

## A Review of Cooking Oils (Coconut and Palm Oil) as Blood Plasma Regulator

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### Abstract

*Cooking oils are major sources of fatty acids and hence, play a major role in altering one's cholesterol level. Two major forms of cooking oil are coconut oil and palm oil. Both are produced locally in Guyana. However, there is limited usage of both for cooking purposes since the commercial oils, which are touted to be healthier, are used instead. Only poor communities and probably a few middle-income homes utilize these oils. These oils have a positive effect on blood plasma cholesterol by lowering HDL and LDL based on the review of research carried out by various researchers.*

**Keywords:** *Blood plasma; Cholesterol; HDL; LDL; Oils; Saturated fatty acids; Unsaturated fatty acids.*

### Introduction

Medical Biochemistry is the study of the chemical processes and transformations in living organisms. To understand the complexity of the human body, it is necessary to understand the individual molecules that are responsible for its proper functioning [1].

An important component of the body is the molecule cholesterol, steroid alcohol. Cholesterol ( $C_{27}H_{45}OH$ ) was identified in solid form by researchers in gallstone in 1784 and is derived from the Greek *chole-* (bile) and *stereos* (solid). Cholesterol is used for building cells and hormone production. Excess cholesterol in the blood results in the formation of plaque. A large amount of plaque increases the chances of having a heart attack or stroke [1].

Cholesterol can be classified based on the amount of lipid and protein ratio it comprises. HDL (high-density lipoprotein) cholesterol binds in the bloodstream and removes fat from the body to take it to the liver. This is sometimes called “good” cholesterol. A high level of HDL cholesterol may lower your

chances of developing heart disease or stroke [2].

LDL (low-density lipoprotein) cholesterol carries mostly fat and only a small amount of protein from the liver to other parts of the body. It is sometimes called “bad” cholesterol. A high LDL cholesterol level may increase your chances of having heart disease [2].

VLDL (very low-density lipoprotein) cholesterol contains very little protein. The main function of VLDL is to distribute the triglycerides produced by your liver. A high level of this can cause serious damage to the heart since it builds up in the artery walls and causes plaque [2].

Triglycerides are fat in the body for energy storage. Only a small quantity is present in the blood. Having a high triglyceride level along with high LDL cholesterol may increase your chances of having heart disease more than having only a high LDL cholesterol level [2].

As per the recommendations of medical experts, screening of cholesterol and triglyceride to assess the problems related to

cholesterol, total cholesterol and HDL levels is also measured by some for routine analysis. [2].

Fatty acids present in the diet can either raise or lower one's cholesterol depending on the type and source it comes from. Listed below are the two major classes of fatty acids and their specific properties.

Saturated fatty acids do not contain any double bonds or other functional groups along the chain. The term "saturated" refers to hydrogen, in that all carbons (apart from the carboxylic acid [-COOH] group) contain as many hydrogens as possible. In other words, the omega ( $\omega$ ) end contains 3 hydrogens ( $\text{CH}_3$ -), and each carbon within the chain contains 2 hydrogens. Some of the commonly occurring fatty acids include:

1. Lauric (dodecanoic acid):  $\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$  or C12:0.
2. Myristic (tetradecanoic acid):  $\text{CH}_3(\text{CH}_2)_{12}\text{COOH}$  or C14:0.
3. Palmitic (hexadecanoic acid):  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$  or C16:0.
4. Stearic (octadecanoic acid):  $\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$  or C18:0.

Unsaturated fatty acids are of similar form, except that one or more alkenyl functional groups exist along the chain, with each alkene substituting a singly-bonded " $-\text{CH}_2-\text{CH}_2-$ " part of the chain with a doubly-bonded " $-\text{CH}=\text{CH}-$ ". Examples of unsaturated fatty acids:

1. Oleic acid:  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$  or *cis*- $\Delta^9$  C18:1.
2. Linoleic acid:  $\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$  or C18:2.
3. Alpha-linolenic acid:  $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$  or C18:3.
4. Arachidonic acid:  $\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_3\text{COOH}^{\text{NIST}}$  or C20:4.
5. Eicosapentaenoic acid or C20:5.
6. Docosahexaenoic acid or C22:6.

7. Erucic acid:  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_{11}\text{COOH}$  or C22:1.

## Cooking Oils

Cooking oils have been used for centuries and is part of cooking across the globe. For decades it was thought that coconut oil and palm oil have bad effects on cholesterol until it had found to have good cholesterol properties, especially coconut oil [3]. However, there seems to be a re-emergence of the usage of these oils since the public is being educated on the benefits of these two oils.

## Coconut Oil

Coconut oil is derived from the plant *Cocos nucifera*, and it is used as a major source of cooking oil in India and other countries of the Asian sub-continent. Several other tropical islands also use coconut oil for cooking purposes. In Guyana, it was widely used by the Guyanese population, especially those in the country sides for cooking up until the early 90s. Now it is mainly used by the poor communities, but even they are changing to the commercial oils being imported or even made right here in Guyana. Coconut oil is a fat consisting of about 90% saturated fat. Saturated fatty acids (86.5%), monounsaturated fatty acids (5.8%), and polyunsaturated fatty acids (1.8%) are the constituents of medium chain triglycerides in coconut oil. Lauric acid (44.6%), myristic acid (16.8%), and palmitic acid (8.2%) constitute saturated fatty acids. Oleic acid (monounsaturated fatty acid) and linoleic acid (polyunsaturated fatty acid) are also present.

The melting point range for unrefined coconut is 20-25 °C with greater shelf life than the other oils up to the period of 2 years with its resilience to high temperatures. The solid form of coconut oil is good for long storage life with a temperature lower than 24.5 °C [4].

Coconut oil contains what are called medium chain fatty acids or medium chain triglycerides (MCTs for short). Most vegetable oils have

longer chain triglycerides (LCTs). Body fat is stored as LCTs, and energy usage is from MCTs that is burnt faster. Coconut is highly rich in MCTs.

Much of the recent research done on coconut oil focused on lauric acid (an MCT), the most predominant fatty acid chain found in coconut oil. Coconut oil is highly rich in lauric acid and medium chain fatty acids. Many studies have been done to study the anti-microbial and anti-viral properties effect of lauric acid. Due to antibiotic resistance to many strains of bacteria, the treatments are becoming ineffective. The dietary consumption of lauric acid in breast milk or in coconut oil tends to inhibit the growth of several bacteria and viruses, including listeria monocytogenes and helicobacter pylori, and protozoa such as *Giardia lamblia* by its conversion to monoglyceride called monolaurin. HIV, measles, herpes simplex virus-1, vesicular stomatitis virus, influenza, and cytomegalovirus have been destroyed by monolaurin based on some of the experimental works done. It has also been reported that MCTs in coconut oil is highly effective against yeast infections (*Candida*) [3]. Among the other, touted benefits of coconut oil include the lowering of LDL-c and the raising of HDL-c.

## **Palm Oil**

Palm oil (*Elaeis guineensis*) is also effective against cholesterol and is used in many countries in cooking. It is manufactured right here in Guyana by the Pomeroon oil mill. Palm oil is a form of edible vegetable oil obtained from the fruit of the Oil palm tree. It is the second-most widely produced edible oil, after soybean oil. Palm oil is found in the fleshy portion of the fruit (mesocarp), whereas palm kernel oil is found in the kernel or the seed of the fruit. Fatty acid composition is different in the two types of palm oil. Palmitic acid (44%), stearic acid (5%), oleic acid (39%), and linoleic acid (10%) are the constituents of palm oil.

Myristic acid and lauric acid are present in present in insignificant quantity.

Palm kernel oil is similar to coconut oil in its constitution. Lauric acid (48%), myristic myristic (16%), and palmitic acid (8%) are the main components of palm kernel oil [5]. Among the touted health benefits of palm oil, most notably, red palm oil are rich in beta-carotene, especially red palm oil. Carotenoids are 15 times more in crude palm oil when compared to carrots. The immune system is boosted by carotenoids through various mechanisms and improvement in cardiovascular system. Red palm oil (processed palm oil) retains 80% of the original carotenoids with a good source of Vitamin A [6].

Palm oil is rich in tocotrienols with antioxidant property is also important for other health benefits. Natural palm oil is a rich source of vitamin E (alpha, beta, gamma, and delta-tocopherols and alpha, beta, gamma, and delta-tocotrienols) with effective properties like antioxidant and anti-cancerous. Some of the research suggests that it may be important in inhibiting human breast cancer cells. Tocotrienols component of Vitamin E in palm oil plays an important role in the reduction of blood cholesterol by reaction with enzymes in the liver and is effective against skin aging, inhibition of oxidation of fat, lowering blood pressure, and other positive effects [6].

There are other minor components like linoleic acid (10%) is an essential unsaturated omega-6 fatty acid needed for human health, squalene (for cholesterol-lowering and anti-cancer effect), and ubiquinone (for energy). Co-enzyme Q10 is an important constituent in red palm oil [6].

Since it was established that the major type of fatty acid found in both coconut oil and palm oil is saturated, its importance of it in the body's chemistry is listed below [6]:

1. The cell membrane is made up of saturated fatty acids (50%) and provides structural support.

2. Saturated fats in our diet facilitate calcium metabolism and bone constitution.
3. Heart disease is indicated by lower LP in the blood.
4. Toxic effect of alcohol and some drugs on liver can be prevented by saturated fatty acids.
5. There is the enhancement of the immune system.
6. A diet rich in fatty acid contain elongated omega-3 fatty acids are retained in the tissues, thereby help in its utilization.
7. Saturated fatty acids like stearic acid (18 C) and palmitic acid (16 C) in food are good for heart and serve as a reserve of fat in stress periods.
8. Saturated fatty acids (short and medium) play an important role against harmful gut microbes.

### **Cooking Oil as Blood Plasma Cholesterol Regulator**

Cooking oil has contributed to both the lowering and rising of “good” and “bad” cholesterol levels in man. For decades it was believed that coconut oil is responsible for the elevation of “bad” cholesterol. However, recent studies have shown the reverse. In research conducted by Enig [5], coconut oil lowers LDL and raises HDL. The coconut oil was natural and not hydrogenated. Hydrogenated coconut oil raises total cholesterol levels. According to another study by [7], diets rich in coconut and safflower oil in comparison to butter resulted in a reduction of cholesterol synthesis, which may be due to lesser production rates of apoB-containing lipoproteins. Experiments on rats showed that coconut oil was effective in changing the lipid composition of epididymal fat pads in comparison to the rats that were given a commercial stock diet. There was an increase in tissue cholesterol and reduction in phospholipids with a diet with safflower oil, whereas a diet with coconut oil resulted in a reduction of both tissue cholesterol and phospholipid concentrations [8].

Palm oil is considered a plant oil in which two types of cooking oil is made, palm seed oil and palm oil. Palm oil has almost 50% saturated fatty acid and 50% polyunsaturated fatty acid. Metabolites such as prostacycline is effective for antithrombosis in cardiovascular disease and variation in lipoprotein. [9] conducted the study on the serum lipid profile in rats due to palm oil, and results indicated that there was a significant increase in levels of serum cholesterol and HDL-c but no significant decrease in LDL-c and triglyceride. In another study conducted [10], the results showed that among hypercholesterolemic subjects (greater than 7.84 mmol/L) over a 4-week period after subjecting them to 200 mg gamma-tocotrienol/d, there was a 31% reduction in serum cholesterol that may be due to potent cholesterol inhibitor (gamma-tocotrienol) in palmitate capsules. [11] confirmed the previous studies on lowering of cholesterol in blood plasma in animals due to tocotrienols, naturally occurring compounds in grain and palm oils, and may be effective in humans as well.

There was a study done over a 5-week period on diet manipulation with palm olein, corn oil, and coconut oil on human subjects in different treatment groups. The results indicated that coconut oil increased total cholesterol in blood serum by 10% when compared to other groups. A subsequent diet with palm oil or corn oil to the groups indicated that there was a reduction in total cholesterol, LDL cholesterol, and HDL cholesterol [12]. The coconut oil with its important constituent Lauric acid (a saturated fatty acid) may have contributed to the results obtained, which is medium chain triglyceride (MCT) is not the storage fat but is useful for energy for the body. It is critical in lowering the bad cholesterol and increasing the good cholesterol apart from antimicrobial effects [3]. Palm oil, on the other hand, has a saturated fatty acid called palmitic acid which may have also contributed to raising HDL cholesterol but, unfortunately, raising LDL cholesterol in the process. However, these results cannot be taken

for granted since the experiment was only conducted for a short period of time, and there may not have been substantial evidence in supporting coconut oil as a better source of fatty acid that may lower cholesterol.

## Conclusion

Cooking oils are an essential component in food and contribute positively to blood plasma cholesterol in terms of reducing HDL and LDL. Some oils like coconut and palm oil are used by communities across the globe that, including

Guyana. These are known for essential properties that are responsible for some of the health benefits, as per a review of research done by the scientific fraternity.

## Acknowledgement

None.

## Conflict of Interest

The author declares that there is no conflict of interest.

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