Original Research Article

Effect of coconut oil and palm oil on blood plasma cholesterol in rats

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Abstract

This study was carried out to evaluate the effect of coconut oil (Cocosnucifera) and palm oil (Elaeisguineensis) on blood plasma cholesterol levels in white rats (Ratusratus). The results showed that coconut oil has better LDL lowering properties than palm oil, but both have similar HDL raising properties. However when subjected to statistical analysis (t-test and ANOVA test) the results for all parameters tested was not significant. Although coconut oil lowered LDL cholesterol by a greater percentage, the t-test and ANOVA test showed that these results were not significant. There fore to conclude, the experiments need further investigation and verification which would bring out further conclusive evidences towards the effective property of lowering the blood cholesterol level.

Key Word: Coconut oil; Palm oil; Cholesterol; LDL; HDL

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INTRODUCTION

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. Coconut oil is used as a major source of cooking oil in India as well as other countries of the Asian sub-continent and tropical islands. In Guyana until the early 90's it is widely used by the Guyanese population especially those in the country sides for cooking up. Now it is mainly used by the poor communities [1]. Coconut oil is a fat consisting of about 90% saturated fat and medium chain fatty acids, or medium chain triglycerides (MCTs). Most vegetable oils have longer chain triglycerides (LCTs). LCTs are typically stored in the body as fat, while MCTs are burned for energy. MCTs burn up quickly in the body[2]. Coconut oil is nature's richest source of 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 was found to be anti-microbial and anti-viral properties of this unique fatty acid [3]. Palm oil (*Elaeisguineensis*) is also known to lower cholesterol and it is widely used in many countries worldwide. Palm oil is a form of edible vegetable oil obtained from the fruit of the Oil palm tree[4]. Palm oil is 50% saturated fat and 50% unsaturated fat. More specifically palm oil contains approximately 44% palmitic acid, 5% stearic acid, 39% oleic acid (monounsaturates), and 10% linoleic acid (polyunsaturates). Myristic acid and lauric acid are negligible[5]. Conversely, the fatty acid composition of palm kernel oil resembles coconut oil, or what one generally thinks of when the term 'saturated fat' is used. Approximately 82% of palm kernel oil is saturated fat with the main contributors being 48% lauric acid, 16% myristic acid, and 8% palmitic acid. Approximately 18% of palm kernel oil is unsaturated fat with 15% oleic acid (monounsaturates) and 3% linoleic acid (polyunsaturates). Thus one has to be careful when considering the chemical properties of the two[6]. For decades it was thought that coconut oil and palm oil have bad effects on cholesterol, until recently Mary Enig and co-workers found them to

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have good cholesterol properties, especially coconut oil. 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. 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[7]. The recent studies of coconut oil and palm oil suggest that there are great health benefits. However, there are various side effects associated with using them[8]. Because of the growing interest in the commercial production of both, it is necessary to know which one is healthier for cooking purposes. So the present study was aimed to investigate the effects of natural coconut oil and palm oil on HDL-c, LDL-c, VLDL-c, and total cholesterol levels in the blood plasma of rats.

MATERIAL AND METHODS

Site of work: The rats were maintained at the University of Guyana Animal house. The analyses of blood samples were done at Ogle Diagnostic centre (ODC) and the feed samples at Central analytical environmental monitoring services (CAEMS).

Selection of animals: The animal care and handling were done according to the guidelines issued by the World Health Organization, Geneva, Switzerland. Either sex were selected from an inbred colony maintained under the controlled conditions of temperature (23 ± 2°C), humidity (50 ± 5%) and 12 h of light and dark cycle, respectively. The animals had free access to the sterile food and water, five animals were housed in a polypropylene cage containing sterile paddy husk (procured locally) as bedding throughout the experiment.

The rats were divided into three groups.

Group I (control group): This group of rats were fed strictly broiler ration mixed with water.

Group II: This group of rats had coconut oil supplemented into their diet. The coconut oil was mixed into the feed (broiler ratio).

Group III: This group of rats had palm oil supplemented into their diet and was given in the same manner as coconut oil.

The rats were fed on a daily basis for five weeks and their water supplies were renewed each day. The temperatures were recorded in the room.

Grouping of rats: There were 2 cages (0.75m x 0.75m) for the control specimen; cage 1 had 3 males and cage 2 had one female. There were 2 cages for the group fed coconut oil; cage 1 had 4 males and cage 2 had I female. There were also 2 cages for the group fed palm oil; cage 1 had 4 males and cage 2 had 1 female.

Mixing and distribution of feed: The cages with one rat were given 20g of feed per day. The feed was mixed with 7 ml of oil. The cages with four rats were given 80g of feed per day. The feed was mixed with 28 ml of oil. The control group was given 60g of feed for the group with three and 20g for the group with one. The feed was weighed and placed in a mortar. With the use of a measuring cylinder the oil was measured and poured into the mortar containing the feed. The mixture was then stirred with a spatula. Each type of oil was mixed in separate mortars to avoid contamination. After various treatments as mentioned above, further rats were dissected and blood was collected for followings assays.

Estimation of Cholesterol: Total cholesterol (520 nm), HDL cholesterol (520 nm) and triglyceride (540 nm) were measured using spectrophotometer at specific wave length. The LDL cholesterol values were obtained using the following formula below: LDL= VLDL+ HDL –Total cholesterol The VLDL values were obtained by the following formula below:

VLDL= TAG x 0.16

Feed analysis: Protein analysis was done using $CuSO_4$/ TiO_2 mixed catalyst Kjeldahl method (AOAC method)

RESULTS

The recent studies of coconut oil and palm oil suggest that there are great health benefits. However, there are various side effects associated with using them. Because of the growing interest in the commercial production of both, it is necessary to know which one is healthier for cooking purposes. In this study rats were used as reference to humans since the blood composition of both is similar owing to the fact that they are from the class *mammalia*. Hence, cholesterol is used and transported in the same manner in both species. The average room temperature over the period of the experiment (5 weeks) was 30.72ºC (Table.1).

Table 1: Mean temperature of animal house during the experiment

Duration of experiment	TemperatureºC
Five weeks (5)	30.72 ± 0.59

Table 2 reflects the major constituents in animal feed. From the results obtained, protein (20.14 ± 1.64 %) is clearly the most abundant macromolecule found in the feed followed by carbohydrates (4.91±0.15 %) and fat (4.40±0.25 %) respectively.

Table 2: Mean constituents of the feed given to the animals.

Constituents	% Mean ± SD
Fat	4.40±0.25
Fiber	4.91±0.15
Protein	20.14±1.64

Table 3 outlines the mean weight of rats before the commencement of the experiment. The group that gained the most weight was the control (9.2 % g), followed by palm oil (8.6 % g) and coconut oil (6.3 % g) respectively (Table.3). This gain indicates how much food was accumulated by each group and converted in to body mass.

Table 3: Mean weight of the rats before the experiment and prior to dissection

Treatment	Initial weight (g)	Final weight (g)	Percentage increase %
Control	265.63±30.51	290.19±33.25	9.2
Palm oil	279.90±8.48	303.90±11.08	8.6
Coconut oil	282.33±13.03	300.15±13.72	6.3

The cholesterol levels were measured after the completion of the experimental period (Table 4and 5). There is increase in HDL in both treatment with palm and coconut oil when compared to control. LDL increased in treatment with palm oil whereas treatment with coconut oil recorded decrease when compared to control. VLDL increase was greater in treatment with coconut oil followed by palm oil when compared to control. Triglycerides increase is greater in treatment with palm oil followed by coconut oil when compared to control. The total cholesterol reduced in treatment with coconut oil followed by palm oil when compared to control. These recorded changes when subjected to t-test and ANOVA showed significant effects of different treatments (Table 6-9).

Table 4: Mean cholesterol content of the rats after the experiment

Treatment	HDL cholesterol mg/dL	LDL cholesterol mg/dL	VLDL cholesterol mg/dL	Triglycerides mg/dL	Total cholesterol mg/dL
Control	28.1±8.14	50.91±7.37	9.23±1.25	57.67±7.82	99.47±33.27
Palm oil	30.47±1.56	57.31±9.32	9.66±3.20	60.37±20.01	97.43±6.90
Coconut oil	30.4±3.67	40.67±10.48	18.3±9.10	114.37±56.91	89.37±11.10

Table 5: Percentage increase and decrease of cholesterol

Treatment	HDL cholesterol %	LDL cholesterol %	VLDL cholesterol %	Triglycerides %	Total cholesterol %
Palm oil	+8.4	+12.6	+4.7	+4.7	-2.1
Coconut oil	+8.2	-25.2	+98.3	+98.3	-11.3

Table 6: t-test for palm oil and coconut oil against control

Treatment	HDL mg/dL	LDL mg/dL	VLDL mg/dL	Triglycerides mg/dL	Total cholesterol mg/dL
Palm oil	*	*	*	*	*
Coconut oil	*	*	*	*	*

* means results are not significant at 0.05 probability level

Table 7: t-test for coconut oil against palm oil

HDL mg/dL	LDL mg/dL	VLDL mg/dL	Triglycerides mg/dL	Total cholesterol mg/dL
*	*	*	*	*

* means results are not significant at 0.05 probability level

Table 8: ANOVA test for palm oil and coconut oil against control

Treatment	HDL mg/dL	LDL mg/dL	VLDL mg/dL	Triglycerides mg/dL	Total cholesterol mg/dL
Palm oil	*	*	*	*	*
Coconut oil	*	*	*	*	*

Table 9: ANOVA test for coconut oil against palm oil

HDL mg/Dl	LDL mg/dL	VLDL mg/dL	Triglycerides mg/dL	Total cholesterol mg/dL
*	*	*	*	

DISCUSSION

The present study was conducted at the University of Guyana animal house which had average room temperatures of 30.72ºC. During this time the animals were divided into their respective groups (control, palm oil and coconut oil respectively) and were fed the experimental diet once per day. The control group was used as a reference point for determining the effects of plasma cholesterol levels. The nutrient content of the ration given along with the treatments (palm oil and coconut oil) was found to be approximately 20 % protein, 5% carbohydrates and 4 % fat. This may have contributed to the gain or loss in cholesterol. The end result of the experiment showed that there is increase in HDL cholesterol in the group treated with palm oil (+8.4%) by a small fraction over the group treated with coconut oil (+8.2 %). This increase is not very significant and hence both oils are good in raising the HDL cholesterol levels. Thus, as we know from the literature an increase in HDL concentration results in the removal of fats from the body by binding it in the blood stream and transporting it to the liver for disposal. This will reduce the chances of someone getting cardiovascular diseases[9]. In the case of LDL cholesterol there was a significant decrease with the coconut oil treatment by -25.2 % rather than the palm oil treatment which increased dramatically by +12.6%. This decrease in LDL by coconut oil means that only limited fats will be transported around the body and hence reduces the chances of it building up on the arterial walls and forming plaque (7). As for palm oil this increase may lead to complications on the arterial walls and may even cause cardiovascular diseases. Thus coconut oil is more efficient in controlling plasma cholesterol levels since it raises HDL cholesterol and at the same time lowers LDL cholesterol. The values for VLDL and triglycerides increased in both treatments. These increases can cause serious complications on the circulatory system since they can build up on arteries, hence putting more pressure on the heart to pump blood around the body (10).As for the total cholesterol there was greater decrease by coconut oil (-11.3%) than palm oil (-2.1%). Again this shows that coconut oil is better for reducing cardiovascular diseases than palm oil. Our studies are in agreement with earlier studies[11]. The major constituent of coconut oil that may have contributed to the above phenomena is Lauric acid (a saturated fatty acid). Lauric acid is a medium chain triglyceride (MCT) and it is the most predominant fatty acid in coconut oil. Unlike long chain triglycerides (LCT), MCTs are used for energy by the body and are not stored as fat. It is found that this fatty acid lowers bad cholesterol and raises good cholesterol in addition to having antimicrobial properties[7].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.

CONCLUSION

Although coconut oil lowered LDL cholesterol by a greater percentage, the t-test and ANOVA test showed that these results were not significant. Therefore to conclude, the experiments need further investigation and verification.

REFERENCES

1. Montagnese C, Santarpia L, Iavarone F, Strangio F, Caldara AR, Silvestri E, Contaldo F, Pasanisi F. North and south american countries food-based dietary guidelines: A comparison. Nutrition. 2017. 42:51-63.
2. Zentek J, Buchheit-Renko S, Ferrara F, Vahjen W, Van Kessel AG, Pieper R. Nutritional and physiological role of medium-chain triglycerides and medium-chain fatty acids in piglets. Animal Health Research Reviews. 2011.12(1):83-93.
3. Carandang EV. Health benefits of virgin coconut oil. Indian Coconut Journal-Cochin-. 2008. 38(9):8.
4. Mukherjee S, Mitra A. Health effects of palm oil. Journal of Human Ecology. 2009. 26(3):197-203.
5. Sambanthamurthi R, Sundram K, Tan YA. Chemistry and biochemistry of palm oil. Progress in lipid research. 2000. 39(6):507-58.
6. Wahid MB, Abdullah SN, IE H. Oil palm. Plant Production Science. 2005. 8(3):288-97.
7. Enig MG. The Health Benefits of Coconuts and Coconut Oil. Nexus Magazine. 2002. 9(2).
8. Calbom C, Calbom J. The Coconut Diet: The Secret Ingredient that Helps You Lose Weight While You Eat Your Favorite Foods. Grand Central Life and Style; 2008.
9. Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. High density lipoprotein as a protective factor against coronary heart disease: the Framingham Study. The American journal of medicine. 1977.62(5):707-14.
10. Awad AB. Effect of dietary lipids on composition and glucose utilization by rat adipose tissue. The Journal of nutrition. 1981.111(1):34-9.
11. Kritchevsky D, Tepper SA, Bises G, Klurfeld DM. Influence of cocoa butter on cholesterol metabolism in rats: comparison with corn oil, coconut oil and palm kernel oil. Nutrition Research. 1983. 3(2):229-36.

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