Extraction of Lauric Acid from Coconut Oil, Its Applications and Health Implications On Some Microorganisms

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Abstract

Lauric acid obtained from coconut oil was studied for its applications and health implications on some microorganisms. Coconut samples obtained from a local market in Ihiala Local Government Area, Anambra State, were prepared and oil was extracted using the soxhlet extraction procedure. Excess solvent (n-Hexane) was removed from the oil and by calculation 92% of oil from five medium sized coconuts was obtained. Lauric acid was extracted from the oil and its health implications on these microorganisms were analyzed; Aspergillus flavus, staphylococcus aureus, Candida albicans and Escherichia coli. 1.2g, 1.3g, 2g and 3g of lauric acid (crushed to powder form) were introduced into isolates of candida albicans, staphylococcus aureus, aspergillusflavus and Escherichia coli respectively. The results obtained showed that lauric acid is highly effective against candida albicans, staphylococcus aureus and aspergillus flavus in that order but had no effect on Escherichia coli. This showed that lauric acid (or monolaurin which is lauric acid but in a different form safe for human consumption) has antimicrobial properties. It is antiviral, antifungal and antibacterial but will only kill or destroy gram-positive bacteria thus it had no effect on Escherichia coli, gram-negative bacteria.

Key words: Antimicrobial, Aspergillus flavus, Coconut, Lauric acid, and Soxhlet extraction

INTRODUCTION

Coconut oil is edible oil that has been used or consumed for thousands of years in tropical countries. It is used in baking industries as it has a long shelf life and a melting point of 76F. It is also used in cosmetics industries, pharmaceuticals, plastics, rubber substitutes, synthetic resins etc. it has also been found useful for mixing with diesel in the ratio 60:70. It gives excellent road performance of diesel vehicles. A negative campaign against saturated fats in general led to most food manufacturers abandoning coconut oil in recent years in favor of hydrogenated oils, particularly trans fatty acids. Studies on populations consuming diets high in coconut oil show no adverse effect on the health of the population (Thampan, 1998). Coconut has exactly 92% saturated fatty acids hence it is less attractive to consumers, although studies show that most of the saturated fats are of the medium chain variety which tend to be used by the body to produce energy rather accumulating in fat tissues. Some researchers feel that because of its structure, the saturated fats found in coconut oil is not as damaging as other saturated fats, like those found in animal products, (NYU Langon, 2014). The fact is all saturated fats are not created equally, because some saturated fats occur naturally while some other fats are manipulated into the saturated state through the man-made process called hydrogenation. Hydrogenation manipulates vegetable and seed oils by adding hydrogen atoms while heating the oil producing rancid thickened oil that really only benefits processed foods shelf life. These unsaturated fats artificially manipulated are what is called trans-fat, (Marcolar, 2000). Saturated fats are those that have no unsaturation or double bonds and tend to be solid at room temperature. Coconut oil is rich in medium chain fatty acids (Bruce 2000). This study is aimed at achieving the following objectives;

1. Extraction of coconut oil
2. Extraction of lauric acid from coconut oil.
3. Determination of the health implications of lauric acid on *Aspergillus flavus*, *candida albicans*, *Escherichia coli* and *Staphylococcus aureus*.

Coconut oil has a secret ingredient not found in other saturated fats. 50% of all the fats content in coconut oil, comprises of an acid rarely found in nature called lauric acid. The body converts lauric acid into monolaurin (a Fat otherwise found in breast milk) which has anti-viral, anti-bacterial and anti-protozoa properties. Monolaurin is a monoglyceride that can actually destroy lipid coated viruses such as HIV, herpes,

measles, influenza virus, various pathogenic bacteria, protozoa such as giardalamblia. Lauric acid is a white solid at room temperature, has a melting point of 40-44C. It is a reducing agent and an oxidizing agent. Lauric acid is a powerful gram-positive bacteria destroyer and coconut oil contains most lauric acid than any substance on earth. The human body converts lauric acid into monolaurin which deals with viruses and bacteria that causes diseases such as herpes, influenza, cytomegalovirus and even HIV. Lauric acid cannot be ingested into the human body because it is highly irritating but when chemically bonded to glycerin it forms monolaurin which is exactly lauric acid but in a different form and does the exact same thing as lauric acid. It is also helpful in fighting harmful bacteria such as listeria monocytogenes and helicobacter pylori and harmful protozoa such as giardia lamblia. Coconut oil is about 2/3 medium chain fatty acids called medium chain triglycerides MCTs. These fatty acids have a whole lot of health benefits. Coconut oil and palm kernel oil are nature's richest source of these healthy MCTs. By contrast, most common vegetable or seed oils comprise of long chain fatty acids LCFAs also known as long chain triglycerides LCTs, these are not healthy for us as the MCTs found in coconut oil because.

- LCFAs are difficult for the body to break down; they require special enzymes for digestion.
- LCFAs put more strain on pancrease, liver and the entire digestive system.
- LCFAs are predominantly stored in the body as fat.
- LCFAs are deposited within your arteries in lipids form such as cholesterol. (Babayan 1998).

In contrast, MCFAs found in coconut oil have many health benefits such as;

- MCFAs are smaller. They permeate cell membranes easily and do not require special enzymes to be utilized effectively by your body.
- MCFAs are sent directly to your liver, where they are immediately converted into energy rather being stored as fat.
- MCFAs actually stimulate your body metabolism leading to weight loss. (Heydnger et al ,1996).

Healing properties of coconut oil

Coconut oil is antiviral, antifungal (kills yeast too) and antibacterial. It attacks and kills bacteria that have a lipid (fatty) coating such as herpes, hepatic C, the flu and mononucleosis. It also kills the bacteria that cause pneumonia, sore throats, dental cavities, urinary tract infections, meningitis, gonorrhea, food poisoning and manmade bacterial infections (Kabara, 2001). It kills the fungus/yeast infection that cause candida, ringworm, athlete's foot, thrush, jock itch and diaper rash.

Anticancer effects of coconut oil

In 1987, Lim Sylianco published a 50-year literature review showing the anti-cancer effects of coconut oil (Lim, 1987). In chemically induced cancers of the colon and breast, Cohen et al showed that coconut oil was far more protective than unsaturated oils. For example, 32% of corn oil eaters got colon cancer but only 3% of coconut oil eaters got the cancers. Animals fed unsaturated oils had more tumors. This shows the thyroid-suppressive and hence the immune-suppressive effects of unsaturated oils.

MATERIALS AND METHOD

Sample Collection and Preparation

Coconut samples were obtained from a local market in Ihiala Local Government Area of Anambra State. The white coconut meat was separated from the hard back, washed properly and dried in the sun for seven days. After drying, they were ground into fine particles using an electric blender. After grinding, they were totally dried in an oven at 50°C. They were stored in a clean polyethene bags ready for extraction.

METHODOLOGY

The extraction was carried out by using soxhlet extraction method at 40°C with n-hexane.

Percentage of Oil Extracted

After extraction, excess n-Hexane was removed from the oil by heating to at 40°C.

Total percentage of oil extracted was calculated; Total mass of the oil obtained / total mass of sample x 100/1

112g/103.1g x 100/1 = 92%

Total percentage of oil obtained is 92%. The oil has a faint coconut smell.

Test for Oil

5ml of coconut oil was shaken in a test tube with water, 4 drops of Sudan III stain were added to the solution. The oil stained red, this proves that it is oil.

Extraction of Lauric Acid

The coconut oil extracted was heated in a water bath in the presence of sodium hydroxide (10M solution of NaOH). This converted the coconut oil into lauric acid and glycerin as two distinct layers and then lauric acid was separated. Lauric acid is white solid at room temperature, it reacts rapidly with oxygen. It has a melting point of 40-44°C. It is a reducing agent and an oxidizing agent.

Test for Lauric Acid

2gram of lauric acid obtained was put into a clean beaker. Acidified $KMnO_4$ was introduced. It decolorized acidified $KMnO_4$ completely.

Effect of Lauric Acid On Microorganisms

An isolate of staphylococcus, *Aspergillus flavus*, Candida albican and *Escherichia coli* obtained from the microbiology laboratory in Anambra State Univerity, was placed on four different petri dishes. Two strains of *staphylococcus* were tested against 1.3gram of lauric acid, this produced a bactericidal effect which was seen after 17minutes. The color of the staph was purple but on addition of lauric acid, it was observed that the color changed to brown. This was interpreted as stress being caused to a non-stressed cell resulting in a loss and change of the cytoplasm and membrane in cells of the bacteria. No further growth of staph was observed after 24hours. An isolate of Escherichia coil (according to the microbiologist) obtained from a stream water, about 0.1ml of water was introduced into an EMB agar (Eosin Methylene blue agar) was mixed with 3grams of lauric acid (crushed to powder form to increase surface area). After observation for 5hours, no visible changes had occurred. After 48hours, it was observed that there were additional growths of E. coli. it still retained its green metallic sheen.

An isolate of Aspergillus Flavus was obtained from corn (maize) infected with afflatoxin. It is greenish in color. 2gram of lauric acid was introduced into an isolate of Aspergillus favus (A. flavus) on a petri dish. The petri dish was covered with cotton wool. After 24hours, it was observed that A. flavus had reduced considerably but not completely dead as a few growth signs were still seen. 2gram of lauric acid was added yet again and it was observed after 2hours that the fungus had died. Its greenish color had turned to black, it had a bad odor. Isolates of Candida albicans dwere tested with 1.2grams of lauric acid and it was observed that the growth of C. albicans deteriorated rapidly, interpreted as rapid death in less than 10minutes.

RESULTS

Table 1: Result of the Effect Of Lauric Acid On Some Micro-Organisms (n = 3)

Microorganism	Amount of lauric acid	Begging of incubation	Incubation period (completely wiped out	Result
Escherichia coli	3 grams	No effect	48 hours	No effect
Candida albicans	1.2 grams	2 ± 0.1 minutes	10 minutes	Rapid effect
Aspergillu flavus	4 grams	10 ± 0.1 minutes	26 hours	Effective after additional 2gran
Staphylococcus aureus	1.3 gram	3 ± 0.1 minutes	24 hours	Effective

DISCUSSION

The results from this study showed that lauric acid has an anti-microbial effect. It is most effective against *Candida albicans* and then *staphylococcus* followed by Aspergillus flavus but does not affect *Escherichia coli.* This goes to say that it is effective against fungus, several viruses and only gram positive bacteria. The observations from the incubation of these microorganisms with lauric acid show that it is not effective against gram-negative bacteria (*Escherichia coli)* as it is (from literature review) a gram- bacteria destroyer. The study proves that lauric acid is effective against viral, bacterial (gram positive) and fungal infections such as common cold, swine flu, genital herpes, blister etc. Lauric acid occurs naturally in breast milk and occurs in abundance in coconut oil (50%) and palm kernel oil (40%). In humans, lauric acid cannot be ingested in order to cure these infections as it is highly irritating but monolaurin which is lauric acid chemically bonded to

glycerin can be ingested to perform these activities. Monolaurin is lauric acid but in a safe form for human ingestion and performs the exact same anti-microbial function. From the study, it is seen that lauric acid destroys lipid coated viruses by binding to the lipid protein envelope of virus thereby preventing it from attaching and entering host cells, this kills the viral envelope seen as no growth sign in our observations, thereby killing the virus. Lauric acid is not an antibiotic, it has no effect on desirable digestive bacteria only on unwanted microorganisms.

CONCLUSION

The use of coconut oil as an alternative to many chemical supplements for cure of fungal, viral and bacterial infections is evident from the study. Coconut oil contains 50% lauric acid which is effective against microorganisms as seen in the study. Lauric acid is converted to monolaurin in our body which is exactly lauric acid but in a different form. Coconut oil can be used for more than a hundred purposes including weight loss as it is stored as fat in our body but converted at all times to energy. It increases HDL and lowers LDL cholesterol, it can be used as a blood sugar stabilizer, healing ointment, Alzheimer's treatment, anti-aging skincare, etc. just to mention a few. Coconut oil is the most versatile health food on the planet.

RECOMMENDATIONS

It is my opinion that coconut oil be used to replace the chemically driven supplements used for diverse purposes, as this will give adequate awareness to the uniqueness of coconut as a miracle fruit and reduce completely the side effects that come with OTC drugs (over the counter drugs), supplements and cosmetics. Lauric acid should be taken as a supplement as it has microbial properties for protection against bacterial, fungal and viral infections.

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