedt and colleagues in 2008 and Neal Simonsen in 1998 showed that increasing the consumption of omega-6 polyunsaturated fats was associated with a rise in the incidence of breast cancer in women [35][36].

Industrial Vegetable Oils and Trans Fats

Trans-fats added to processed foods are unsaturated fats that have been chemically modified to be solid at room temperature. They have known health risks and most developed nations have begun the process of removing the chemically modified trans-fats from processed foods. However, vegetable oils also contain significant amounts of trans-fats. In one study of common soybean and canola oil in U.S. supermarkets, the *trans*-fat content was measured at 0.56 percent to 4.2 percent of total fatty acids, an alarmingly high level. [47]

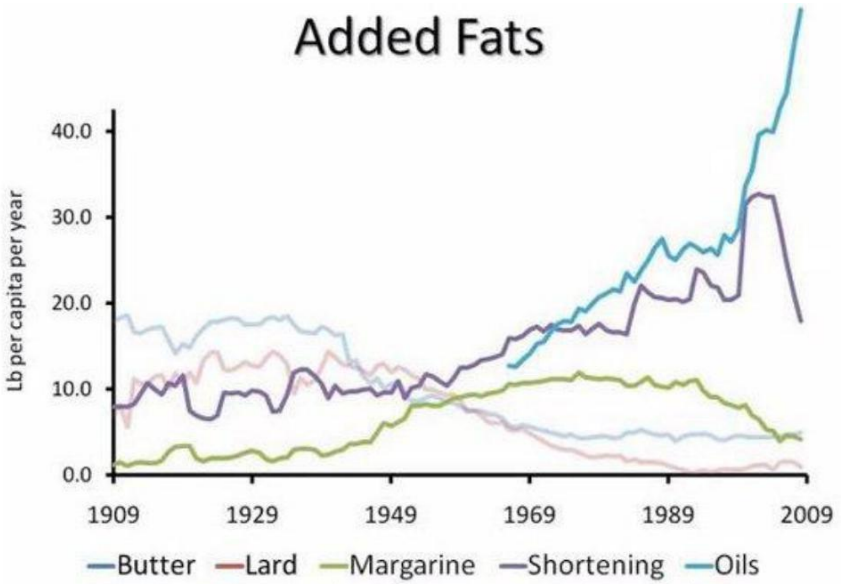

Figure (2): People Have Abandoned Traditional Fats in Favor of Processed Vegetable Oils [Stephan Guyenet, The American Diet, 2012.]

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Conflict of Interests

There is no conflict of interests between the authors of this research article.

Conclusion

Increased consumption of processed vegetable oils has led to an epidemic of harmful structural changes in cell membranes.Althogh it is true that vegetable oils can lower Total and LDL cholesterol levels, they also lower HDL which is a negative effect. Vegetable oils change the structure of the cell membrane which results in an increase in the Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) in human cells. This increase may be one of the

prime drivers behind the transformation of normal cells into cancer cells. The steep increase in consumption of these harmful products is likely to be one of the leading causes of the current epidemic of heart disease and cancer.

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