

Coconut oil: a review

PADMINI SHANKAR*, SUMAN AHUJA, ALEXANDRA TRACCHIO

*Corresponding author

Department of Health & Kinesiology, Georgia Southern University,
PO Box 8076, Statesboro, GA 30460, USA



Padmini Shankar

KEYWORDS: virgin coconut oil; medium chain triglycerides; antimicrobial properties; cardiovascular health; metabolic syndrome

ABSTRACT: Coconut and its by-products have been used for centuries as culinary, cosmetic, and medicinal agents. More recently, virgin coconut oil (VCO) is gaining recognition as a functional food due to its perceived health benefits. Virgin coconut oil has a high proportion of medium-chain triglycerides, which unlike the long-chain triglycerides, are oxidized to energy in the liver. In addition to its excellent antioxidant profile, coconut oil is said to have antimicrobial and hypolipidemic properties too. This review focuses on the historical and functional aspects of coconut oil, with special emphasis on its health properties.

INTRODUCTION

Coconut, also known as *Cocos Nucifera* (1), a tree known for its many nutritional and medicinal properties has gained new found interest in western medicine. It is believed that certain parts of the coconut, for example, tender coconut water and kernel have medicinal qualities including but not limited to antibacterial, antiviral, antifungal, antioxidant, low glycemic index, hepatoprotective, and immune system enhancement (1). Coconut oil is very commonly used as a tropical edible oil in many Asian cultures and is composed of almost 90-95% saturated fatty acids (2). The health and nutritional benefits derived from coconut oil are both compelling and contradictory, mainly due to its high saturated fat content as relates to chronic diseases, especially those involving the cardiac system (3).

Compositionally, coconut oil is derived from the dried kernel or meat of coconut, also known as copra (3, 4). Chemically, coconut oil primarily comprises of lauric acid (47.5%), a low molecular weight saturated fatty acid known to be a better alternative to other saturated fatty acids, the kind found in butter (5). It has been documented through the National Nutrition Survey of 2003 that in certain Asian cultures, wherein coconut oil happens to be the primary source of cooking fat, the incidences of hyperlipidemia, stroke and angina were relatively low (5). In fact, a study reported that levels of low density lipoprotein (LDL) appeared to be relatively higher in individuals consuming safflower oil and/or butter as compared to those consuming coconut oil (5, 6). While speculations regarding use of coconut oil and its many potential medicinal benefits have captured the attention of the scientific and clinical world here in the United States, available clinical data suggesting the many medicinal and nutritional properties of consumption of coconut oil remain scarce. Although, there are studies suggesting the many health benefits offered by consumption of coconut oil, most of these studies have reported data derived from animal studies or use of methodology including but not limited to self-reporting through various dietary recalls; thus, with this comprehensive review, we aim to shed light on information related to the health benefits of consuming coconut oil.

HISTORY

Being touted as the world's oldest oil, coconut oil has been used as far back as 4000 years ago (7). It has been used widely around the world, more particularly in the tropical regions of Southern Asia and Pacific, Africa, Central America and the Caribbean due to the abundant coconut palms that grow there. Historical information claims that coconut oil was the cure for illness in ancient India and China, treating anything from infections and disease, to nausea and toothaches. The creamy, soft texture of coconut oil has also been used as a skin moisturizer and as hair therapy, aiding in the prevention and treatment of dry skin and damaged hair in the hot, tropic sun. Claimed to guarantee blemish and infection free skin as well as strong bones, Samoan mothers massage their children's entire bodies frequently since infancy with the miracle oil. Coconut oil is also rubbed on the gums of babies to ease the pain during teething. In the Philippines, coconut oil has been used as a muscle relaxer and joint pain reliever. Jamaicans believed coconut oil to be valuable to heart health, and drank it as a tonic whenever sick (8). In India, coconuts, known as the "fruits of aspiration", are offered to the gods and have a prominent role in many Indian religions (1).

Apart from the many medicinal and religious uses of coconut oil, it also has been utilized in cooking. In Thailand and Sri Lanka, as well as many other places around the globe, coconuts make up most of the diet providing nutritious sources of milk, meat, juice, and oil (8). After seeing the benefits of coconut oil, England and the United States began producing and selling coconut oil as margarine and butter, respectively (7). Coconut oil was taken off the US market temporarily in 1986 when the American Soybean Association instigated an anti-tropical oil campaign in order to drive out the competition. This campaign, which targeted both coconut and palm oils, was challenged in 1988 by Harvard Medical School's Dr. N.W. Istan whose findings showed that coconut oil consumption did not increase the risk for heart disease (9). It is categorized as a "functional food" because of the oil's rich supply of fiber, vitamins, and minerals. Due to the VCO's strong stability, it is resistant to free radical generation during intense temperature heating, making coconut oil a very safe oil to cook with (7). Among the health conscious consumers, coconut oil is gaining wide spread popularity and is recommended as a healthy

cooking oil and a source of alternative medicine. Although a saturated fat, VCO is rich in medium chain triglycerides (MCT), much different than the more common long chain triglycerides (LCT). The difference between LCT and MCT are in the way human bodies metabolize and digest them (10). MCT do not require pancreatic lipase or bile for digestion. Unlike LCT which are stored in our cells, MCT are immediately transported to the liver and are metabolized for energy (11). According to the Coconut Research Center, MCT may actually help to lower the risk of both atherosclerosis and heart disease (10).

ANTIMICROBIAL EFFECTS OF COCONUT OIL

For thousands of years, coconut oil has been found to aid as an antibacterial, antifungal, antiviral, and anti-dermatophytic agent. It has been used in Ayurvedic medicine as well as in many other cultures worldwide. More recently, studies have been conducted to test the effects of coconut oil as an antimicrobial agent and findings from many support this thousand year old universal remedy. By-products of coconut oil breakdown result in the production of medium-chain fatty acids (MCFA) and monoglycerides (MG). It is these MCFA and MG that confer antimicrobial properties, by destroying pathogenic bacteria, virus, fungi, and protozoa (12).

Coconut oil has been proven very successful and effective against viruses that are lipid-coated, such as Epstein-Barr virus, influenza virus, leukemia virus, hepatitis C virus, and cytomegalovirus (CMV), to name a few. It accomplishes this by interfering and disrupting the virus membrane, assembly, and maturation (1).

Oyi and colleagues studied the effectiveness of VCO in the treatment of skin inoculations of *Ps. Aeruginosa*, *E. coli*, *P. vulgaris*, *B. subtilis*, and *C. albicans* by converting the oil to a cream. With the study's success, there is now evidence coconut oil can be formulated into creams to treat bacterial and fungal infections. The effectiveness of VCO as an antimicrobial agent is due to the active compound monolaurin, a monoglyceride, which is a product of lauric acid metabolism (13). Lauric acid is the predominant fatty acid found in coconut oil. It is also found in breast milk and helps to support healthy growth in breastfed infants and has been shown to have many antimicrobial properties (14). In today's fast-paced and quick-fix society, antibiotics are overused and this indiscriminate use can lead to the elimination of beneficial bacteria population in the gut. This in turn can promote overgrowth of microorganisms such as *Candida* and cause fungal infections. Because VCO is a rich source of MCT and possesses antifungal properties, a study in Nigeria focused on its effectiveness as an antifungal agent and compared it to the action of fluconazole, the first line of treatment for *Candida albicans* infection. It was found that coconut oil was effective against *Candida* at 100% concentration when compared to fluconazole. The study concluded coconut oil to be a powerful alternative medicine, especially against fungal species such as *Candida* (15).

HYPOLIPIDEMIC EFFECTS OF COCONUT OIL

While cardiovascular disease is on the rise, mainly, due to its correlations with obesity, a growing epidemic across the globe, risk factors of cardiovascular diseases

include several components, such as diet, levels of physical activity, psychological well-being, and other lifestyle components like smoking. Of these, scientific evidences have indicated that dietary factors predominantly influence serum lipid concentrations (3). It is largely believed that certain dietary fats lower low density lipoprotein (LDL) levels while assisting in elevating higher density lipoprotein (HDL) levels in the blood. Clinical evidences have also indicated that risk for cardiovascular diseases increase dramatically when serum LDL is easily oxidized (3). There is new found interest in the cardio-protective effects of coconut oil as reported by the Coconut Research Center. In one study, coconut oil was reported to cause an increase in total cholesterol levels; however, it is noteworthy that some of the elevation in cholesterol levels is attributed to an increase in HDL or good cholesterol (12). Therefore, it is essential to understand the chemical composition of coconut oil in order to extrapolate the health benefits and clinical significance of consuming coconut oil as a health promoting dietary fat. Most coconut oil is extracted from the kernel or meat of coconut, copra. Another form of extraction of coconut oil involves using a wet process (involves extraction of coconut oil directly from the coconut milk, done so under controlled temperatures) and the resulting product is VCO, obtained from coconut milk (3). Nevin et al. (2004) reported that VCO has been shown to decrease total cholesterol, triglycerides, and phospholipids. The researchers also reported that in addition to an overall decrease in serum cholesterol, LDL, and very low density lipoprotein (VLDL) levels were also reduced after consumption of VCO. Furthermore, elevated levels of HDL were found, thus enhancing the cardio-protective benefits of coconut oil. Lastly, this study also found that VCO was capable of increasing antioxidant enzyme activity, thus able to halt LDL oxidation, a primary factor associated with atherosclerosis (3).

EFFECT OF COCONUT OIL ON CARDIOVASCULAR HEALTH

A recent study investigated the risk for cardiovascular diseases upon consumption of coconut oil in the Philippines, a country wherein coconut oil is abundantly used for cooking purposes. Coconut oil being extremely rich in saturated fats, the premise of this study was to investigate the effects of saturated fats in coconut oil and its atherogenic properties in a cohort of 1,839 Filipino women (5). The results of this study indicated that consumption of coconut oil did not elevate serum total cholesterol or serum



triglycerides. However, measurement of coconut oil intake was calculated using self-reporting via two 24-hour dietary recalls. Thus, due to the nature of the design practiced by this study and lack of ability to control various external and confounding variables, it would be safe to assume that additional clinical trials are required before health professionals are confidently able to prescribe coconut oil consumption as it relates to being a cardio-protective agent.

HEPATOPROTECTIVE EFFECTS OF COCONUT OIL

Liver is one of the largest and the most important organs in the human body. The human liver is responsible for controlling carbohydrate storage and metabolism, protein synthesis, breakdown of red blood cells, and detoxification (16). Despite the many advances in the medical field, western medicine has been unable to prevent and cure many chronic conditions, one being offering protection from much chemical and physiological damage to hepatic cells resulting from routine exposure to different nutrients, drugs, and environmental factors. In the most recent times, VCO has gained a lot of popularity in the clinical field, especially in relation to its antioxidant and cardio-protective properties. However, the understanding of the functional properties of coconut oil clinically within the human body requires sophisticated research methodologies. Data in animals suggest that VCO may induce a hepatoprotective effect in addition to the antiviral, anti-inflammatory, and cardio-protective mechanisms. Zakaria et al. (2010) investigated the hepatoprotective effects of VCO on paracetamol induced liver damage in rats. The results indicated that treatment of the damaged rat liver with VCO significantly reduced liver damage concluding that coconut oil may indeed offer some hepatoprotective effects. Of course, the authors concluded that further in-depth studies are required to observe similar results in humans (16).

EFFECTS OF COCONUT OIL ON METABOLIC SYNDROME

While there is a surge in chronic diseases, mainly stemming from presence of obesity, very little preventive cure is available through western medicine. Type 2 diabetes, hypertension, cardiovascular disease, and certain cancers are all chronic conditions, risk for which can be increased by what is deemed as metabolic syndrome, a cluster of factors comprising of low levels of HDL, hyperglycemia, abdominal obesity, hypertension, and high triglycerides (17). Although the pathogenesis of metabolic syndrome is complex, very little is known about the underlying mechanisms and successful prevention and treatment through western medicine. It has been observed that in animals (mice models), consumption of MCT such as those found in coconut oil may offer enhanced lipid oxidation and greater energy expenditure. A recent study suggested that consumption of MCT's (coconut and milk) resulted in greater elevation of post prandial oxygen consumption in healthy men as compared to LCT (18). Hyperlipidemia, a classic condition associated with metabolic syndrome is one of the many leading causes of cardiovascular diseases and while there are numerous synthetic drugs available to treat the condition, none come without the added risk of side effects, sometimes debilitating and interfering with body processes and metabolism (16). It has been demonstrated that MCT's could potentially offer a therapeutic advantage in the treatment of hyperlipidemia

and metabolic syndrome, and in addition, MCT's when tested in animal models, offers promising results as far as improving insulin sensitivity and type 2 diabetes, both conditions associated with presence of metabolic syndrome (17).

Of the many chronic conditions associated with metabolic syndrome, waist circumference can be used as an indicator of abdominal obesity (19) resulting in health issues such as type 2 diabetes, certain cancers, hypertension, and infertility, especially in women. A recent study investigated the effects of supplementation with dietary coconut oil in women who presented with abdominal obesity determined by their waist circumference. The study population was provided with either soybean oil or coconut oil. While reductions in body mass index (BMI) were observed in both groups, only the women supplemented with coconut oil presented reductions in waist circumference. The study concluded that coconut oil supplementation offered protection against dyslipidemia, an imbalance of serum lipids associated both with metabolic syndrome and abdominal obesity (19). Liao et al. (20) studied the efficacy of VCO in weight reduction and lipid profile of 20 Malay people. While no improvements were seen in the lipid levels, decrease in visceral adiposity as measured by waist circumference was seen, especially in men.

CONCLUSION

There is renewed emphasis on incorporating heart-healthy fats in our diet today. Virgin coconut oil with its versatility as a cooking medium and limited pharmacotherapeutic properties is gaining popularity in modern society. However, further research is needed to provide conclusive evidence on its clinical applications. Until such time it is important to adhere to dietary guidelines, which recommend moderate amounts of healthy fats in our daily diet.

REFERENCES

1. DebMandal M., Mandal S., *Asian Pac. J. Trop. Med.*, **4(3)**, 241-247 (2011).
2. Burnett C.L., et al., *Int. J. Toxicol.*, **30(3 Suppl)**, 5S-16S (2011).
3. Nevin K.G., Rajamohan T., *Clin. Biochem.*, **37(9)**, 830-835 (2004).
4. Creswell D.C., Brooks C.C., *J. Anim. Sci.*, **33(2)**, 366-369 (1971).
5. Feranil A.B., et al., *Asia Pac. J. Clin. Nutr.*, **20(2)**, 190-195 (2011).
6. Cox C., et al., *J. Lipid Res.*, **36(8)**, 1787-1795 (1995).
7. Coconut Oil from Coconut Connections: www.virgincoconutoil.co.uk/#1 (last checked July 3rd 2013).
8. South Pacific Coconut Oil: <http://rudanetrading.com/au/information/coconut-oil.html> (last checked July 5th 2013).
9. How a PR campaign led to unhealthy diets. Coconut Research Center: <http://www.coconutresearchcenter.org/article10027.htm> (last checked September 11, 2013).
10. Coconut. Coconut Research Center: www.coconutresearchcenter.org (last checked July 5th 2013).
11. Healthy Oil Planet: www.healthy-oil-planet.com/history-of-coconut-oil.html (last checked July 3rd 2013).
12. Fife, B, *Agro Food Ind Hi Tec.* **24(3)**, 7-10 (2013).
13. Oyi A.R., Onaolapo J.A., et al., *Res. J. Appl. Sci. Eng. Technol.*, **2(2)**, 133-137 (2010).
14. Nutiva, Nourishing People and Planet: www.nutiva.com/articles/coconut-oil/ (last checked July 6th 2013).
15. Ogbolu D.O., Oni A.A., et al., *J. Med. Food.* **10(2)**, 384-387 (2007).
16. Zakaria Z.A., et al., *Evid. Based Complement Alternat. Med.*, **2011**, 142739 (2011).
17. Nagao K., Yanagita T., *Pharmacol Res.*, **61(3)**, 208-212 (2010).
18. Seaton T.B., et al., *Am. J. Clin. Nutr.*, **44(5)**, 630-634 (1986).
19. Assuncao M.L., et al., *Lipids*, **44(7)**, 593-601 (2009).
20. Liao K.M., Lee Y.Y., et al., *ISRN Pharmacol.*, **2011**, 1-7 (2011).



WHAT HAPPENS IN VEGAS IS YOUR BUSINESS

WHERE GLOBAL INGREDIENT SUPPLIERS AND BUYERS GATHER

Come explore the latest developments from over 1,700 booths -- featuring ingredient suppliers, contract manufacturers, manufacturing equipment companies, packaging experts, lab testing firms, business support services and more! Only at SupplySide West will you discover what you need to drive your business forward.

Join us at the industry's gathering place - because everything that happens at SupplySide West is **your** business!

Nov 12-16 | **The Venetian, Las Vegas**

Expo Hall Nov 14-15

2013

BEST RATES END SOON

suppliesideshow.com

 **INSIDER**

FOOD PRODUCT
DESIGN

 **INSIDER**
Cosmetics
Immersion Center

SupplySide
Animal Nutrition **INSIGHTS**

SupplySide
Beverage **INSIGHTS**

  #SSWExpo  /SupplySideShow