



COCONUT OIL: HOW HEALTHY FAT CAN LEAD TO A HEALTHY LIFESTYLE



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CHAPTER 1. EFFECTS OF COCONUT OIL ON METABOLISM, APPETITE, AND CHOLESTEROL

MCTs: What Are They?

It seems a bit counter-intuitive that fat could actually aid in weight loss. But it's true, coconut oil promotes weight loss and I'm going to tell you how. Let's start by going over some of the basics that you likely learned in college biochemistry, if you took it, but may have forgotten. Fats and oils are composed of fatty acids. There are really two different ways to characterize fatty acids. The first method is based on saturation, and is probably the one you are most familiar with. Most of you are acquainted with saturated or unsaturated fats and oils. The second way to classify a fatty acid is based on size or length of the fatty acid. There are short chain fatty acids (SCFA), medium chain fatty acids (MCFA), and long chain fatty acids (LCFA). Short chain fatty acids (SCFA) contain less than 6 carbon atoms, medium chain fatty acids (MCFA) have between 6-12 carbons, and long chain fatty acids (LCFA) have 14 or more carbon atoms. The reason fats are classified based on their length is because the size of the carbon chain influences the chemical and physical properties of the fatty acid.

Most of the fats and oils that you eat come from either plant or animal sources, all of which are composed of long chain fatty acids (LCFA). In fact, probably more than 98% of the dietary fat that humans consume is composed of LCFA. Coconut oil is really unique because it is primarily composed of medium chain fatty acids (MCFA), with lauric acid constituting approximately 47% of coconut oil. Here is where it gets important: medium chain fatty acids (MCFA) are metabolized very differently from long chain fatty acids (LCFA). First, I'll explain how most dietary fats consisting of long chain fatty acids are digested and metabolized. Then I'll inform you how medium chain fatty acids found in coconut oil are digested and metabolized, pointing out the significance in the major differences.

The Health Benefits of MCTs

Long chain fatty acids (LCFA) found in plant and animal fat are not easily absorbed by the GI tract and require pancreatic enzymes and bile salts to break them down so that they can be absorbed by the intestine. Next, the long chain fatty acids are packaged into chylomicrons, which are lipoproteins that transport lipids throughout the body. The lipoproteins are transported through the lymphatic system then circulate through the bloodstream, where they deliver fat components to a variety of tissues, including adipose, cardiac and skeletal tissue. After the lipoproteins have uploaded their triglyceride components to these tissues, the left over lipoproteins are transported to the liver, where they are imported into the mitochondria of liver cells, using the carnitine palmitoyl transferase (CPT) machinery, and are finally oxidized for energy use.¹ This is how all saturated fat, unsaturated fat, and cholesterol that consists of long chain fatty acids (all of your dietary fat) is transported throughout the body.

In contrast, medium chain fatty acids found in coconut oil are absorbed by the gastrointestinal tract (GI tract) with ease, they do not require any pancreatic enzymes to break them down, which means less work for your pancreas. Next, medium chain fatty acids are transported to the portal blood stream, directly to the liver, where they go directly into mitochondria independent of the carnitine palmitoyl transferase, and are immediately oxidized for energy. Medium chain fatty acids from coconut oil do not get packaged into lipoproteins, and do not get transported to a variety of tissues and are not stored as body fat, they go directly to the liver and are metabolized for energy.¹ The bottom line is that medium chain fatty acids from coconut oil produces almost exclusively energy, whereas, long chain fatty acids found in all other dietary fats, are stored as body fat (and some energy).

Coconut Oil Increases Energy and Metabolism

Because the medium chain fatty acids found in coconut oil are easily and rapidly transported into the mitochondria, unlike long chain fatty acids, they are immediately used for energy, resulting in a burst of energy and thermogenesis, which, subsequently, increases metabolism. Several animal studies and clinical studies have proven that ingestion of coconut oil increases metabolism and decreases body fat both in animal studies performed on mice, and humans. Rats that were fed a diet consisting of medium chain fatty acids had less subcutaneous fat, a visibly evident decrease in body fat, increased metabolism and increased thermogenesis.² The energy burst that is produced by medium chain fatty acids is also important for athletic endurance. In one study, researchers tested the physical endurance of mice that were fed medium chain fatty acids (coconut oil) compared those fed a diet high in long chain fatty acids (98% of all dietary fat) for six weeks. The mice were subjected to a swimming endurance test, where they had to swim against a current, every other day. The mice that were fed medium chain fatty acids continually performed better than the others and displayed a much higher physical endurance.³ These studies provide us with evidence that medium chain fatty acids increase metabolism and promote the loss of fat while providing a burst of energy that increases physical endurance. Yes, this boost in energy means you feel less lethargic, and can help you feel less tired as you perform daily activities.

Coconut Oil Decreases Body Fat

Numerous studies have shown that coconut oil clearly has an effect in men and women very analogous to what has been demonstrated in other mammalian animal models: it increases metabolism and decreases overall body fat. For example, healthy men and women were administered either medium chain fatty acids or long chain fatty acids in addition to a diet similar in fat, protein, and carbohydrates for 12 weeks. Throughout the 12 weeks, individuals that took medium chain fatty acids had significantly less body weight and, specifically, body fat.⁴ Studies have also shown that medium chain fatty acids also increase the oxidation of long chain fatty acids that are already in your body, tucked away in your lovehandles.⁵ Similar to the animal studies, medium chain fatty acids also boost energy production by increasing thermogenesis, which speeds up metabolism in humans as well.⁶ In another study, people with high

triglyceride levels were given medium chain fatty acids for eight weeks. In addition to decreasing body fat, their triglyceride levels were lowered by 14.5%.⁷

So just a quick refresher for those of you that lost focus:

- Coconut oil is metabolized by a different process than long chain fatty acids altogether, this process expedites use as energy instead of storage.
- Because the body has to preferentially burn the fat off, it ramps up the metabolism by increasing thermogenesis.
- This ramping up of the metabolism then proceeds to not only burn off coconut oil, but long chain fatty acids pre-existing the consumption of coconut oil.
- These effects have been demonstrated both in animal studies, and more importantly, human studies as well.

To reap the medium chain triglyceride benefits you simply need to change the type of oil you use to cook with to coconut oil. If you're worried about the coconut taste, you can buy expeller pressed coconut oil, which has no coconut smell or flavor and is great for cooking. Also, because coconut oil is made up of medium chain fatty acids, it is a solid at temperatures below 76°F.

Appetite Suppressing Effects of Coconut Oil

One aspect of coconut oil that is very interesting is that in addition to the ability to boost metabolism as mentioned earlier, it also has a secondary effect of suppressing appetite to some degree. In some people, initial ingestion of coconut oil can cause some mild nausea. If you're going to give coconut oil a try it might be ill-advised to consume a large quantity of it for the first round. However, after becoming acclimated to it the effect it has on appetite can easily be observed with larger doses. I bring up the nausea simply because I want to emphasize that the initial nausea is largely separate and apart from its appetite suppressing effects. In my experience, it is quite possible to become largely used to the oil such that you feel no nausea but still experience appetite suppression many hours after consumption.

The mechanism by which coconut oil suppresses appetite is apparently through two separate pathways. Both of these pathways are actually triggered very specifically by the lauric acid component of coconut oil. Note: this component, lauric acid, is NOT present in all Medium Chain Triglyceride (MCT) oils which are often used for things like "bulletproof coffee". The lauric acid in coconut oil increases blood levels of both cholecystikinin (CCK) and Glucagon-like peptide-1 (GLP-1). CCK mediates satiety by inhibiting gastric emptying and the secretion of gastric acids.⁸ Similar to CCK, GLP-1 inhibits gastric secretion and motility as well.⁸ Consequently, this effect slows the absorption of carbohydrates and contributes to the effect of satiety. GLP-1 is also known to increase insulin-sensitivity in some cell types and has been suggested as a treatment for diabetes.

Coconut Oil and Bulletproof Coffee: The Secret to Easy Consumption

One surprisingly easy and effective way to consume even large quantities of coconut oil is to make something similar to bulletproof coffee. Bulletproof coffee is a hip way of making a ketosis-fueling caffeinated beverage popularized by the "bulletproof executive" blog. Whereas the original recipe for Bulletproof Coffee suggests the use of MCT oil, in my personal experiments I substituted in the coconut oil in its place and left out the unsalted butter. What I found as a consequence of my personal experimentation was somewhat surprising -- because coffee has such a strong natural flavor, so long as you stir vigorously in between sips, it almost perfectly masks the oil. In fact, you can put a truly staggering amount of oil in each cup of coffee. I should mention at this point, however, that the oil I used was the flavorless "expeller pressed" variety which eliminates the coconut odor. Using this method I was able to boost my own coconut oil consumption to the point that the appetite suppressing effects became extraordinarily obvious.

Effects of Coconut Oil on Cholesterol

Since I have revealed the "ultimate" method to consuming coconut oil en masse -- by putting it in your coffee -- I should also mention one reason why you should tread carefully here. There is mixed evidence on the effects of coconut oil on lipid profiles. Early studies showed that coconut oil supplementation had adverse effects on lipid profiles.⁹ However, these studies used hydrogenated coconut oil.¹⁰ The process of hydrogenation of fats, makes them more stable at elevated temperatures but it dramatically increases the levels of trans-fatty acids (trans fats) which are known to have an adverse effect on lipid profiles.¹¹ Clinical studies using non-hydrogenated coconut oil supplements provide evidence for modest benefits of coconut oil consumption on lipid profiles.^{12,13} Animal studies have shown that coconut oil supplementation lowered total cholesterol, lipoproteins and phospholipids.¹⁴ It is possible these benefits are a consequence of the biochemical properties of MCTs. As I previously mentioned, MCTs are rapidly metabolized in the liver into energy and does not participate in the biosynthesis and/or transport of cholesterol.¹⁵

In addition, another study showed that coconut based diets lowered the postprandial tissue plasminogen and lipoprotein (a), a blood marker associated with the risk of heart attack. Lipoprotein (a) was lower in women that consumed the diet high in coconut oil.¹³ Similarly, another study investigated the effects of coconut oil individuals with moderately elevated levels of cholesterol. The study demonstrated that coconut oil consumption lowered the amount of total and LDL-c.¹² The effects of coconut oil on cholesterol are not straightforward, if cholesterol is a cause for concern, you should be aware! In fact, if anyone were to engage in this experiment over the long-term, I'd suggest getting regular checkups and having your cholesterol checked to monitor any changes.

There are many other advantages of high HDL cholesterol levels, besides the cardio-protective effects. One study in men found that higher HDL cholesterol levels were

associated with a longer lifespan, in fact, the more HDL the more likely it was that they would reach the age of 85.4.¹⁶ It is important to note that a diet with adequate amounts of saturated fat is important in maintaining HDL high cholesterol levels.

CHAPTER 2. COCONUT OIL AND THE BRAIN

Ketone bodies are an alternative fuel for brain cells when glucose availability is insufficient. For example, the neuro-protective potential of ketone bodies has been demonstrated by the practice of ketogenic diets in the treatment of epilepsy. Our body can produce ketones from stored fat during fasting or in starvation, but they can also be produced from medium chain fatty acids. As previously mentioned, coconut oil is rich in medium chain fatty acid and is converted into the ketone body called beta-hydroxybutyrate (beta-OHB) by the liver. This means that coconut oil is able to provide the brain with an alternate energy source in the form of ketones. As the brain ages, it becomes less efficient at utilizing glucose and requires alternative energy sources such as ketones, this is particularly the case in Alzheimer's disease. A study found that administering coconut oil to Alzheimer's patients resulted in an increase in beta-OHB and improvement on memory recall tests.¹⁷ In a mouse model for Alzheimer's disease, feeding beta-OHB improved anxiety, learning and memory. In addition, the beta-OHB fed mice had significantly less amyloid beta (the toxic plaques found in the brains of Alzheimer's patients) deposition in various regions of the brain.¹⁸

CHAPTER 3. BENEFITS OF COCONUT OIL ON SKIN AND HAIR

Coconut Oil Kills Acne Bacteria

Approximately 50% of coconut oil consists of lauric acid, a medium chain fatty acid. Lauric acid has very potent anti-bacterial activity against the acne-causing bacteria propionbacterium acnes (*P. acnes*). Propionbacterium acnes plays a substantial role in the pathogenesis of acne. The bacteria *P. acnes*, resides in the sebaceous glands of the facial skin and feeds on sebum that is secreted by the sebaceous glands. An overgrowth of bacteria causes an inflammatory response, resulting in the production of many pro-inflammatory cytokines, such as IL1-alpha, and lead to chronic, inflammatory acne. Lauric acid has exhibited very strong anti-microbial activity against propionbacterium acnes. Lauric acid inhibits *P. acnes* bacterial growth and is 15 times more potent at killing propionbacterium acnes than benzoyl peroxide.¹⁹ Many acne sufferers use benzoyl peroxide to treat acne but experience substantial negative side effects such as redness and dry skin due to the toxicity of benzoyl peroxide. Lauric acid does not have any toxic side effects and will not cause redness or dry skin. In addition, topical application of lauric acid, has been shown to decrease *P. acnes* bacterial growth and reduce swelling and inflammation.¹⁹ Since coconut oil is 50% lauric acid, topical application of coconut oil has enormous therapeutic potential for the treatment of acne by killing the acne-promoting bacteria, therefore, terminating the inflammatory response that propagates chronic inflammatory acne.

Coconut Oil: Hormonal Acne Treatment

Coconut oil inhibits the production of androgens, which are a major cause of hormonal acne. 5-alpha-dihydrotestosterone (5-alpha-DHT) is a potent androgen that regulates the production of sebum, a mixture of lipids in the sebaceous glands of the facial skin. Testosterone is converted into 5-alpha-dihydrotestosterone (5-alpha-DHT) by the enzyme 5-alpha reductase. 5-alpha-dihydrotestosterone stimulates sebum production, providing an ideal environment for propionbacterium acnes to grow and proliferate. Androgens, specifically, 5-alpha-DHT, also regulate follicular hyperkeratinization seen in acne. Hyperkeratinization means there is an overabundance of keratin being produced in the skin. This results in adherence of dead skin cells together, which, consequently, do not detach from the skin's surface normally. This leads to clogging of the skin's pores and instigates the formation of a comedone (acne lesion). There is substantial evidence that the activity of the 5-alpha reductase enzyme is considerably higher in acne-prone areas compared to non-acne-prone areas.²⁰

Several studies provide evidence that lauric acid inhibits 5-alpha reductase activity, and blocks the conversion of testosterone into 5-alpha-dihydrotestosterone.^{21,22} Another study found that lauric acid inhibited the activity of 5-alpha reductase by 50%.²³ Since lauric acid is an effective inhibitor of 5-alpha reductase, it has natural anti-androgenic activity and can be used therapeutically to treat hormonal acne. Inhibition of 5-alpha reductase with coconut oil would result in less androgen production, dramatically reduced

sebum production, decreased propionibacterium acnes proliferation, decreased inflammation, and a reduction in keratinocyte proliferation, all of which are implicated as major causes of acne.

Coconut Oil: A Possible Treatment for Alopecia?

The conversion of testosterone into 5-alpha-DHT is thought to play a role in the pathogenesis of alopecia. In fact, inhibitors of 5-alpha reductase are routinely used to clinically treat alopecia.²⁴ The question is: can coconut help treat alopecia? Given the role that lauric acid (~50% of coconut oil) plays in inhibiting the 5-alpha reductase enzyme, one might extrapolate that topical application to the scalp may inhibit the activity in hair follicles. After all, studies have shown that topical application of lauric acid does indeed blunt the activity of this enzyme so it only seems logical that it would have the same effect on the scalp.²² Coconut oil has been shown to have a protective effect on the hair shaft. One study found that coconut oil, when applied topically, was very effective at penetrating the hair shaft and preventing the proteins from being damaged and degraded.²⁵ While studies on the direct effects of coconut oil on alopecia are still lacking, it is clear that coconut oil can inhibit 5-alpha reductase, and inhibitors of this enzyme are clinically used to treat alopecia.

CHAPTER 4. SUMMARY

In summary, there are many health benefits of coconut oil, ranging from boosting metabolism to providing an alternative energy source for your brain. Another important factor about coconut oil is that it is not prone to oxidation because it is a saturated fat so it has an extremely long shelf life (over 2 years). Many cooking oils are high in polyunsaturated fats which are very prone to oxidation, rapidly making them rancid. Consumption of rancid fats (oxidized fats) can have severe health consequences such as promoting atherosclerosis and damaging your mitochondria. Mitochondrial health is very important for the survival of nearly all cell types in your body, particularly neurons. Mitochondrial damage in neurons is a major cause of many different neurodegenerative diseases such as Parkinson's, Alzheimer's, and ALS. Therefore, protecting your mitochondria from oxidative damage will increase the lifespan of every cell in your body, therefore, extending your overall lifespan.

REFERENCES

1. Papamandjaris, A A; D E MacDougall, P J Jones (1998). "Medium chain fatty acid metabolism and energy expenditure: obesity treatment implications". *Life Sciences* 62 (14): 1203-1215.
2. Baba, N; E F Bracco, S A Hashim (1987-06). "Role of brown adipose tissue in thermogenesis induced by overfeeding a diet containing medium chain triglyceride". *Lipids* 22 (6): 442-444.
3. Hashim, S A; P Tantibhedyangkul (1987-06). "Medium chain triglyceride in early life: effects on growth of adipose tissue". *Lipids* 22 (6): 429-434.
4. Tsuji, H; M Kasai, H Takeuchi, M Nakamura, M Okazaki, K Kondo (2001-11). "Dietary medium-chain triacylglycerols suppress accumulation of body fat in a double-blind, controlled trial in healthy men and women". *The Journal of Nutrition* 131 (11): 2853-2859.
5. Papamandjaris, A A; M D White, M Raeini-Sarjaz, P J Jones (2000-09). "Endogenous fat oxidation during medium chain versus long chain triglyceride feeding in healthy women". *International Journal of Obesity and Related Metabolic Disorders: Journal of the International Association for the Study of Obesity* 24 (9): 1158-1166.
6. Hill, J O; J C Peters, D Yang, T Sharp, M Kaler, N N Abumrad, H L Greene (1989-07). "Thermogenesis in humans during overfeeding with medium-chain triglycerides". *Metabolism: Clinical and Experimental* 38 (7): 641-648. ISSN 0026-0495.
7. Xue, C; Y Liu, J Wang, R Zhang, Y Zhang, J Zhang, Y Zhang, Z Zheng, X Yu, H Jing, N Nosaka, C Arai, M Kasai, T Aoyama, J Wu (2009-07). "Consumption of medium- and long-chain triacylglycerols decreases body fat and blood triglyceride in Chinese hypertriglyceridemic subjects". *European Journal of Clinical Nutrition* 63 (7): 879-886.
8. Feltrin, K. "Effects of intraduodenal fatty acids on appetite, antropyloroduodenal motility, and plasma CCK and GLP-1 in humans vary with their chain length". *Am. J. Physiol. Regul. Integr. Comp. Physiol.* 287:R524-R533, 2004.
9. Hegsted DM, McGandy RB, Myers ML, Stare FJ. Quantitative effects of dietary fat on serum cholesterol in man. *American Journal of Clinical Nutrition.* 1965;17:281-295.

10. Anderson JR, Grande F, Keys A. Independence of effects of cholesterol and degree of saturation of the fat in the diet on serum cholesterol in man. *American Journal of Clinical Nutrition*. 1976;29:1184–1189.
11. Kintanar Q. Is coconut oil hypercholesterolemic and atherogenic? A focused review of the literature. Vol. 10. *Transactions of the Academy of Science and Technology*; Philippines: 1988. pp. 371–414.
12. Cox C, Mann J, Sutherland W, Chisholm A, Skeaff M. Effects of coconut oil butter and safflower oil in lipids and lipoproteins in persons with moderately elevated cholesterol levels. *Journal of Lipid Research*. 1955;36:1787–95.
13. Sundram K, Hayes KC, Siru OJ. Dietary palmitic acid results in lower serum cholesterol than does a lauric-myristic acid combination in normolipemic humans. *American Society for Clinical Nutrition*. 1994;59:841–846.
14. Nevin KG, Rajamohan T. Beneficial effects of virgin coconut oil on lipid parameters and in vitro LDL oxidation. *Clinical Biochemistry*. 2004;37:830–835.
15. Dayrit C. Coconut Oil: Atherogenic or Not? (What therefore causes atherosclerosis?) *Philippine Journal of Cardiology*. 2003;31(3):97–104.
16. *Am J Cardiol*. 2011 Feb 4. Relation Between High-Density Lipoprotein Cholesterol and Survival to Age 85 Years in Men (from the VA Normative Aging Study). Rahilly-Tierney CR, Spiro A 3rd, Vokonas P, Gaziano JM.
17. Reger MA, Henderson ST, Hale C, Cholerton B, Baker LD, Watson GS, Hyde K, Chapman D, Craft S. “Effects of beta-hydroxybutyrate on cognition in memory-impaired adults”. *Neurobiol Aging*. 2004 Mar;25(3):311-4.
18. Richard L. Veech, Y Kashiwaya. A ketone ester diet exhibits anxiolytic and cognition-sparing properties, and lessens amyloid and tau pathologies in a mouse model of Alzheimer's disease”. *Neurobiology of Aging*, 2012, 1-10.
19. Nakatsuji, Teruaki; Mandy C Kao, Jia-You Fang, Christos C Zouboulis, Liangfang Zhang, Richard L Gallo, Chun-Ming Huang (2009-10). "Antimicrobial property of lauric acid against *Propionibacterium acnes*: its therapeutic potential for inflammatory acne vulgaris". *The Journal of Investigative Dermatology* 129 (10): 2480-2488.
20. Thiboutot, D M; H Knaggs, K Gilliland, S Hagari (1997-02). "Activity of type 1 5 alpha-reductase is greater in the follicular infundibulum compared with the epidermis". *The British Journal of Dermatology* 136 (2): 166-171. ISSN 0007-0963.

21. Liu, Jie; Kuniyoshi Shimizu, Ryuichiro Kondo (2009-04). "Anti-androgenic activity of fatty acids". *Chemistry & Biodiversity* 6 (4): 503-512.
22. Raynaud, Jean Pierre; Henri Cousse, Pierre Marie Martin (2002-10). "Inhibition of type 1 and type 2 5alpha-reductase activity by free fatty acids, active ingredients of Permixon". *The Journal of Steroid Biochemistry and Molecular Biology* 82 (2-3): 233-239.
23. Weisser, H; S Tunn, B Behnke, M Krieg (1996-05). "Effects of the sabal serrulata extract IDS 89 and its subfractions on 5 alpha-reductase activity in human benign prostatic hyperplasia". *The Prostate* 28 (5): 300-306.
24. Reboral, A (2004-05). "Pathogenesis of androgenic alopecia". *Journal of American Academy of Dermatology* 50 (5): 777-779.
25. Rele, A, Mohile, R (2003-02). "Effect of mineral oil, sunflower oil, and coconut oil on prevention of hair damage". *Journal of Cosmetic Science* 54 (2): 175-192.

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Rhonda Perciavalle Patrick, Ph.D. is passionate about disseminating health-related information in a way that the general public can easily understand. She is a frequent speaker and writer on topics ranging from general health and wellness, to diet and aging, to vitamins and their effects. It is Dr. Patrick's goal to shift healthcare away from palliative treatment and focus on prevention in order to increase your youthful years and prolong longevity.

Dr. Patrick has a Ph.D. in Biomedical Science and has done extensive research on aging, cancer, and nutrition. She is an expert on nutrition and metabolism and currently conducts clinical trials examining the positive effects of vitamin and mineral supplementation on metabolism, inflammation, and aging.

