Effect of *Chrysophyllumcainito* Leaf Extract on Hyperlipidemic Sprague-Dawley Rats

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Abstract - Lipids are substances obtained from diet that should be metabolized by the body to become its source of energy. Without proper breakdown of the substance results to an increased level of lipid content in the blood known as hyperlipidemia. *Chrysophyllumcainito Linn* (Family: Sapotaceae), commonly known as star apple is traditionally used against cardiovascular diseases, and diabetes. This study was undertaken to validate the study of Manuel et al. (2011) on phytochemical components of *C. cainito*, to determine the effect of the aqueous and ethanolic leaf extracts of *C. cainito* on hyperlipidemic Sprague-Dawley rats and to compare the possible anti-hyperlipidemic activity of the varying concentrations of the extracts. Preliminary phytochemical screening revealed the presence of sterols, flavonoids,saponins, glycosides and tannins.Oral administration of the aqueous and ethanolic extracts at doses 50mg/kg, 100mg/kg and 200mg/kg body weights in rats revealed that there was a significant decrease on TC, TAG, HDL,VLDL and LDL-C level when grouped according to treatment (baseline, pre-test and post-test) with values 187.74 mg/dL, 147.32 mg/dL 112.6 mg/dL and 29.46 mg/dLat ($p<0.05$) level. It was also found that the significant difference is not dose-dependent at ($p<0.05$) level. Likewise, there is also no significant difference in the ethanolic and aqueous extract of *C. cainito*in their antihyperlipidemic activity together with the varying concentrations of the extracts. The results revealed that *C. cainito* has an antihyperlipidemic activity.

Keywords: *Chrysophyllumcainito*,hyperlipidemia, leaf extract, lipids

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INTRODUCTION

Elevated levels of lipids in the plasma including cholesterol, triglycerides, (Rajyalakshmi,Anreddy&Vollala,2009) and low density lipoproteins along with the reduction in high density lipoproteins (Ghule,Ghante,Saoji & Yeole, 2006) are known to cause hyperlipidemia which contribute significantly in the manifestation and development of stroke and cardiac diseases such as atherosclerosis and Coronary Heart Disease (CHD) (Elekofehinti, Andanlawo, Saliu & Sodehinde, 2012). Increased in LDL is an important risk factor for atherosclerosis. Furthermore, increase in low density lipoproteins may progress in the development of atherosclerosis that may progress to ulcerated plaques (Mahmud, Bachar&Qais 2011).Increased intake of biological lipids such as cholesterol and triglyceride is relevant in the cause of two common cardiovascular risk factors, hypercholesterolemia and hypertriglyceridemia (Mosa-Al-Reza, Saeed, Sadat & Marziyeh, 2012) which is the most prevalent lipid abnormalities (Arulmozhi, Krishnaveni, Dhamodharan & Mirunalini, 2010).

The incidence of CHD due to hyperlipidemias has increased alarmingly (Latha, Vijaya, Reddy, Ismail & Rao, 2011). Different factors such as diet high in saturated fats, age, hypertension, family history and life style contribute also to hyperlipidemia (Adaramoye, Akintayo, Achem & Fafunso, 2008; Dhulasavant, Shubhangi, Pawar & Naikwade, 2011). Hyperlipidemia is associated with obesity. People who are obese tend to have relatively high LDL, TAG and low HDL(Elekofehinti, Andanlawo, Saliu & Sodehinde, 2012).

Figure 1. *Chrysophyllum cainito* tree and leaves

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C. cainito leaf is composed of phytochemicals namely saponins and cardiac glycosides, alkaloids, steroids, tannins and polyphenols which found to be good as antimicrobial activity (Manuel,Balangcod, Patacsil & Laruan, 2011). Many identified natural edible components having antihyperlipidemic effects including saponin (Hu et al., 2006). Saponin is defined to be a glycoside found in many plants and is well-known as a foaming agent (Kim&Wampler, 2009). It has been identified to have therapeutic and medicinal properties such as treatment for diabetes (Patel, Shah & Goyal, 2008), antiviral, antioxidant activity (Fidan et al., 2009) liver, hepatitis, cardiovascular as high blood pressure,anticarcinogenic and physical stress (Astuti, Sakinah, Andayani & Risch, 2011;Negi, Singh, Pant & Rawat, 2011).

C.cainito is a common medicinal plant but no experimental study on its anti-hyperlipidemic activity has been carried out. This study is conductedto determine the effect of the aqueous and ethanolic leaf extracts of *C. cainito Linn*. on hyperlipidemic Sprague-Dawley rats and to compare the possible anti-hyperlipidemic activity of the varying concentrations of the extracts. The total serum cholesterol, triglycerides, HDL, LDL and VLDL will be used to assess the effectiveness of the leaf extract of *C. cainito*. Our main goal aims at discovering alternative,non-expensive, affordable therapies stabilize and normalize the hyperlipidemia.

MATERIALS AND METHODS

Collection and authentication of plant material

The leaves of *C. cainito* were collected locally from Rosario, Batangas last July 2013. The plant samples were identified and authenticated at University of the Philippines, Los Baños, Laguna.

Phytochemical Test

The fresh leaves about 300g were qualitatively tested for the presence of sterols, flavonoids,saponins, glycosides and tannins,triterpenes and alkaloids (Manuel et al., 2011).

Chemicals

Triton X-100(a non-ionic detergent, isooctylpolyoxyethylene phenol, formaldehyde polymer) and ethanol were procured at DKL laboratory in Manila, Philippines (Sudha, Karthic & Naveen, 2009). Triglycerides (TAG), Total Cholesterol (TC) and high density lipoprotein (HDL) test kit were procured from PALSMED and Green Thumb Marketing and laboratory supplies (Masani, Matthew, Chakraboty & Kamath, 2011).

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Preparation of aqueous extract

Leaves of *C.cainito*were dried and then pounded in a mortar. It was then furtherground to powder and stored in an air tight container until required. Two hundred grams of the powder were mixed with 1000 mL of distilledwater and shaken thoroughly at intervals to ensure adequate extraction. It was then soaked for 48 hours and then filtered using Muslin clothafter which a filter paper was used to obtain a pure filtrate. The filtrate was collected and then evaporated to dryness in a steam bath togive a brownish black residue (chocolate-like) which was stored in a small plastic container. The resulting residue was reconstituted indistilled water to give the required doses of 50, 100 and 200 mg/kg-1 b.wt., respectively (Arise, Akintola, Olarinoye, &Balogun, 2012).

Ethanolicextraction

The leaves of *C.cainito*were collected and dried under shade and ground intopowder. The powder (500 g) was macerated in 1000mL 70%ethanol at room temperature for 24 hours. It was then filtered using a filtered paper and thefiltrate was evaporated to dryness. Abrownish residue weighing 30.5 g was obtained. This waskept in air tight bottle in a refrigerator until used.The resulting slurry was weighed and reconstituted in distilled water to administer the required dose (Tende, Ezekiel, Dikko & Goji, 2012).

Experimental animals

Sprague Dawley female rats weighing175-250g wereprocured from the University of the Philippines, Manila. Rats were maintained under a good hygienic condition. Animals were caged in a group with a maximum of five rats per cage. A standard condition were maintained for these animals(22 ± 2 degree celsius, 55 ± 5% humidity, 12hr L:Dcycle) and fed with a standard feed and water *ad libitum* (Masani, Matthew, Chakraboty & Kamath, 2011).

Induction of hyperlipidemia

Hyperlipidemia was induced in Sprague Dawley rats by single intraperitoneal injection of freshly prepared solution of Triton-X-100 (100 mg/kg) in physiological saline solution after overnight fasting for 18 hours.The animals were divided into 8 groups of five rats each. A single dose of triton administered at a dose of 100mg/kg. After 72 hours of triton injectionreceived adaily dose of 5% CMC in 5ml/kg body weight for 7 days (Sudha, Karthic & Naveen, 2011).

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Dose preparation and administration of atorvastatin and leaf extract

Standard atorvastatin at a dose of 10 mg/kg was prepared by suspending bulk atorvastatin dissolved in distilled water. The aqueous and ethanolic extract of *C. cainito* leaf was dissolved in water and a dose of 50 mg/kg, 100mg/kg and 200mg/kg were given to the hyperlipidemicrats once in a day. Treatment was given daily for seven days(Shah et al.,2010).

Experimental protocol for antihyperlipidemic activity

The experimental animals were divided into nine groups, five animals in each group (Kaur&Meena, 2013):

Group1: Normal
Group2:Triton X-100 (Hyperlipidemic rats)
Group3: Hyperlipidemicrats treated with standard atorvastatin (10 mg kg-1 body weight (b.wt.), orally (p.o.)
Group 4 :Hyperlipidemic ratstreated with *C.cainito* aqueous extract (50mg/kg)
Group 5 : Hyperlipidemic rats treated with *C.cainito* aqueous extract (100mg/kg)
Group 6 : Hyperlipidemic rats treated with *C.cainito* aqueous extract (200mg/kg)
Group 7: Hyperlipidemic ratstreated with *C.cainito*ethanolic extract (50mg/kg)
Group 8: Hyperlipidemic ratstreated with *C.cainito*ethanolic extract (100mg/kg)
Group 9: Hyperlipidemic ratstreated with *C.cainito*ethanolic extract (200mg/kg)

Treatment was given daily for seven days orally.

Collection of blood

On the 8thday, blood was collected by retro-orbital sinus puncture, under mild ether anesthesia after 10 hoursof fasting and was allowed to clot for 30 minutes at room temperature.Blood samples were centrifuged at 3000 rpm for 20 minutes. Serum was separated and stored at -20°C until biochemical estimations were carried out (Shah et al.,2010).

Biochemical analysis of lipids in plasma

The serum samples were analyzedspectrophotometrically for total serum cholesterol (TC), triglyceride (TG) and high-density

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lipoprotein cholesterol (HDL-C) were measured using diagnostic kits. Very low density lipoprotein (VLDL)andlow density lipoprotein cholesterol (LDL-C) using the Friedewaldformula (Adeyemi, Adeqole&Obuotor, 2009;Mahmud, Bachar&Qais, 2011).

Statistical analysis

Results were presented as mean ± SEM of 5 animals. Statistical differences between the means of the various groups were evaluated using one-way analysis of variance (ANOVA). Data was consideredstatistically significant at ($p< 0.05$).

RESULTSAND DISCUSSION

Determination of phytochemicals

The phytochemical results revealed the presence of medically active plant compounds. It can be seen from the Table 1 that sterols, flavonoids, saponins, glycosides, and tannins are present from the *C. cainito* leaves. Furthermore, triterpenes and alkaloids were found out to be absent from the leaves of the tested plant which validates the study of Manuel et al.(2011).

Table 1
Preliminary phytochemical screening of *Chrysophyllum cainito*

Phytochemical substance	Results
Sterols	(+)
Triterpenes	(-)
Flavonoids	(+)
Alkaloids	(-)
Saponins	(+)
Glycosides	(+)
Tannins	(+)

*(+)Positive indicates the presence of constituents and (-) negative indicates the absence of constituents.

These phenolic compounds are commonly present in plants. It has different biological effects and it can be used against various conditions such as cancer, inflammation, apoptosis and atherosclerosis. Such compounds can also be used for cardiovascular protection and for inhibition of angiogenesis as well as improvement of endothelial function. Tannins are proline-rich proteins which inhibit the synthesis of proteins. Flavonoids have antimicrobial functions against various microorganisms. They are also considered as good antioxidants, thus showing good anti-cancer activities. Saponin has inhibitory properties

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against inflammation and has cholesterol binding properties. Glycosides are substances which are known to lower blood pressures (Yadav&Agarwala, 2011).

Hyperlipidemic Activity

Hyperlipidemia is one of the greatest risk factors of atherosclerosis and cardiovascular diseases (Elekofehinti., et al 2012). Several studies showed that decrease TC, TAG and LDL and increase HDL is associated with a decrease in the risk of cardiovascular diseases. Therefore, the prime concrens of different theraphy for hyperlipidemia is to lessen the elevated plasma/serum levels of lipids (Ghule et al., 2006).

Table 2 shows the effect of aqueous and ethanol extract when grouped according to treatment (normal, pre-test and post-test). Group 1 is composed of rats not injected by Triton X-100 and served as normal control. Group 2 is composed of hyperlipidemic rats with high levels of cholesterol, TAG, LDL and VLDL with obtained values of 401.7 mg/dl, 335.36 mg/dl, 314.33 mg/dl and 67.07 mg/dl, respectively. They were injected by Triton X-100 to increase the lipids level.This group has the highest lipid levels compared to other group since they are not treated withleaf extract. This shows that group 2 has high lipids level as compared to group 1. This group served as the hyperlidemic control. Group 3 hyperlipidemic rats showed decreased lipid level after the treatment of atorvastatin resulting from 200.66 mg/dl, 167.06 mg/dl, 122.65 mg/dl and 33.84 mg/dl, respectively.

This shows that the atorvastatin which is the drug of choice actually lowers the level of lipids in the blood (Rajyalakshmi, Anreddy & Vollala, 2009). Treatment of aqueousextract of *C. cainito* with a dosage of 50 mg/kg, 100mg/kg and 200mg/kg is done in group 4, group 5 and group 6. The level of cholesterol of group 3, group 4 and group 5 were decreased resulting to 242.6 mg/dl, 188.58 mg/dl and 173.34 mg/dl, respectively. Triglyceride level was also reduced after the treatment which resulted to 211.12 mg/dl, 161 mg/dl, and 120.76 mg/dl, respectively for the three dosages while reduced level of LDL was produced resulting to164.36 mg/dl, 115.96 mg/dl, and 102.23 mg/dl, respectively. The VLDL produced lower levels such as 42.22 mg/dl, 32.2mg/dl and 24.15 mg/dl. Group 7, group 8 and group 9 received ethanol extract with a dosage of 50 mg/kg, 100mg/kg and 200mg/kg, respectively. After the administration of the extract, a decreased in lipid level was observed. The cholesterol hada total reduction of 241.38 mg/dl, 228.78 mg/dl, and 187.74 mg/dl, respectively. Reduction of other lipid levels was also detected.

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Table 2

Effect of aqueous and ethanol extract when grouped according to treatment (normal, pre-test and post-test)

Group	CHOLESTEROL (mg/dl)			TRIGLYCERIDES (mg/dl)			LOW DENSITY LIPOPROTEIN (mg/dl)			VERY LOW DENSITY LIPOPROTEIN(mg/dl)		
	BASE-LINE	PRE-TEST	POST TEST	BASE-LINE	PRE-TEST	POST TEST	BASE-LINE	PRE-TEST	POST TEST	BASE-LINE	PRE-TEST	POST TEST
Group 1 (Normal)	181.38	171.56	170.76	156.76	139.56	147.54	102.15	97.78	94.91	31.35	27.91	29.51
Group 2 (Hyperlipidemic)	170.14	399.62	401.7	151.06	308.16	335.36	95.17	318.39	314.33	30.21	61.63	67.07
Group 3 (Standard Atorvastatin)	197.18	417.64	200.66	156.96	347.64	167.06	118.21	327.25	122.65	31.39	69.53	33.84
Group 4 (Aqueous extract 50mg/kg)	159.58	389.9	242.6	150.86	336.32	211.12	78.29	303.14	164.36	30.17	67.26	42.22
Group 5 (Aqueous extract 100mg/kg)	160.92	414.38	188.58	166.04	313.98	161	80.47	331.68	115.96	33.21	62.8	32.2
Group 6 (Aqueous extract 200mg/kg)	174.06	474.46	173.34	160.62	311.14	120.76	95	391.19	102.23	32.12	65.03	24.15
Group 7 (Ethanol extract 50mg/kg)	169.32	389.06	241.38	167.12	309.78	202.54	91.2	307.16	157.87	33.42	61.96	40.51
Group 8 (Ethanol extract 100mg/kg)	190.6	462.34	228.78	165.18	302.12	166.68	116.22	379.92	151.12	33.04	60.42	33.34
Group 9 (Ethanol extract 200mg/kg)	179.36	505.12	187.74	150.44	303.5	147.32	104.23	426.5	112.6	30.09	60.7	29.46

Triglyceride level was reduced after the treatment of ethanol extract which produced 202.54 mg/dl, 166.68 mg/dl, and 147.32mg/dl and reduced level of LDL was also detected with levels of 157.87 mg/dl, 151.12 mg/dl and 112.6 mg/dl. In the present study, the parameters in lipids were evaluated for all normal and hyperlipidemic rats. Based from the result, it was found out that aqueous and ethanolic extract has the ability to lower the lipid levelsof hyperlipidemic rats when grouped according to treatment (normal, pre-test and post-test) since the computed values ($p < 0.05$). In the present study, both extract of leaves of *C. cainito*showed significant anti-hyperlipidemic activity in cholesterol level and other lipids in hyperlipidemic rats which was almost comparable to that of the atorvastatin drug used in the treatment. The actions of the plants in lowering the lipids level may be due to its components that have the ability to inhibit the intestinal absorption of cholesterol, increased expression of hepatic LDL, receptorsinterference with lipoprotein production and their protection (Shah et al., 2010).These effects may be attributed to the presence of some active components of *C. cainito* leaf such as flavonoids, saponins and polyphenolics that have different mechanisms from polar extract which is responsible for the hyperlipidemic activity in the rats (Ghule, Ghante, Saoji&Yeole, 2006).

Table 3
Mean Average o f High Density Lipoprotein

HDL (mg/dl)	BASELINE	PRETEST	POSTTEST
Group 1 (Normal)	47.88	45.87	46.34
Group 2 (Hyperlipidemic)	44.76	19.72	22.1
Group 3 (Standard Atorvastatin)	47.58	20.86	44.6
Group 4 (Aqueous extract 50mg/kg)	51.12	19.5	36.02
Group 5 (Aqueous extract 100mg/kg)	47.24	19.9	40.42
Group 6 (Aqueous extract 200mg/kg)	46.94	18.24	46.94
Group 7 (Ethanol Extract 50mg/kg)	44.7	19.94	43
Group 8 (Ethanol Extract 100mg/kg)	41.34	22	44.32
Group 9 (Ethanol Extract 200mg/kg)	45.04	17.92	45.68

Table 3 showsthe mean average of high density lipoprotein. Group 1 served as the normal control with 46.34 mg/dl andgroup 2 served as the hyperlipidemic control with value of 22.1 mg/dl. Group 2 had the lowest value of HDL for the reason that they are injected with Triton X-100 and do not have treatment after the injection. Low level of HDL may contribute to risk factor to mortality from cardiovascular diseases (Elekofehianti, Andanlawo, Saliu & Sodehinde, 2012). Group 3, with treatment of atorvastatin, manifested a markedly increased level in HDL from 20.86 mg/dl to 44.6 mg/dl. Groups 4, 5 and 6 with aqueous extract treatments increase levels of 36.02 mg/dl, 40.42 and

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46.94, respectively while incresed level of 43 mg/dl, 44.32 mg/dl and 45.68, with ethanol extract were observed. Marked increased in serum HDL was observedafter the administration of aqueous and ethanolic extract. Increased in HDL acts as a protective factor because it is involved in the transport of cholesterol from the peripheral tissues to liver (Patel, Shah & Goyal 2009). Thus, apart from the regulation of carbohydrate metabolism, *C.cainito* also played an important role in lipid metabolism. The current findings coincide with those of earlier studies which reported that plants positive with sterols, flavnonoids, saponins, glycosides, and tannins has been reported to produced antihyperlipidemic activities (Patel, Shah & Goyal 2009). It can also prevent the various phases said to be involved in the intiation of atherosclerosis thus, this study was undertaken(Latha et al., 2011).Thus, HDL-C was found significantly decreased in hyperlipidemic rats.

Table 4
Comparison on the Effect based of the treatment

GROUP	Paired Differences	Sig.
Pair 1 pre CHOLE - post_CHOLE	211.26842	0.000*
Pair 2pre_HDL - post_HDL	-14.93368	0.000*
Pair 3pre_TAG- post_TAG	136.89873	0.000*
Pair 4pre_LDL - post_LDL	205.82366	0.000*
Pair 5pre_VLDL- post_VLDL	27.74106	0.000*

**Significant-observed by the obtained p-values < 0.05 level of significance*

As a summary, based from the result, it was found out in Table 4 that there was a significant difference on the effect on each extract when grouped according to treatment (normal, pre-test and post-test) since the computed significant values ($p < 0.05$) using Analysis of Variance with post hoc analysis. The pretest compared to post test is significantly different with 0.000 level. There is a marked decreasing values in cholesterol, triglycerides, and very low density lipoprotein and an increasing values in high density lipoprotein after the seven day administration of atorvastatin, aqueous and ethanol extract.

Table 5 shows the statistical analysis of lipids when treated according to group. Normal control (Group 1) shows non-hyperlipidemic rats with obtained values of 174.57, 46.69, 147.95, 92.28 and 29.59 for the cholesterol, HDL, TAG, LDL and VLDL, respectively.

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Table 5
Effects of Aqueous Extract and Ethanol Extract of *Chrysophyllum cainito* When Treated According to Group

	Cholesterol	HDL-C	TAG	LDL	VLDL
Normal	174.57	46.69	147.95	92.28	29.59
Hyperlipidemic	323.82	28.86	264.86	242.62	52.97
Standard Atorvastatin	262.61	37.54	222.93	180.48	44.58
Aqueous extract (50mg/kg)	264.02	35.55	232.76	181.92	46.55
Aqueous extract (100mg/kg)	254.63	35.85	213.67	176.03	42.73
Aqueous extract (200mg/kg)	273.95	37.37	197.50	196.13	40.43
Ethanolic Extract (50mg/kg)	266.59	35.88	226.48	185.41	45.29
Ethanolic Extract (100mg/kg)	293.91	35.88	211.32	215.75	42.26
Ethanolic Extract (200mg/kg)	290.74	36.21	200.42	214.44	40.08

*Values are in mean ± SD; number of animals in each group = 5; * p<0.05*

The hyperlipidemic control group showed the highest level of cholesterol, TAG, LDL and VLDL with values of 323.82, 264.86, 242.62, and 52.97, respectively. This group was injected with Triton X-100 similar with the other groups. Increased cholesterol levelswere observed on groups with aqueous and ethanol extracts showing anti-hyperlipidemic activity. *C. cainito a*queous extract produced 264.02, 254.63 and 273.95while ethanolic extract produce 273.95, 293.91and 290.74. It indicates that decreasing number of lipids indicates the antihyperlipidemic activity of the plants. Increase HDL after the administration of the treatment for Sprague Dawley rats for seven days revealed that there is an increase HDL level. Decrease level of LDL, total cholesterol, TAG and VLDL will lower the risk for cardiovascular disease (Elekofehinti, Andanlawo, Saliu & Sodehinde, 2012). This suggests that there is a potential anti-hyperlipidemic ativity of *C. cainito*extractresulting in the decrease of cardiovascular diseases.

Table 6 shows comparison of dosage per treatment. It reveals that 50 mg/kg aqueous extract in leaves of *C.cainito as* compared to 100 mg/kg and 200 mg/kg had the same therapeutic effect. This is similar to 100mg/kg as compared to 50 mg/kg, 200 mg/kg and 200 mg/kg as compared to 50 mg/kg and 100 mg/kg. All dosages in aqueous extract compared to other dosage gave the same effect in treatment. In different dosages of ethanol extract it produced same lowering effect as that of aqueous. The50 mg/kg of ethanol extract as compared to 100 mg/kg and 200 mg/kg had the same effect in lowering the lipid levels. This is similar with that of 100 mg/kg compared to 50 mg/kg and 200 mg/kg which produced same anti-hyperlipidemic effect and similar with 200 mg/kg compared to 100 mg/kg. Statisticaly, it was found out that there is no significant difference on the effects when treated according to group since the

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obtained p-values greater than 0.05 alpha level. The low and high doses of leaf extracts produced the same effect. This indicates that both aqueous and ethanol extracts may contain same components which produced the same effect in treatment.

Table 6
Comparison of Dosage per Treatment

		Aqueous extract			Ethanolic extract		
TRIGLYCERIDES	CHOLESTEROL	50 mg/kg	100mg/kg	1.000	50 mg/kg	100mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		100 mg/kg	50 mg/kg	1.000	100 mg/kg	50 mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		200 mg/kg	50mg/kg	1.000	200 mg/kg	50mg/kg	1.000
			100mg/kg	1.000		100mg/kg	1.000
	HDL	50 mg/kg	100mg/kg	1.000	50 mg/kg	100mg/kg	1.000
			200mg/kg	0.993		200mg/kg	1.000
		100 mg/kg	50 mg/kg	1.000	100 mg/kg	50 mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		200 mg/kg	50mg/kg	0.993	200 mg/kg	50mg/kg	1.000
			100mg/kg	1.000		100mg/kg	1.000
	LDL	50 mg/kg	100mg/kg	1.000	50 mg/kg	100mg/kg	1.000
			200mg/kg	0.993		200mg/kg	0.999
		100 mg/kg	50 mg/kg	1.000	100 mg/kg	50 mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		200 mg/kg	50mg/kg	0.997	200 mg/kg	50mg/kg	0.999
			100mg/kg	1.000		100mg/kg	1.000
	VLDL	50 mg/kg	100mg/kg	1.000	50 mg/kg	100mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		100 mg/kg	50 mg/kg	1.000	100 mg/kg	50 mg/kg	1.000
			200mg/kg	1.000		200mg/kg	1.000
		200 mg/kg	50mg/kg	0.997	200 mg/kg	50mg/kg	0.999
			100mg/kg	1.000		100mg/kg	1.000

**Significant*

In the previous study the contents of this plant effectively lower the lipid levels (Astuti et al., 2011) and in this study, the presence of this phytochemical components that are identified may be responsible for the lipid lowering activity of *C. cainito*.

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CONCLUSION

The study revealed that *Chrysophyllumcainito* leaves extract possesses anti-hyperlipidemic activity in Sprague Dawley rats, which suggest the presence of biologically active components. Aqueous and ethanolic extracts were found to decrease the levels of triglycerides, cholesterol, and low density lipoproteins and increase high density lipoproteins. It was also proven that varying concentrations have the same effect to the hyperlipidemic rats.

RECOMMENDATION

Further analysis of the anti-hyperlipidemic activity of *Chrysophyllum cainito* using its active component such as saponin must be performed.Clinical testing of *C. cainito* as potential alternative to commercially available anti-hyperlipidemic drugs is recommended.

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REFERENCES

Adaramoye O.A., Akintayo O., Achem, J., and Fafunso M. (2008). Lipid-lowering effects of methanolic extract of *Vernoniaamygdalina* leaves in rats fed on high cholesterol diet. *Vascula Health and Risk Management,4*, 235-241.Retrieved fromhttp://www.nIm.nih.gove/pmc/articles/ PMC2464769

Adeyemi, D., Komolafe, O., Adewole, S. & Obuotor,E.(2009). AntiHyperlipidemic Activities of *AnnonaMuricata* (*Linn*).*The Internet Journal of Alternative Medicine*, 7, 1-8.doi:10.ruek/293b

Arise, R.O., Akintola, A.A., Olarinoye, J.B. & Balogun, E.A. (2012). Effects of Aqueous Extract of Nauclealatifolia Stem on Lipid Profile and Some Enzymes of Rat Liver and Kidney. *International Journal of Pharmacology*. 8.389-295.doi :10.3923/ijp.2012.389.395

Arulmozhi, V., Krishnaveni, M., Dhamodharan, G., &Mirunalini, S. (2010).Antioxidant and antihyperlipidemic effect of *Solanumnigrum* fruit extract on the experimental model against

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chronic ethanol toxicity. *Pharmacognosy Magazine*.*6*,42-50. doi: 10.4103/09731296.59965

Astuti, S. M., Sakinah, M.,Andayani,R. & Risch, A. (2011). Determination of Saponin Compund from *Anrederacordifolia* (Ten). Steenis Plant (Binahong) to Potential Treatment for Several Diseases. *Journal of Agricultural Science*, *3*, 224-232 doi:10.5539/jas.v3n4p224.

Dhulasavant, V., Shubhangi, S. Pawar, M. & Naikwade,N.S. (2011). Antihyperlipidemic activity of *Cinnamomumtamala*Nees. On high cholesterol diet induced hyperlipidemia. *International Journal of Pharmacy and Life Sciences*,*2*, 506-510.

Elekofehinti, O., Andanlawo, I., Saliu, J. &Sodehinde, S. (2012). Saponins from *Solanumanguivi*fruitsexhibit hypolipidemic potential in Rattusnovergicus. *Der Pharmacia Lettre*,*4*, 811-814. Retrieved fromhttp://www.scholarsresearchlibrary.com

Fidan, A. F., Kucukkurt, I.,Yuksel,H., Ozdemir, A., Ince, S. &Dundar,Y.(2009). The Effects of Structurally Different Saponin Containing Plants on Tissue Antioxidant Defense Systems, Lipid Peroxidation and Histopathological Changes in Streptozotocin Induced Diabetic Rats. *Journal of Animal and Veterinary Advances*, *8*,920-927.

Ghule, B. V., Ghante, M. H., Saoji, A. N., & Yeole, P.G. (2006). Hypolipidemic and antihyperlipidemic effects of *Lagenaria siceraria*. Indian *Journal of Experimental Biology*,*44*, 905-909.

Hu, S. H., Liang, Z.C., Chia, Y.C., Lien, J.L., Chen, K. R., Lee, M.Y., et. al. (2006). Antihyperlipidemic and antioxidant Effects of Extracts from*Pleurotuscitrinopileatu*, *Department of Food Science and Technology*,*54*, 2103-2113. doi:10.1021/jf052890d.

Inyama, C. N., Mbagwu, F.N.,Unamba, C. N. & Osuha,V.U.N.(2011). Comparative Epidermal Studies on Three Species of the Genus Chrysophyllum (Sapotaceae).*Global Research Journal of Science*,*1*, 104-108.Retrieved from http://www.academicpublicatons.org/grjs

Kaur, G &Meena, C. (2013). Evaluation of Antihyperlipidemic Potential of Combinatorial Extract of Curcumin, Piperine and Quercetin in Triton-induced Hyperlipidemia in Rats. *Science International*. 1 (3). 57-63. doi: 10.5567/sciintl.2013.57.63

Kim, Y. &Wampler, D. (2009).Determination of Saponin and Various Chemical Compoundsin *Camellia* Sinensis and *Genus Ilex*. *Sensus Technical Note*.1

Koffi, N., Ernest, A. K., Solange, T., Beugre, K. & Noel, Z. (2009).Effect of aqueous extract of *Chrysophyllum cainito* leaves on the glycaemia of diabetic rabbits. *African Journal of Pharma*

ISSN: 2094-5906

and Pharmacology, 501- 506. Retrieved from http://www.academicjournals.org/ajpp

Latha, B. P., Vijaya, T., Reddy, I.R.M., Ismail, M. &Rao, S.D. (2011). Therapeutic Efficacy of *Achyranthesaspera* saponin extract in high fat diet induced hyperlipidemia in male wistar rats. *African Journal of Biotechnology*, *10*, 17038-17042.doi:10.5897/AJB11.2100

Lawal, I.O., Igboanugo, A. B . I., Osikarbor, B., Duyilemi, O.P., Adesoga, A.A., Borokini, T.I., et al. (2010). Evaluation of plant-base non-timber forest products (ntfps) as potential bioactive drugs in South Western Nigeria. *Journal of Clinical Medicine and Research*, *3*, 61 - 66**.** Retrieved from http://www.academic journals.org/JCMR

Mahmud, Z., Bacha**r,** S., &Qais, N. (2011). Antihyperlipidemic activity of leaf and root extracts of *Premnaesculenta*(Roxb.) in Poloxamer407 induced Hyperlipidemic mice and rats. *Orient Pharm ExpMed,11,*263-270.doi:10.1007/s13596-0110031-5

Manuel, J., Balangcod, T., Patacsil, M., Laruan, L. M. V., & Cortez, S. M. 2011 December). Supression of Growth of Some Medically Important Bacterial Pathogens (*Escherichi coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Salmonellatyphimurium* with Plant Extracts of Selected Indigenous Semi Temperature Medicinal Plants in the Philippines. Paper presented during the Ratchaphruek 2011 International Symposium on Medicinal and Aromatic Plants, Thailand, CM.

Masani Y.A., Matthew, N., Chakraboty M., & Kamath, J.V. (2012). Effect of VitisVinifera against Triton X-100 induced hyperlipidemia in rats. *International Research Journal of Pharmacy*.3 (12).Retrieved from www.irjponline.com

Mosa-Al-Reza, H., Saeed, S.,Sadat, D. A., Marziyeh, A. (2012). Comparison of the beneficial effect of guar gum on lipid profile in hyperlipidemic and normal rats. *Journal of Medicinal Plant Research*,*6*, 1567-1575. doi:10.5897/JMPR11.887

Parker, I., Lopez, I., Petersen, J., Anava, N., Rios, L., & Potter, D. (2010). Domesticatio Syndrome in Caimito (*Chrysophyllum cainito L.):* Fruit and Seed Characteristics. *Economic Botany*,*64*, 161-175. doi: 10.1007/s12231-01091214

Parveen, T. & Nyathamulla, S. (2011). Antihyperlipidemic Activity of the Methanolic extract from the Stems of *Tinosporacordifolia*on Sprague Dawley rats. *Der Pharmacia Sinica, 2(1).* 104109

Patel S., Shah S., and Goyal R., et al. (2009). Antihyperglycemic, antihyperlipidemic and Antioxidant effect of Dihar, a polyherbal

ISSN: 2094-5906

ayurvedic formulationin streptozotocin induced diabetic rats. I*ndian Journal of Experimental Biology, 47*,564-570.

Petersen, J., Parker, I., & Potter, D. (2012). Origins and Close Relatives of a Semi Domesticated Neotropical Fruit Tree: *Chrysophyllumcainito* (Sapotaceae). *American Journal of Botany*,*99*, 585-604. Retrieved from http://www. amjbot.org

Rajyalaksmi, G., Anreddy, R., &Vollala, V. (2009).A Comparative Antihyperlipidemic Activity of Atorvastatin with Simvastatin In Rats. *The Internet Journal of Pharmacology, 6*,1-8.doi:10.5580/203b

Shah, K., Patel, M., Shah, S., Chauhan, K., Parmar, P. & Patel, N. (2010). Antihyperlipidemic activity of Mangifera indica l. Leaf extract on rats fed with high cholesterol diet. D*erPharmacia Sinica*,*1*,156-161. Retrieved from http://www.pelagiaresearchlibrary.com

Sudha, S., Karthic, R., Naveen, J.R. (2011). Antihyperlipidemic activity of Spirulina platensis in Triton x-100 induced hyperlipidmeic rats. *Hygeia Journal for Drugs and Medicines*.3 (2). 32-37. Retrieved from www.hygeiajournal.com

Tantiado, R. (2012).Survey on Ethnopharmacology of Medicinal Plants in Iloilo, Philippines. *International Journal of Bio-Science and Bio Technology*,*4*,11-26.

Tende, J.A., Ezekiel, I., Dikko, A.A. &Goji, A.D. (2010). Effect of Ethanolic Leaves Extract if Moringaoleifera on Blood Glucose Levels of Streptozocin-Induced Diabetes and Normoglycemic Wistar Rats. *Bristish Journal of Pharmacology and Toxicology*.2 (1).1-4.

Yadav, R.N.S. & Agarwala, M .S (2011). Phytochemical analysis of somemedicinal plants. *Journa l of Phytology. 3(12).*10-14. Retrieved from http://journal-phytology.com

ISSN: 2094-5906