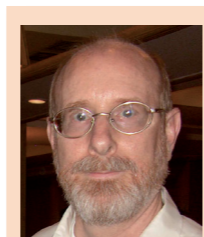


# Health properties of coconut oil

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**ABSTRACT:** Coconut oil has a long history of use throughout the world as both a food and as a medicine. Over the past 50 years research has shown that coconut oil possesses unique properties with important nutritional and medical applications. Coconut oil is unique in that it is composed predominately of a special group of saturated fats known as medium-chain triglycerides (MCT). Although MCT are classified as saturated fats they do not contribute to cardiovascular disease. Evidence shows they may actually protect against it. Studies have shown that populations that use coconut oil as their primary source of dietary fat have very low rates of cardiovascular disease. Coconut oil is easier to digest than other fats, improves nutrient absorption, does not contribute to weight gain, stimulates metabolism, boosts energy, possesses potent antimicrobial properties, and improves energy metabolism in the brain. All these features suggest that coconut oil is a healthy choice with important nutritional and medicinal applications.

## INTRODUCTION

Coconut oil is extracted from the kernel or meat of mature coconut harvested from the coconut palm (*Cocos nucifera*). Throughout the tropical world it has provided the primary source of fat in the diets of millions of people for generations. When Europeans began to explore the South Pacific in the 15<sup>th</sup> and 16<sup>th</sup> centuries one of the first commodities they brought back with them was coconut. In Europe the oil was used for food, fuel, and for making soap. Coconut oil provided a less expensive and cleaner alternative to animal fats. The oil made a good fuel for lamps and was especially valued in soap making because it produces a rich bubbly lather in hard water and even in seawater, unlike other soaps.

Today coconut oil and its components (fatty acids) are used in cooking and food preparation, infant formulas, enteral (tube feeding) and parenteral (intravenous) nutritional formulas for hospital patients, as carriers for transdermal delivery of medication, antifungal, antibacterial, and antiviral medications, skin creams and lotions, sunscreens, cosmetics, toothpastes, soaps and detergents, lubricants, biofuels, and numerous other pharmaceutical and industrial applications.

## PHYSICAL PROPERTIES

Coconut oil is composed predominately of a special group of fat molecules known as medium chain fatty acids (MCFA). The majority of fats in the human diet are composed almost entirely of long chain fatty acids (LCFA), making coconut oil unique among the dietary fats.

The primary difference between MCFA and LCFA is the size of the molecule, or more precisely, the length of the carbon chain that makes up the backbone of the fatty acid. MCFA have a chain length of 6 to 12 carbons. LCFA contain 14 or more carbons.

The length of the carbon chain influences many of the oil's physical and chemical properties. When consumed, the body processes and metabolizes each fatty acid differently depending on the size of the carbon chain. Therefore, the physiological effects of the MCFA in coconut are

significantly different than those of the LCFA that are more commonly found in the diet.

Coconut oil contains approximately 92.1% saturated fatty acids, 6.2% monounsaturated fatty acids, 1.6% polyunsaturated fatty acids. All of the MCFA in coconut oil are saturated. For this reason, it has a relatively high melting point. Above 76°F (24°C) coconut oil is a colourless liquid. Below this temperature it solidifies into a pure white solid. Coconut oil is very heat stable so it makes an excellent cooking and frying oil. It has a smoke point of about 360°F (182°C). Because of its high degree of saturation, it is slow to oxidize and thus resistant to rancidity.

Fatty Acid Profile of Coconut Oil			
Fatty Acid	Saturation	Carbons	Percent
Caproic	Saturated	6	0.5
Caprylic	Saturated	8	7.8
Capric	Saturated	10	6.7
Lauric	Saturated	12	47.5
Myristic	Saturated	14	18.1
Palmitic	Saturated	16	8.8
Stearic	Saturated	18	2.6
Arachidic	Saturated	20	0.1
Oleic	Monounsaturated	18	6.2
Linoleic	Polyunsaturated	18	1.6

The above numbers are averages based on samples taken. Numbers can vary slightly depending on age of the coconut, growing conditions, and variety.

## HEALTH EFFECTS

### Cardiovascular Disease

One of the major issues regarding coconut oil consumption is its effect on the heart and circulatory system. Because coconut oil contains a high amount of saturated fat, it has been believed to raise blood cholesterol levels and promote heart disease.

Some studies have shown that in laboratory controlled diets, coconut oil may increase total cholesterol levels, but most of these studies used hydrogenated coconut oil, not natural coconut oil, or the studies were designed in such a way as to create an essential fatty acid deficiency, both of these scenarios would cause a rise in total cholesterol regardless of

the type of oil used.

Coconut oil may increase total cholesterol levels slightly in some individuals, but the rise in total cholesterol is due primarily to an increase in HDL (good) cholesterol. HDL cholesterol is believed to protect against heart disease and the higher the HDL the better. Total cholesterol is a poor indicator of heart disease risk. The reason for this is that total cholesterol includes both HDL cholesterol and LDL (bad) cholesterol and there is no indication of how much of each make up the total. This may explain why 75% of those people who experience heart attacks have normal to below normal total cholesterol values (1). A far more accurate indicator of heart disease risk is the cholesterol ratio (total cholesterol/HDL cholesterol). The cholesterol ratio takes into account the amount of HDL in the total cholesterol reading.

Researchers at Harvard Medical School have shown that coconut oil consumption increases HDL levels and in so doing improves the cholesterol ratio, thus reducing risk of heart disease (2). They also demonstrated that coconut oil does not significantly affect total cholesterol levels even when up to half of the total daily fat consumption (up to 37% of total calories) consists of coconut oil. The researchers state, "Two conclusions are solidly based. The first is that consumption of up to 50% of dietary fat as coconut oil does not significantly alter either total cholesterol or LDL cholesterol in otherwise healthy young men. More importantly, HDL levels seemed to increase significantly with coconut oil consumption. In fact, coconut oil was the only fat [in the study] which raised HDL." They went so far as to suggest using coconut oil as an aid in preventing heart disease in high risk patients and said, "This observation is very significant since it raises the possibility of beneficial effects from coconut oil in subjects with increased cardiovascular risk due to low HDL levels...coconut oil may significantly improve blood lipid profiles in at-risk patients."

Other researchers, after studying coconut oil, have come to similar conclusions. Kurup and Rajmohan (3) conducted a study on 64 volunteers and found no statistically significant alteration in the serum total cholesterol or LDL cholesterol from baseline values.

Kaunitz and Dayrit (4) reviewed epidemiological and experimental data regarding coconut-eating peoples and noted that the "population studies show that dietary coconut oil does not lead to high serum cholesterol or to high coronary heart disease mortality or morbidity." Mendis (5) reported undesirable changes in blood cholesterol values when young adult Sri Lankan males substituted corn oil (a polyunsaturated oil) for their customary coconut oil. When these subjects switched from eating coconut oil to corn oil their total serum cholesterol decreased by 18.7% and their LDL (bad) cholesterol decreased by 23.8%. Both of these changes are normally considered good, however, when you take into account the HDL values, a different picture emerges. The HDL cholesterol also decreased, from an average of 43.4 to 25.4 mg/dL (putting the HDL values very much below the acceptable lower limit of 35 mg/dL) and the cholesterol ratio increased from 4.14 to 5.75. These cholesterol values indicate that coconut oil is more protective against heart disease than corn oil.

Prior and colleagues (6) showed that Pacific islanders with high intakes of fat, mostly from coconut, comprising up to 50% of total daily calories indicated "no evidence of the high saturated fat intake having a harmful effect in these populations." When these people migrated to New Zealand, however, and lowered their intake of coconut oil and total fat, their cholesterol increased, and their HDL cholesterol decreased.

In the Pacific Islands, rural communities generally consume more coconut and more saturated fat (from coconut) than do those in urban communities, which are more educated and in general more conscious about avoiding saturated fat. Yet, total blood cholesterol levels are generally lower in rural areas than in urban areas (7). The incidence of heart disease is also much lower in urban areas in Pacific Island communities where coconut oil is the predominate source of dietary fat.

## Digestion and Nutrient Absorption

The fatty acids in all dietary fats and oils are in the form of triglycerides. Triglycerides are simply three fatty acid molecules joined together by a glycerol molecule. Most of the triglycerides in dietary fats and oils contain only LCFA and are referred to as long chain triglycerides (LCT). Coconut oil is composed predominately of medium chain triglycerides (MCT).

One of the major differences between MCT in coconut oil and other fats is the way in which they are digested and metabolized. Most all fats in our diet, whether they are saturated or unsaturated, both vegetable oils and animal fats, are composed almost entirely of LCT. The MCT in coconut are much smaller in size. The size makes a big difference. When consumed, the large LCT pass through the stomach and into the intestinal tract where the majority of fat digestion takes place. Here they are broken down into individual fatty acids with the aid of pancreatic digestive enzymes and bile. As individual fatty acids are released from the triglyceride molecule they are absorbed into the intestinal wall. In the intestinal wall they are combined into bundles of fat and protein called chylomicrons (a form of lipoprotein). These lipoproteins are sent into the bloodstream to be distributed throughout the body. Lipoproteins are the source of the fats that are packed away into our fat cells and the fats that end up inside artery walls as a part of plaque.

MCT, on the other hand, are metabolized differently. They do not need pancreatic digestive enzymes or bile for digestion and put little strain on the enzyme and digestive systems of the body. Once they pass through the stomach they are immediately absorbed into the portal vein and channelled directly to the liver. In the liver, they are used preferentially as a source of fuel to produce energy. They act as a more efficient source of fuel than glucose, the body's normal energy source. Consequently, MCFA do not circulate in the bloodstream to the same degree that other fats do. As a result, they are much less likely to be incorporated into fat cells and do not collect in artery walls or contribute to hardening of the arteries.(8) MCFA are utilized primarily by the body to produce energy rather than body fat. Because of the ease at which coconut oil is digested, it has proven useful in the treatment of malnutrition.

Coconut oil has shown to be superior to most vegetable oils for promoting growth and improving nutritional status in malnourish children.(9) For this reason, coconut oil is recommended over other oils for those who have digestive problems or who have trouble digesting fats. Coconut oil or MCT are routinely added to commercial and hospital infant formulas because they are better tolerated by new-borns whose digestive systems are still developing. Likewise, they are added to adult hospital feeding formulas to improve patients' nutritional status (10).

Medium-chain fatty acids also improve the absorption of many other nutrients. The absorption of minerals (particularly calcium and magnesium), B vitamins, fat soluble vitamins (A, D, E, K and beta-carotene) and also amino acids have been found to increase when infants are fed a diet containing MCT (11-12).

### Energy and Weight Management

The fact that the fatty acids in coconut oil are used as fuel to generate energy, rather than being put into storage like other fats, provides many health benefits. The most obvious is a boost in energy. The energy boost is not like the kick you get from caffeine, it's more subtle but longer lasting. It is most noticeable as an increase in endurance (13). This effect is accumulative, that is, energy level increases with daily use. Some studies have shown when athletes are given MCFA during training their performance and endurance improves (14). For this reason, coconut oil or MCT oil, is added to many sports drinks and energy bars.

Because coconut oil produces energy, it stimulates the metabolism. This thermogenic or metabolic stimulating effect causes the body to burn more calories, thus leaving fewer calories to be converted into body fat. For this reason, coconut oil can help promote weight loss in overweight individuals. Studies have shown that replacing LCFA with MCFA in the diet yield meals having a lower effective calorie content (15).

In one study, the thermogenic (fat-burning) effect of a high-calorie diet containing 40 percent fat as MCFA was compared to one containing 40 percent fat as LCFA. The thermogenic effect of the MCFA was almost twice as high as the LCFA. The researchers concluded that the excess energy provided by fats in the form of MCFA would not be efficiently stored as fat, but rather would be burned. A follow-up study demonstrated that MCFA given over a six-day period can increase diet-induced thermogenesis by 50 percent (16-17). In another study, researchers compared single meals of 400 calories composed entirely of MCFA and of LCFA. The thermogenic effect of MCFA over six hours was three times greater than that of LCFA. Researchers concluded that substituting MCFA for LCFA would produce weight loss as long as the calorie level remained the same (18).

### Antimicrobial Effects

Jon J Kabara and other researchers have reported that certain fatty acids, primarily MCFA, and their derivatives (e.g., monoglycerides) have potent antibacterial, antiviral, antifungal, and antiprotozoal properties (19). When coconut oil is consumed, the MCT are broken down into individual medium chain fatty acids and monoglycerides which can kill or inactivate disease-causing microorganisms inside the body. This is another reason why MCT are so important in infant and enteral feeding formulas in hospitals. They help protect patients from infections.

Unlike antibiotics which are only effective against bacteria, MCFA and their monoglycerides can kill bacteria as well as viruses, fungi, and protozoa, which make coconut oil a potentially useful aid in fighting infections.

It is reported that the fatty acids and monoglycerides produce their killing/inactivating effect by lysing the plasma membrane lipid bilayer of the microorganisms. This causes the organisms to essentially fall apart and die. The antiviral action attributed to monolaurin (the monoglyceride of lauric acid) is that of solubilizing the lipids and phospholipids in the envelope of the organisms causing the disintegration of their outer membrane. There is also evidence that MCFA interfere with the organism's signal transduction (20) and another antimicrobial effect in viruses is due to interference with virus assembly and viral maturation (21).

Research has shown that MCFA and monoglycerides are effective in killing a number of disease-causing microorganisms among which include streptococcus, staphylococcus, *H. pylori*, *Chlamydia trachomatis*, *Neisseria*, candida, giardia, herpes virus, influenza, Epstein-Barr virus, hepatitis C virus, human immunodeficiency virus (HIV), and others (22-25).

### Neurological Effects

The brain is the most metabolically active organ in the body. It requires a continual source of energy to maintain function, even during sleep. Glucose is the brain's primary source of fuel. We get glucose from our foods. When food is not eaten for a time, such as between meals, during sleep at night, or when fasting, blood glucose levels fall. When this happens the brain needs another source of energy to function and to survive. This alternative fuel source comes in the form of ketone bodies or ketones. Ketones are a special type of high-energy fuel produced in the liver specifically to nourish the brain. Ketones are produced from fat stored in the liver. Ketones are produced when blood glucose level falls. After eating, blood glucose levels are restored and ketone production declines. This way, the brain has a continual supply of either glucose or ketones to rely on.

A common feature found in Alzheimer's disease and many other neurological disorders is chronic inflammation. Inflammation interferes with normal glucose metabolism. This defect in energy conversion starves the brain cells causing them to degenerate and die. In the process, the brain rapidly ages and degenerates into dementia.

Ketones bypass this defect in glucose energy metabolism. Therefore, if enough ketones are available on a continual basis, they could satisfy the brain's energy needs. However, ketones are only produced when food, and particularly carbohydrate, consumption is very low.

When coconut oil is consumed, a portion of the MCFA is automatically converted into ketones regardless of blood glucose levels or what other foods are eaten at the same time (26). These ketones supply the Alzheimer's brain with the energy it needs to survive, and if given on a continual basis will support processes in the brain that are involved in healing and repair. Case histories of Alzheimer's patients receiving coconut oil have demonstrated that it is possible to not only stop the progression of the disease, but even bring about significant improvement (27).

In clinical studies, MCFA have produced better results in

Alzheimer's patients than any other treatment currently in use. In one study, for instance, Alzheimer's patients consumed a beverage containing MCT or a beverage without MCT. After 90 minutes a cognitive test was administered. Those patients who received the MCT scored significantly better on the test than the other group.(28) This study demonstrated that MCFA do have a positive effect on Alzheimer's patients. It also showed that improvement was almost immediate and can occur after a single dose. No Alzheimer's drug or treatment has come close to achieving results like this. Based on studies such as this, a new medicinal food supplement containing MCFA has been approved by the FDA for the treatment of Alzheimer's disease (29).

### CONCLUSION

Coconut oil has nourished millions of people throughout the world for generations. Those populations that use it as their primary source of dietary fat are remarkably free of cardiovascular disease and other common degenerative conditions. In comparison to other fats, coconut oil is easy to digest and improves the absorption of vitamins, minerals, amino acids, and fatty acids, making it an excellent choice for the treatment of malnutrition and for those who have digestive concerns. MCT are added to hospital infant and enteral formulas for this reason. MCT are digested quickly and are immediately utilized to produce energy rather than being stored as body fat. This increase in energy elevates metabolism making it a useful tool in weight management.

The antimicrobial effects of MCFA in coconut oil are well documented. Evidence suggests that consuming coconut oil on a regular basis may provide significant protection against a wide variety of infectious illnesses.

When consumed, many of the MCFA in coconut oil are immediately converted into ketones which are used as a major energy source for the brain. Neurological disorders involving defects in glucose metabolism can be successfully treated with the regular consumption of coconut oil. All these features make coconut oil an excellent dietary choice to support good overall health.

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