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Effect of Cashew Kernel and Soya Bean Oils on Blood Serum Cholesterol and Triglyceride of Albino Rats (*Rattus rattus*)

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Authors' contributions

This work was carried out in collaboration between both authors. Authors NJTE and LIB jointly designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript including analyses of the study and literature searches. Both authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Cashew kernel oil was processed, used in combination with procured soya bean oil and used in the formulation of basal rat diets. Three rats were decapitated initially and their serum cholesterol (SC) determined before the feeding trial. The remaining 60 rats were randomly assigned into six groups of ten rats each labeled I, II, III, IV, V and VI. Basal diet (BD) alone was fed to I; which was used as the control. Group II was fed with BD and 0.20 g crystalline cholesterol (CC). Group III was fed BD and 2.0 g of cashew kernel oil (CKO). Group IV was fed BD and 2.0 g soya bean oil (SBO). Group V was fed with BD, 2.0 g CKO and 0.2 g CC. Group VI was fed BD, 2.0 g of SBO and 0.20 g CC. Feed and water was provided ad libitum for ten weeks. After which the effect of cholesterol, CKO and SBO on total serum cholesterol (SC) and triglyceride of the rats was analyzed. The result showed that addition of 0.20 g crystalline cholesterol to the BD resulted in significant ($p<0.05$) increase in total SC (128.60 mg/dl) as against 92.84 mg/dl of rats fed with BD. The serum triglyceride (ST) of rats fed CKO and SBO were 64.04 and 81.50 mg/dl, respectively and were

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lower than the ST of rats fed CC with a value of 101.29 mg/dl. CKO and SBO lowered the SC of the rats to 152.15 and 137.97 mg/dl, respectively from 158.60 mg/dl. Feeding rats with cashew kernel oil (CKO) and soya bean oil (SBO) has a positive effect in reducing serum cholesterol (SC) and triglyceride (ST).

Keywords: Cashew kernel oil; soya bean oil; serum triglyceride; serum cholesterol; albino rats.

1. INTRODUCTION

Cashew kernel extract from the mesocarp of cashew nut contains on average of 48% oil. The fatty acids present in cashew kernel are oleic (73.73%), linoleic (13.60%) and steric (10.20%) in the ratio of 1:2:1. Cashew kernel is rich in fat, carbohydrate, protein, minerals and vitamins. Cashew kernel is mainly roasted and consumed as peanut as well as used as a functional ingredient in the bakery and confectionery products. The kernel can be processed into flour and used to formulate infant food and snack products [1,2]. The ratio of saturated, monounsaturated and polyunsaturated fatty acid (PUFA) is ideal for the maintenance of healthy heart [3]. Cashew kernel is available in huge amount in the Southern States of Nigeria. The Federal Government spends a huge sum on foreign exchange annually for the importation of Omega-3-fatty acid oils as supplement to lower serum cholesterol. The ratio of fatty acid present in cashew kernel oil can also lower serum cholesterol [3]. The processing of cashew kernel is mainly done by small and medium scale farmers despite the fact that Nigeria is one of the major cashew producers in the world. There has been an increase in cashew nut production in Nigeria from 100,000 tonnes in 2011 to 175,000 tonnes [4]. Nigerian cashew quality is now high in ranking. This means prosperity for farmers, traders, exporters and processors. Nigeria gained 50.4bn naira from cashew export in 2016 as reported by Faseru [4]. Yet, the awareness of the health potential of cashew kernel oil is low.

Tashev [5] reported that PUFA like linoleic as found in soya bean oil reduced serum cholesterol of humans. Soya bean oil contains 2.4% saponins [6,7] associated soya bean oil with lowering of serum cholesterol. The objective of this work is to find out the effect of cashew kernel and soya bean oils supplemented feed on the blood serum cholesterol of albino rats.

2. MATERIALS AND METHODS

2.1 Materials

Twenty-five kilograms of cashew (*Anacardium occidentale*) nuts were harvested from an orchard at Uturu, Abia State and transported to the Laboratory of Food Chemistry in the Department of Food Science and Technology, Rivers State University, Port Harcourt, Nigeria. Sixty three (63), 12 weeks old male albino rats with an average weight of 134.34 g were purchased from the University of Port Harcourt animal house. Other materials include Hexane (M & B), soya bean oil (Sunola Company, Nigeria), Growers mash (Top Feed, Nigeria), crystalline cholesterol (BDH) and cholesterol test kit (Randox Laboratories, UK). All chemicals and used for this research were obtained from the same Laboratory and were of analytical grade.

2.2 Methods

2.2.1 Processing of cashew kernel oil

Cashew kernels were processed using the oil-bath roasting method described by Emelike et al. [2]. The obtained cashew kernels were divided into 300 g batches for easy milling. They were milled using Kenwood blender (Model A907D, UK). The milled cashew kernel flour was further oven dried at 105°C for 1 h to reduce the moisture content, hence, condition the fat molecules of the flour. The oil was extracted using solvent extraction by introducing petroleum ether (b.p 40 – 60°C) in continuous soxhlet extraction apparatus for 3 h. The extracted oil was transferred into a clean dry sterile bottle to be used for the rats feeding experiment.

2.2.2 Formulation and feeding experiment

The procured albino rats were divided into six groups and used for the feeding trial to determine the effect of cashew kernel and soya bean oils on the serum cholesterol and triglyceride of the rats. The rats were acclimatized for 7 days on the basal diet, and then randomly assigned into 6 groups of 10 rats each (Group I, II, III, IV, V, VI). Three of the rats were decapitated with a knife and their blood collected to determine the serum cholesterol of the rats before feeding studies. They were housed individually in stainless steel cages with raised screen bottoms to allow for weekly collection and removal of faeces. Feed and water were provided *ad libitum.* The

proximate composition of Top Feed Grower Mash which was used as the basal diet is presented in Table 1 as collected from Top Feed Company. Crystalline cholesterol and the various test supplements such as cashew kernel and the soya bean oils were incorporated directly into the basal rat diets except in diets I III and IV as shown in Table 2 to obtain 6 diet groups.

Table 1. Percentage proximate composition of the top feed growers mash

Proximate	Compositions
Moisture	9.72 ± 0.50
Ash	6.70 ± 0.20
Fibre	7.94 ± 0.30
Fat	4.11 ± 0.04
Crude Protein	22.72 ± 0.33
Carbohydrate	48.81 ± 1.00

At the end of the feeding period, the final weights of the rats were measured and recorded. The rats from each diet treatment groups were slaughtered by decapitation with a knife and 3 ml blood drawn with a syringe from the aorta into a centrifuge tube. The blood was separated into serum and plasma by centrifugation within 2 h. The serum and plasma were transferred into plain plastic specimen containers appropriately coded, labeled and stored in the refrigerator at a chilling temperature of 4°C until the next day when they were analyzed.

2.2.3 Analysis for total serum cholesterol and triglyceride of the rats

The total serum cholesterol and triglyceride level was estimated by the chod-pap enzymatic colorimetric method from Randox Manual/RX Monza TR 210 as described by Meiattini et al. [8]. The cholesterol and triglyceride test kits contained the enzyme reagents and standards 5.17 mmol/L or 200 mg/dl concentration.

2.3 Statistical Analysis

The data generated were analyzed in triplicate using a one-way Analysis of Variance (ANOVA) using Statistical Package for Social Science (SPSS Inc, Chicago) V20.0 software, year 2011 to test the level of significant difference at 5% level of probability ($p<0.05$). Duncan New Multiple Range Test was used to separate the means where significant differences existed according the method outlined by Wahua [9].

3. RESULTS AND DISCUSSION

3.1 Effect on Serum Cholesterol and Triglyceride of Rats Fed with Cashew Oil, Soya Bean Oil and Crystalline Cholesterol

Effect of cashew kernel oil (CKO) and soya bean oil (SBO) supplementation on total serum cholesterol and triglyceride of albino rats (*Rattus rattus*) after 10 weeks feeding is presented in Table 3. The addition of 0.20 g crystalline cholesterol to the basal rat diet (Diet II) resulted in a significant ($p<0.05$) increase (128.60 mg/dl) in total serum cholesterol level when compared with the cholesterol value (92.84 mg/dl) of rats fed with basal Diet I alone. Feeding the rats with Diet III, which was a supplementation of basal diet with 2.00 g cashew kernel oil without crystalline cholesterol resulted in a decrease (88.97 mg/dl) in total serum cholesterol of the rats although this was not significantly different ($p>0.05$) from that obtained when the basal diet alone was fed (92.84 mg/dl). The supplementation of 2.00 g soya bean oil in the basal rat diet fed without crystalline cholesterol (Diet IV) also resulted in a decrease (81.24 mg/dl) in total serum cholesterol level of the rats and was not significantly different ($p>0.05$) from that obtained when the basal rat diet alone was fed (92.84 mg/dl). The supplementation of 2.00 g cashew nut oil and 0.20 g crystalline cholesterol in basal rat diet (Diet V) resulted in a decrease (152.15 mg/dl) in total serum cholesterol level of the rats which was significantly different ($p<0.05$) from that obtained when 0.20 g crystalline cholesterol was incorporated into the basal diet (158.60 ml/dl). The supplementation of 2.00 g soya bean oil and 0.20 g crystalline cholesterol to the basal rat diet (Diet VI) resulted in a decrease (137.97 mg/dl) in total serum cholesterol level of the rats and it was significantly different ($p<0.05$) from that obtained when 0.20 g crystalline cholesterol was incorporated into the basal rat diet (158.60 mg/dl). The results also showed that there was a significant ($p<0.05$) increase of 101.29 mg/dl in the total serum triglyceride of rats fed with 0.20 g crystalline cholesterol over that obtained when the basal diet alone was fed (90.23 mg/dl). However the supplements of 2.00 g cashew nut oil and 2.00 g soya bean oil fed in conjunction with 0.20 g crystalline cholesterol resulted in a significant decrease in total serum triglyceride of rats over that obtained when 0.20 g crystalline cholesterol was incorporated into the basal diet.

Table 2. Formulation of diets (units in grams)

Parameters	Diet I	Diet II	Diet III	Diet IV	Diet V	Diet VI
	Basal diet (Grower Mash)	Basal Diet + CC	Basal Diet + CNO (CKO)	Basal Diet + SBO	Basal Diet + CNO (CKO) + CC	Basal Diet + SBO + CC
Basal diet	25.00	25.00	20.00	20.00	20.00	20.00
Cashew kernel oil	-	-	2.00	-	2.00	-
Soya beam Oil	-	-	-	2.00	-	2.00
Crystalline Cholesterol	-	0.20	-	-	0.20	0.20

Key: *CC = Crystalline Cholesterol, CNO = Cashew kernel oil (CKO) and SBO = Soya bean Oil*

Table 3. The effect of CKO and SBO supplementation on total serum cholesterol and triglyceride after 10 weeks feeding period

Parameters (mg/dl)	Before Resumption of feeding	(Diet I)	(Diet II)	(Diet III)	(Diet IV)	(Diet V)	(Diet VI)
Total serum cholesterol	91.74±2.70[a]	92.84±3.15[a]	158.60±3.16[a]	88.97±3.15[a]	81.24±3.15[a]	152.15±6.57[a]	137.97±4.82[a]
Total serum triglyceride	90.10±3.0[b]	90.23±3.21[b]	101.29±3.17[b]	64.04±2.50[b]	81.50±4.12[a]	72.48±4.27[b]	65.49±2.90[b]

[a,b] *Means with same superscript within the column do not differ significantly at 5% level of confidence, ± = standard deviation of triplicate determination.*

KEY:

D_i = 25.00g basal diet
D_{ii} = 25.00g basal diet + 0.20g crystalline cholesterol
D_{iii} = 20.00g basal diet + 2.00g cashew kernel oil
D_{iv} = 20.00g basal diet + 2.00g soyabean oil
D_v = 20.00g basal diet + 20.00g cashew kernel oil + 0.20g crystalline cholesterol
D_{vi} = 20.00g basal diet + 2.00g soybean oil + 0.20g crystalline cholesterol
CKO = Cashew Kernel Oil
SBO = Soya Bean Oil

Vegetable oils such as cashew kernel and soya bean oils appear to be beneficial in lowering total serum cholesterol in rat fed crystalline cholesterol. Also, both oils fed at 2.00 g without crystalline cholesterol lowered the total serum cholesterol in the rats. Both oils prevented increase in total serum cholesterol induced in cholesterol fed rats. The significant reduction ($p<0.05$) in total serum cholesterol which was observed in this study agrees with the results of other investigators [10] on the effect of diets on steroid absorption and excretion. Cashew kernel oil and soya bean oil both significantly lowered serum cholesterol compared with the basal diet, with no difference between the two. However, serum triglyceride was significantly lower in Diets III and VI while it remained the same for Diets I and V.

Tashev [5] reported that polyunsaturated fatty acids like linoleic acid were found in soya bean oil, the presence of a high content of linoleic acid in the diets affected dietary cholesterol thereby reducing serum cholesterol. Soya bean contains 2.4% saponins [6] and saponins have some beneficial effects as reported by Sirtori et al. [7] who associated soya bean saponins with lowering of serum cholesterol. Saponins prevent intestinal absorption of cholesterol in rats and subsequently decrease serum cholesterol level in cholesterol fed rats. Oakenful and Sidhu [11] showed that saponins were hypo cholesterolemic. As the results showed, although, the same amount of soya bean oil and cashew nut oil was fed to the rats, soya bean oil contained more polyunsaturated fatty acid about 59% than cashew nut oil which had about 7.7%. Soya bean oil had saturated fatty acids of about 13% while cashew nut oil has saturated fatty acids of about 18%. Tashev [5] reported from multiple feeding trials, that saturated fatty acids raised serum cholesterol level about twice as much as polyunsaturated fatty acids lowered it. Channey and Ross [12] suggested that polyunsaturated fatty acids promoted the etherification of cholesterol and transformed it into an easily utilizable form. As the result showed, serum cholesterol level of the rats fed soya bean oil was lower than the serum cholesterol level of rats fed cashew nut oil. This may be due to the higher polyunsaturated fatty acids/saturated fatty acids p/s ratio, p/s ratio of about 0.4. A ratio of 0.5 or over is thought to be satisfactory. When polyunsaturated fatty acid intake was low or lacking, the transport of cholesterol was retarded and cholesterol accumulates in the blood serum and walls of the blood vessels [12]. Ehnholm et al. [13] reported that a diet rich in polyunsaturated fatty acids but low in saturated fatty acids and cholesterol lowered serum cholesterol at least in short term studies. Sanders et al. [14] reported that essential fatty acids had a cholesterol lowering effect.

The lowering of serum cholesterol level by cashew nut and soya bean oils may be due to the fact that both oils contain high level of PUFA. Sanders et al. [14] described groundnut oil as non athrogenic because of its high content of monounsaturated fatty acid (oleic acid) polyunsaturated fatty acid (linoleic and linolenic acid). Cashew kernel oil has the same ratio of these fatty acids. Ajayi and Ajayi [15] found a relationship between intake of cholesterol in the diet and mortality rate from coronary heart disease. Mudambi and Rajagopal [16] found that cholesterol in addition to fat increased serum cholesterol level remarkably. There is a relationship between dietary fat/oil and serum cholesterol. As the dietary fat/oil increases, serum cholesterol increases as well. As the result also showed, the serum triglyceride of the rat fed cashew nut and soya bean oils was lower than the serum triglyceride of the rats fed crystalline cholesterol supplemented diets. This is due to the fact that serum triglycerides are somewhat lower if dietary fat is polyunsaturated than saturated, endogenous triglyceride come from the liver and are carried on every low density lipoproteins except when the subject has had a meal containing fat in the last few hours [17].

The result showed that cashew kernel oil and soya bean oil lowered total serum cholesterol level of the rats when fed without crystalline cholesterol below that obtained when basal rat diet alone was fed. Also, the cashew kernel oil and soya bean oil when fed in conjunction with crystalline cholesterol lowered total serum cholesterol levels of the rats below that obtained when crystalline cholesterol was incorporated into the basal rat diet and fed without cashew kernel oil and soya bean oil. Cashew kernel oil and soya bean oil are hypocholesterolemic. Cashew kernels are rich in fat (47%) with the right combination of fat in the ratio of 1:2:1 comprising saturated, monounsaturated and polysaturated and its ideal for human consumption. The relative abundance of monounsaturated fatty acid in cashew kernel is an advantage [3].

4. CONCLUSION

The result of this research work has shown that addition of crystalline cholesterol to the basal diet of rats increased the total serum cholesterol and triglyceride of rats. Feeds supplemented with cashew kernel and soya bean oils had the potential of lowering total serum cholesterol and triglyceride of rats. More research of cashew kernel oil's ability to lower serum cholesterol may lead to the discovery of local dietary substitutes to Omega-3-fatty acids. The human populace should be encouraged to consume more cashew kernels as it contains fatty acids that are good for the heart.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Onyeike EN, Ikuru PR. Preliminary investigation of proximate composition of heat processed cashew nut seed flours. Plant Foods for Human Nutrition. 1998;48(2):85-93.
2. Emelike NJT, Barber LI, Ebere CO. Proximate, mineral and functional properties of defatted and undefatted cashew (*Anacardium occidentale Linn.*) Kernel flour. European Journal of Food Science and Technology. 2015;3(4):11-19.
3. Achal E. Cashew: Nutritional and medicinal value of cashew. Colarade State University Press. 2005;159–165.
4. Faseru B. National Cashew Association of Nigeria Bulletin of NCAN General Meeting September 12; 2017.
5. Tashev T. Nutrition and chronic disease. In: The nutrition in health and disease and international development symposia. 11th International Congress of Nutrition. New York; 1981.
6. Achinewhu SC. Chemical and nutrient composition of fermented products from plant goods. Nigeria Food Journal. 1983;1(1):200-210.
7. Sirtori CRB, Agnadi F, Conti O, Matere EG. Soya bean protein diet in treatment of type II hyperliproteinamia. Lancet. 1979;1: 175-176.
8. Meiattini F, Principe L, Bardelli F, Giannini G, Tarli P. The 4-hydroxy benzeote/4-amino phenazone chromogenic system used in the enzymic determination of serum cholesterol. Clinical Chemistry. 2000;24:2161-2165.
9. Wahua TAT. Applied statistics for scientific studies. African Link Press, Aba, Nigeria; 1999.
10. Ibezim BN, Achinewhu SC. Effect of diet on steroid absorption and excretion. Delta Agricltura. 1999;6:21-29.
11. Oakenful D, Sidhu GS. Saponins. In: Toxicants in Plant Origin. Cheeke, P.R (ed). New York. Acas Press; 1989.
12. Channey JC, Ross SI. Nutrition. India: Surgeet Publisher; 1979.
13. Ehnholm C, Huttunen JK, Pietineu P. Effect of diet on serum lipoprotein in population with a high risk of coronary heart disease. New England Journal of Medicine. 1982;307(14):850-855.
14. Sanders TH, McMicheal Jr. RW, Hendrix KW. Occurrence of resveratrol in edible peanut. Journal of Agriculture and Food Chemistry. 2009;48(4):1243-6.
15. Ajayi OB, Ajayi DD. Effect of oil seed diets on plasma lipid profile of albino rats. Pakistan Journal of Nutrition. 2009;8(2): 116-118.
16. Mudambi SR, Rajagopal MV. Fats and other lipids. In: Fundamentals of Food, Nutrition and Diet Therapy. 5th Edition. New Age International Publishers Ltd. New Delhi. 2007;46-57.
17. Davidson MS, Passmoore R, Brock JF, Truswell AS. Human nutrition and dietetics. 6th Edn. Edinburgh: ELBS and Churchill Publishers; 1975.

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