International Journal of Advanced Scientific Research
ISSN: 2456-0421; Impact Factor: RJIF 5.32
Received: 02-06-2020; Accepted: 17-06-2020; Published: 03-07-2020
www.allscientificjournal.com
Volume 5; Issue 4; 2020; Page No. 04-10

Hypolipidemic effect of the crude ethanolic extract of *thymus vulgaris* in rats fed with lipid

David Christopher Bando[1*], Hannah Nuhu Tubasen[2], Imbasire Nuhu[3], Emmanuel Odiba Ogu[4], Sylvia Ozioma Madukwe[5]

[1, 2, 3, 4] Bioresources Development Centre, National Biotechnology Development Agency, Jalingo, Taraba, Nigeria

[5] Department of Medical Laboratory Science, Faculty of Health sciences and Technology, College of Medicine, University of Nigeria

Abstract
This study was designed to evaluate the hypocholesterolemic effect of crude ethanolic extract of *Thymus vulgaris* in cholesterol fed rats. Acute toxicity test and preliminary quantitative screening were performed. Twenty-five (25) adult female Albino Wistar rats weighting 120-150g were used for this study. The animals were divided into five (5) groups (A-E) according to their body weights (w±20g). Group A and B, were set as the test groups and received 150mg/kg and 300mg/kg ethanolic extract of *Thymus vulgaris* (EETV) respectively. Group C received 20mg/kg Atorvastatin (positive control) and group D received 2000mg/kg cholesterols in coconut oil only (negative control) and group E received feeds and water (normal control). The administration was by oral route. Group E served as normal control. The administration of the EETV and cholesterol was for a period of twenty one (21) days. After an overnight fast all the animals (group A to E) were bled (5-8ml) through the retro-orbital vein into labeled plain tubes with the aid of heparinized capillary tubes for lipid profile. The Acute toxicity study revealed that the extract has an oral LD_{50} of >3000mg/kg. The phytochemical screening on the extract revealed the abundance of oils, saponins, polyphenols, flavonoids and tannins. There were no alkaloids, glycosides and high dose (300mg/kg/bw of EETV) lowered the levels of these cholesterol parameters in the rats significantly when compared with those of the negative control group. There was significant increase in the mean triglycerides (TG) levels of group C and D with mean TG levels of 1.18±0.09 mmol/L respectively when compared with the normal control group (0.22±0.02mmol/L; $p<0.001$). Furthermore, rats in groups A and group B had mean total cholesterol levels of 3.65±0.20mmol/L and 3.05±028mmol/L respectively and these were significantly lowered when compared with the negative control group with mean total cholesterol level of 5.15±0.11mmol/L ($p<0.001$). The atorvastatin group (positive control), had also significantly lowered mean total cholesterol level when compared with the negative control group. From the result of this study it could be concluded that *Thymus vulgaris* has a hypolipidemic effect in lipid fed rats.

Keywords: hypolipidemic; thymus vulgaris; hdl; vldl; ethanolic extraction; eetv

1. Introduction

Cholesterol is one important biological molecule that plays vital roles in membrane structure as well as a key precursor for the synthesis of the steroid hormones, the bile acids and vitamin D [1] cholesterol is found in every cell of the body and has important natural functions. Although cholesterol is being manufactured by the body but also, is taken in from food. It has a waxy and fat-like nature or appearance. Cholesterol being an oil-based substance does not mix with the blood, because it is water based substance; it is therefore carried around the body in the blood by lipoproteins [2].

The parcels of cholesterol are carried by two types of lipoproteins: Low-Density lipoprotein (LDL-cholesterol carried by this type is known as 'bad' cholesterol) and High-Density lipoprotein (HDL –cholesterol carried by this type is known as 'bad' cholesterol). There are four main functions of the cholesterol, without which we could not live; consequently it contributes to the structure of cell walls, makes up digestive bile acid in the intestine, allows the body to produce vitamin D and enable the body to make certain hormones. Cholesterol synthesis and utilization is tightly regulated in order to prevent over accumulation and abnormal deposition within the body of particular clinical importance in the abnormal deposition of cholesterol and cholesterol-rich lipoproteins in the coronary arteries [3].

The transportation of Cholesterol in the plasma predominantly takes place as cholesteryl esters associated with lipoproteins. Cholesterol from diet gets conveyed from the small intestine to the liver within chylomicrons. All synthesized Cholesterol by the liver, as well as any dietary cholesterol in the liver that exceeds hepatic needs, is transported in serum within LDLs.

In the liver VLDLs are synthesized and invariably converts it into LDLs through the action of endothelial cell-associated lipoprotein lipase. Cholesterol that are found in living organisms plasma membranes can be extracted by HDLs and it is esterified by the HDLs associated enzyme Lecithin: cholesterol acyltransferase (LCAT).

The cholesterol acquired from peripheral tissues by HDLs can then be transferred to VLDLs and LDLs via the action of cholesteryl ester transfer protein (apo-D) which is associated with HDLs. Peripheral cholesterol are allowed to be returned to the liver in LDLs by reverse cholesterol transport process. Ultimately, cholesterol is excreted in the bile as free cholesterol or as bile salts following conversion to bile acids in the liver. [4].

Animal's fats are basically complex mixtures of triglyceride which possess lesser amounts of phospholipids and cholesterol. Consequently, it is deduced that all foods containing animal fat contain cholesterol to varying extents

[5]. Some major pools of dietary sources of cholesterol include cheese, egg yolks, beef, pork, poultry, fish and shrimp etc. Research has it that the human breast milk also contains significant quantities of cholesterol. Cholesterol is not found in significant amounts from plant sources, judging from a dietary perspective [6].

High cholesterol (hypercholesterolemia) is a major risk factor for coronary heart disease, a cause of heart attacks, and reducing blood lipid level lowers the cardiovascular risk [7]. High levels of LDL lead to a build-up of cholesterol in the arteries, whereas HDL carries cholesterol is part of the process that narrows arteries, called atherosclerosis, in which plaques form and cause restriction of blood flow [8].

Abnormally low levels of cholesterol are termed hypocholesterolemia. Analysis into the causes of this state is comparatively restricted; however some studies counsel a link with depression, cancer and cerebral hemorrhage. In general, the low cholesterol levels appear to be a consequence, instead of a cause, of an underlying illness [9]. A genetic disease in cholesterol synthesis causes Smith-Lemli-Opitz syndrome, which is commonly related to low plasma cholesterol levels. Gland disease or the other endocrine disturbance that causes up regulation of the LDL receptor may result in hypercholesterolemia.

Atorvastatin is a HMG-CoA reductase (HMGR) inhibitor and a member of the family of drugs referred to as the statins. The cellular uptake LDLs, since the intercellular synthesis of cholesterol is inhibited and cells are therefore dependent of extracellular sources of cholesterol. However, since the product of the 3-hydroxy-3-methyl-glutaryl-CoA (HMG-CoA) reductase reaction is needed for the synthesis of different vital isoprenoid compounds besides cholesterol, there is high risk of toxicity in long-term treatment [3].

Medicinal plants are used in many countries as an alternative to synthetic drugs. Various spices and herbal extracts are used for preservation of food, also some are used as appetizers and many of them are used medicinally in old times [10]. Medicinal herbs are high natural sources of medicinal products that are used in traditional medicine and also as chemical entities for modern drugs. Medicinal plants are largely used either directly (home remedies) or indirectly (modern medicines) by all sectors of population [11]. Among the economically important plants, medicinal and aromatic plants have played role in reducing human misery [12]. Medicinal value of a plant is dependent on the presence of different phytochemical components (oils, saponins, polyphenols, flavonoids and tannins) that bring particular physiological effect in human body [13].

Thymus vulgaris (common thyme) is a spicies of flowering plant in the mint family lamiaceae, native to southern Europe from the western Mediterranean to southern Italy. Growing to 15-30cm (612 in) tall by 40cm (16 in) wide, it is a bushy, woody-based evergreen subshrub with small, highly aromatic, grey-green leaves and clusters of purple or pink flowers in early summer [14]. Therefore, this research aimed at determining the hypocholesterolemic effect of crude ethanolic extract of *Thymus vulgaris* in cholesterol fed rats and to also measure the lipid profile; Total glycerol (TG), cholesterol (CHOL), high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL).

2. Materials and methods

2.1. Experimental animals

Twenty five adult healthy female albino Wistar rats weighing 120-150g were used for the research. They were obtained from animal House Unit of the Department of Physiology, College of Medicine, University of Nigeria, Enugu Campus. The rats were housed in Animal House Unit at Old university of Nigeria teaching hospital Enugu. The rats were divided into five groups A,B,C,D and E, (n=4) according to their weight in clean wire gauzed cages and were fed for two weeks under standard environmental conditions and controlled temperature (25 ± 3^0C) to enable them acclimatize prior to the experiment. Throughout the experiment, all the criteria for taking care of animals prepared by the National Academy of Sciences and outlined in the "Guide for the Care and Use of laboratory Animals" were applied [15].

2.2. Plant collection, confirmation and extraction

Thymus vulgaris was collected from Ezeagu village in Enugu state. The plant was authenticated by a taxonomist at the Department of Botany, University of Nigeria, Nsukka Campus. A voucher specimen was deposited at the herbarium for future references. (INTERCEED/1479). The leaves were washed and then pulverized with a grinding machine.

2.3. Chemicals and reagents

All chemicals and reagents used were of analytical grade and were obtained from a Diagnostic Kits company "Randox Laboratory Ltd. Antrium, U.K" for the assays of lipid profile (TG; Total Glycerol, CHOL; Cholestrol, HDL; High Density Lipoprotein, VLDL; Very Low Density Lipoprotein, LDL; Low Density Lipoprotein). All the solutions and reagents with glass wares, distilled water and stored in the refrigerator at 4 ± 2^0C.

2.4. Drug preparation and reconstitution

2.4.1. Atorvastatin

Atorvastatin stock solution was prepared by dissolving 100mg which is in crystal form into 50ml distilled water to give a final concentration of 2mg/ml. this was shaken and stored in a refrigerator (4 ± 2^0C).

2.5. Acute toxicity test (Median lethal Dose, LD_{50})

Lorke procedure of LD_{50} detrermination was used to perform acute toxicity test.

2.6. Experimental design

Twenty five (25) apparently healthy Wister rats were used for this study. The rats were divided into five (5) group's labeled A-E according to their body weights. Group A and B, were set as the test groups. Group A and B received 150mg/kg and 300mg/kg ethanol extract of *Thymus vulgaris* (EETV) respectively. Group C received 20mg/kg Atorvastatin (Positive control) and group D received 2000mg/kg Cholesterol (negative control).

The administration was by oral route. Group E served as normal control group and received the administration of the extract and cholesterol was for a period of three weeks (21 days).

Table 1: Experimental protocol

GROUP	Mean weight (g)	Extract volume (ml)	Atorvastatin	Cholesterol (2000mg/kg)	Bile salt (10mg/kg)
A: 150mg/kg EETV	165	0.3	-	3.0ml	1.6
B: 300mg/kg EETV	124	0.4	-	2.4	1.2
C: 20mg/kg atorvastin	100		1.0ml	2.0ml	1.0
D: 2000mg/kg cholesterol only	77	-	-	1.5ml	0.8
E: Normal control	57	-	-	-	0.6

0n the 22nd day all the animals (group A to E) were bled after an overnight fast through the retro-orbital vein into labeled plain tubes. The blood samples in the plain tubes were allowed to clot and the serum was expressed after centrifugation at 1500r.p.m for 10 minutes.
The serum transferred into correspondingly labeled tubes and was stored in frozen state till the next day for analysis. The serum samples obtained from the plain tubes were used for biochemical analysis.

2.7. Biochemical analysis
After collection of the blood and expression of the serum into a plan bottle, the samples serum was analyzed to determine the levels of TG; Total Glycerol, CHOL; Cholesterol, HDL; High Density Lipoprotein, VLDL; very Low Density Lipoprotein, VLDL; Low Density Lipoprotein using the standard kits.

2.8. Estimation of lipid profile
2.8.1. Determination of Total Cholesterol
Method: Enzymatic Endpoint method [16].
Assay Principle: the cholesterol is determined after hydrolysis and oxidation. The indicator, quinoneimine is formed from hydrogen
Peroxide and 4-aminoantipyrine in the presence of phenol and peroxidase.

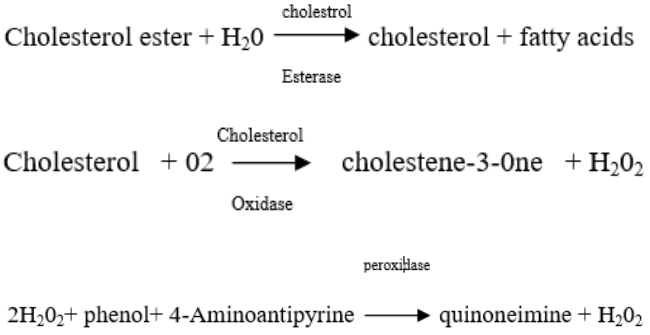
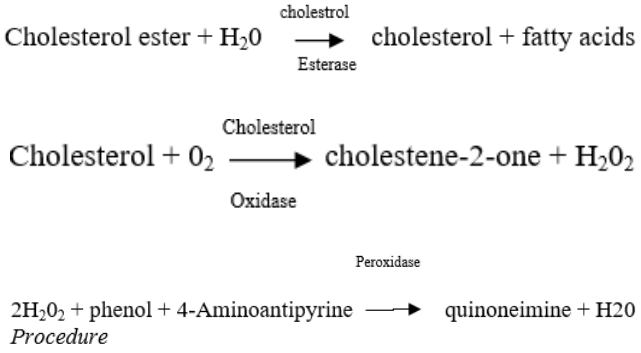


Table 2: Protocol/procedure

	Reagent black (ul)	Standard (ul)	Sample (ul)
Distilled H_20	10	---	---
Standard	---	10	---
Sample	---	---	10
Reagent	1000	1000	1000

Mix and incubate at +20 to +25ºC for 10 minutes. Zero colorimeter with reagent blank, and react at 500nm within 60 minutes.
Calculation
Concentration of cholesterol in sample = Absorbance of sample x conc. Of standard
Absorbance of standard
Concentration of cholesterol standard= 5.33mmo/L (206mg/dl)

2.8.2. Determination of HDL cholesterol
Method: precipitation method [17].
Assay Principle: LDL, VLDL and chylomicron fractions are precipitated quantitatively by the addition of phosphotungtic acid in the presence of magnesium ions. After centrifugation, the cholesterol concentration in the HDL fraction, which remains in the supernatant, is determined.



Procedure

Table 3: Precipitation

Pipette into centrifuge tubes:	
Sample/standard	200ul
Precipitant	500ul

Mixed well and allowed to stand at room temperature for ten (10) minutes. Centrifuge for 10mins at 4,000rpm.
The clear supernatant was separated within two (2) hours and cholesterol concentration determined as shown below.

Table 4

	Reagent blank (ul)	Standard (ul)	Sample (ul)
Distilled H_20	100	---	---
Standard Supernatant	---	100	---
Sample Supernatant	---	---	100
CHOL Reagent	1000	1000	1000

Each tube was mixed and incubated for ten (10) minutes at 25^0C and read at 5000nm in the colorimeter after zeroing with the reagent blank.
Calculation
Concentration of HDL cholesterol in sample =Absorbance of sample x conc. Of standard
Absorbance of standard
Concentration of cholesterol standard = 5.33mmol/L (206mg/dl)

2.8.3. Determination of LDL Cholesterol
Method: calculation using friedwald Equation [18]
In mmol/L:

$$\text{LDL cholesterol} = \frac{\text{TC-TAGs}}{2.2} - \text{HDL cholesterol}$$

TC= total cholesterol In m/dl:

$$\text{LDL cholesterol} = TC - \frac{TAGs}{5} - \text{HDL cholesterol}$$

2.8.4. Determination of Triacylglycerides

Method: GPO-PAP method [19].

Principle: the TAGs are determined after enzymatic hydrolysis with lipase. The indicator is quinoneimine formed from hydrogen peroxide,
4-aminophenazone and 4-chlorolphenol under catalytic influence of peroxidase.

$$\text{Triacylgycerides} + H_20 \xrightarrow[\text{Lipase}]{} \text{glycerol} + \text{fatty acids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow[\text{Kinase}]{\text{Glycerol}} \text{glycerol-3-phosphate} + \text{ADP}$$

$$\text{Glycerol-3-phosphate} + 02 \xrightarrow{\text{GPO}} \text{Dihydroactonephosphate} + H_20_2$$

Table 5*:* procedure

	Reagent blank (ul)	Standard (ul)	Sample (ul)
Distilled H20	10	--	--
Sample	--	--	10
Satandard	--	10	--
Reagent	1000	1000	1000

The tubes were well mixed and incubated at 25^0C for ten (10) minutes. The colorimeter was zeroed with the reagent blank, and absorbance taken at 500nm.

Calculation

Concentration of TAG in sample = $\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}}$ x conc. Of standard

Concentration of TAG standard = 2.17mmol/L (192mg/dl)

2.9. Statistical analysis

The results obtained were presented as mean $\pm$ standard error mean. Differences between means were determined with the one way ANOVA followed by Turkey's post hoc SPSS program (Version 18) for windows (SPSS Inc., Chicago, IL, USA0 was used to analyze the data, $p<0.05$ being considered to be significant.

2.10. Phytochemical analysis

Phytochemical analysis was based on procedures outlined by Harbourne (1073), [20].

Test for carbohydrate

Molisch Test

Procedure: 0-1g of the powdered material was boiled with 2ml of water and filtered. To the filtrate, few drops of naphtol solution in ethanol (molisch,s reagent) were added. Concentrated sulphuric acid was then gently poured down the side of the test to form a lower layer. A purple interfacial ring indicates the presence of carbohydrates.

Test for Reducing Sugars

0.1g of the powder was shaken vigorously with 5ml of distilled water and filtered.

The filtrate was used in the following tests

Fehling's test: to 1 portion of the filtrate, were added equal volumes of fehling's solution 1 and 2 and boiled in water bath for few minutes. A brick red precipitate indicates the presence of reducing sugar.

Benedict test: to 1 ml portion of the filtrate, was added 2ml of Benedict's reagent. The mixture was shaken, heated on a water bath for 5 minutes. A rusty brown precipitates the presence of reducing sugar.

Test for Alkaloids

General test: 20ml of 5% sulfuric acid in 50% ethanol was added to 2g of each of the powdered samples and heated in boiling water bath for 10minutes, cooled and filtered. 2ml of the filtrate was treated with few drops of Mayer's reagent, Dragendorff's reagent, Wagner's reagent, Picric acid solution (1%), while the remaining filtrate with dilute ammonia solution.

The aqueous alkaline solution was separated and extracted with two 5ml portion precipitate with one drop of Wagner's yellow precipitate with one drop of picric acid reagents. Brick red precipitate of Dragendorff's reagent indicates the presence of alkaloids.

Test for Saponins

20ml of water was added to 0.25g of each of the powdered samples in a 100ml beaker and boiled gently on hot water bath for 2 minutes.

The mixture was filtered hot and allowed to cool and filtrate was used for the following tests.

Frothing test: 5ml of the filtrate was diluted with 20ml of water and shaken vigorously. A stable froth (foam) upon standing indicates the presence of saponins.

Emulsions test: To the frothing solution was added 2 drops of olive oil and the content shaken vigorously. The formation of emulsion indicated the presence of saponins.

Test for Tannins

1g of the powered leaves of each sample was boiled with 50ml of water, filtered chloride test and used for the following tests:

Ferric chloride test: To 3ml of the filtrate, few drops of ferric chloride were added. A greenish black precipitate indicates the presence of tannins.

Lead acetate test: To a little portion of the filtrate was added lead acetate solution. A reddish colour indicates the presence of tannins.

Test for Flavonoids: 10ml of ethyl acetate solution was added to 0.2g of each of the powdered Samples and heated in a water bath for 3 minutes. The mixture was cooled, filtered and the filtrate used for the following tests:

Ammonium test: 4ml of filtrate was shaken with 1ml of dilute ammonia solution. The layers were allowed to separate and the yellow colour in the ammoniacal layer indicates the presence of flavonoids.1% aluminum chloride solution test: Another 4ml portion of the filtrate was shaken with 1ml of 1% aluminum chloride solution. The layers were allowed to separate. A yellow colour in the aluminum chloride layer indicates the presence of flavonoids.

Test for Resins

Precipitation test: 0.2g of the powdered material was extracted with 15ml of 96% ethanol. The alcoholic extract was then poured into 20ml of distilled water in a beaker. A precipitate occurring indicates the presence of resins.

Test for proteins
Million's test: To a little portion of the filtrate in test tube, two drops of million's reagent was added. A white precipitate indicates the presence of proteins.
Xanthroproteic reaction test: 5ml of filtrate was heated with few drops of concentrated nitric acid. A yellow colour which changes to orange on addition of an alkali indicated the presence of protein.
Picric acid test: To a little portion of the filtrate was added a few drops of picric acid. A yellow precipitate indicated the presence of proteins.

Test for Steroids and Terpenoids.
Another 9ml of ethanol was added to 1g of the powder and refluxing was done for a few minutes and then the mixture was filtered. The filtrate was concentrated to 2.5ml in boiling Water bath and 5ml of hot water added. The mixture was allowed to stand for 1 hour and then filtered. The filtrate was extracted with 2.5ml of chloroform and 1ml of concentrated sulphuric acid added to form a lower layer. A reddish brown interface showed the presence of steroids.

Test for Terpenoids.
0.5ml of the chloroform extract was evaporated to dryness and heated with 3ml of concentrated sulphuric acid for 10minutes on a water bath. A grey colour indicates the presence of terpenoids.

Test for acid compounds
0.1g each of the powder samples was placed in a clean dry test tube and sufficient water added. This was warmed in a hot water bath and the colour change on the litmus paper used act as indicator for acid presence.

3. Results.

Table 6: effects of Crude Ethanolic Leaf Extract of *Thymus vulgaris* on lipid Profile of lipid Fed Rats

Groups	Triglyce rides (mmol/l)	Total Cholest Erol	High Density Lipopro	Low Density Lipopro	Very Low Density
		(mml/L)	TEIN	TEIN	LIPOPRO
			CHOLEST	CHOLEST	TEIN
			EROL	EROL	CHOLEST
			(mmol/L)	(mmol/L)	EROL
Group a (150mg/kg) eetv)	0.48±0.09 f, h	3.65±0.20 c, i	1.70±O.18 b, g	1.74±O.31 b	0.22±0.04 f, g
Group b (300mg/kg) eetv)	0.42±0.09 f, h	3.05±O.28 c, i	1.65±0.46 a	1.21±39	0.19±0.43 f, h
Group c atorvas tatin)	1.18±.09 c	3.61±0.46 c, i	1.60±0.30 a	1.48±0.39	0.53±0.40 c
Group d (2000mg/kg cholest erol)	0.96±0.10 c	5.15±0.11 c, f	2.60±0.10 c, d	2.12±0.45 b	0.53±0.40 c
Group e (normal control)	0.22±O.02 f, i	1.19±0.15 f, i	0.56±0.11 d, i	0.56±0.11 h	0.10±0.01 f, i
F- ratio	24.749	59.918	12.067	7.309	24.679
p-value	<0.001	<0.001	<0.01	<0.01	<0.001

Key: a= p>0.05, b=p>0.01, c=p>0.001 when compared with the normal control D=p>0.05, e=p>0.01, f=p>0.001 when compared to with the positive control G=p>0.05, h=p>0.01, i=p>0.001 when compared with the negative control Eetv = ethanol extract of *thymus vulgaris* Positive control= atorvastatin group Negative control = group fed with cholesterol only

3.1. Toxicity test (LD_{50})
Result of acute toxicity test showed that the extract had an oral LD_{50}>3000mg/Kg in rats. Preliminary quantitative photochemistry screening revealed the presence of flavonoids, thymol, carvacrol, eugenol, phenol, luteolin and tetrathoxylated.
There was significant increase in the mean triglycerides (TG) levels of group C and D with mean TG levels of 1.18+0.09 mmol/L respectively when compared with the normal control group (0.22+0.02 mmol\L;p<0.001). groups A, B, C, and D had mean total cholesterol levels of 3.65+0.20 mmol/L, 3.0+0.28 mmol/L, 3.61+0.224mmol/L, 5.15+0.11mmol/L respectively and these were significantly high than the mean total cholesterol level of the normal control group (1.19+0.15mmol/L; p<0.001). also the mean HDL cholesterol level of groups A, B, C, and D were significantly higher than the normal control value, (p<0.001; Table 1). Groups C and D had significantly lower VLDL-C values when compared with the normal control, (p<0.001).
Furthermore, rats in groups A and B had mean total cholesterol levels of 3.65+0.20mmol/L and 3.05+0.28mmol/L respectively and these were significantly lowered when compared with the negative control group with mean total cholesterol level of 5.15+0.11 mmol/L (p<0.001). The atorvastatin group (positive control), had also significantly lower mean total cholesterol level when compared with the negative control group.
It was also noted that rats in the negative control group and those that received the lowest dose of the extract (group A) had significantly increased and mean LDL-cholesterol levels when compared with the atorvastatin control group (p<0.001).

4. Discussion
High cholesterol (hypercholesterolemia) is a major risk factor for coronary heart disease, a cause of heart attacks, and reducing blood lipid levels lowers the cardiovascular risk. High levels of LDL lead to a build-up of cholesterol in the arteries, whereas HDL carries cholesterol to the liver for removal from the body. A build-up of cholesterol is part of the process that narrows arteries, called atherosclerosis, in which plaques form and cause restriction of blood flow [21]. The health significance is that such individuals are prone to cardiovascular diseases. If a clot forms and blocks the narrowed artery, a series of cardiovascular disease such as hypertension, myocardial infarction, arteriosclerosis, angina pectoris, heart attack or stroke can result [22]. High levels of cholesterol are also closely associated to diabetes. HDL is known as "good" cholesterol in that it removes excess cholesterol in the arteries and transports it back to the liver for excretion or neutralization, and thus preventing the arteries from clogging.
Atorvastatin is a HMG-C0A reductase (HMGR) inhibitors and a member of the family of drugs referred to as the statins. The net result of treatment is an increased cellular uptake of LDLs, since the intracellular synthesis of

cholesterol is inhibited and cells are therefore dependent on extracellular sources of cholesterol. However, since mevalonate (the product of the HMG-CoA reductase reaction) is required for the synthesis of other important isoprenoid compounds besides cholesterol, long-term treatments carry some risk of toxicity [23, 24].

In this study, lipid profiles (TG; Total Glycerol, CHOL; cholesterol, HDL; High Density Lipoprotein, VLDL; very Low Density Lipoprotein, LDL; Low Density Lipoprotein) were increased after cholesterol administration. However, it was observed that both the low dose (150mg/bw) of EETV and high dose (300mg/Kg/bw) of EETV lowered the levels of these cholesterol parameters in the rats.

When compared with those that received atorvastatin which also showed a reduction in the levels of these lipid profiles, the degree of reduction was more in those that received EETV than those that received atorvastatin. The remedial potential of *Thymus vulgaris* is due to the abundance of oils, saponins, polyphenols, flavonoids, and tannins. There were no alkaloids, glycosides and terpenoids. In recent years, *Thymus vulgaris* has gained particular interest as a useful and health promising agent as compared with other structurally related flavonoids because of its low intrinsic toxicity and prominent effects on normal verses cancer cells [25]. Thyme has changed from a traditional herb to a serious drug rational phytotherapy. It is incredible wellspring of iron, calcium, manganese, vitamin K and likewise upgrades blood flow and pushes and invigorating impact for the entire system [26].

5. Conclusion.

From the results of this study it could be concluded that *Thymus Vulgaris* has a hypolipidemic effect in cholesterol fed rats, the hypolipidemic effect of EETV was more when compared with that of atorvastatin. This shows that *T. vulgaris* can protect against a series of cardiovascular diseases such as hypertension, myocardial infarction, arteriosclerosis, angina pectoris, heart attack or stroke.

6. Acknowledgments

We sincerely wish to appreciate the intellectual support of the staff and management of the Department of Medical Laboratory Sciences of the college of Medicine [University of Nigeria, Nsuka, Nigeria] and Dr. Jummai Adamu Tutuwa, the Director, Bioresources Development Centre, National Biotechnology Development Agency, Jalingo, Nigeria.

References.

1. Micheal C Philips. “Molecular mechanisms of cellular cholesterol efflux”. J Biol. Chem. 2014; 289(35):24020-24029.
2. Schmitz G, Orso E. “Lipoprotein (a) hyperlipidemia as cardiovascular risk factor: Pathophysiological aspects”: chemical research in cardiology supplements. 2015; 10(1):21-25.
3. Micheal B Fessler. “Revisiting “Good” and “Bad” Cholesterol. The battle over flow through arteries now shifts to flow through airways”. AM J Respir crit care Med. 2015; 191(9):969-970.
4. Campos H, Moye LA, Glasser SP, Stampfer MJ, Sacks FM. Low-density lipoprotein size, pravastatin treatment and coronary events. JAMA. 2001; 286:1468-1474.
5. Assmann G. “Pro and con: High-density lipoprotein, triglycerides, and other lipid subfractions are the future of lipid management”. AM J Cardiol. 2001; 87:2B-7B.
6. Behrman EJ, Venkat Gopalan. Cholesterol and plants. J.Chem.Edu. 2005; 82(12):1771.
7. James E Dalen, Joseph S Alpert, Robert J Goldberg and Ronald S. Weinstein; “The Epidemic of the 20(th) century: Coronary Heart disease”. (2014). AM J Med. 2014; 127(9):807-812.
8. Bandeali S, Farmer J. “High-density lipoprotein and atherosclerosis: the role of antioxidant activity”. (2012).Curr Atheroscler Rep. 2012; 14:101-107.
9. John D Brunzell, Micheal Davidson, Curt D Furberg, Ronald B Goldberg, Barbara V Howard, James H Stein, *et al*. “Lipoprotein management in Patients With Cardiometabolic risk: Consensus statement from the American diabetes association and the American college of cardiology foundation” Diabetes care. 2008; 31:811-822.
10. Mousavi SM, George W, David R, Mirzargar SS, Omidbaigi R. “Antibacterial activities of a new combination of essential oils against marine bacteria”. Aquaculture International. 2011; 19(1):205-214.
11. Srinivasan D, Perumalsamy LP, Nathan S, Sures T. “Antimicrobial activity of certain indian medicinal plants used in folkloric medicine”. Journal of Ethnopharmacology. 2001; 74(3):217-222.
12. Baquar SR. Textbook of economic botany. 1ST Edn, Lahore: Published in Pakistan by Ferozsons(Pvt) Ltd, 2001.
13. Hill AF. Economic botany: A textbook of useful plants and plant products. 2nd Edn.: McGraw-Hill Book Co., Inc., New York, 1952.
14. (Hosseinzadeh S, Kukhdan AJ, Hosseini A, Armand R. “The application of Thymus vulgaris in traditional and Modern medicine”. (2015). A review. Global journal of pharmacology. 2015; 9(3):260-266.
15. American Physical Society (APS), Ethics and values 02.2APS Guidelines for professional conduct, 2002.
16. Charles C Allain, Lucy S Poon, Cicely SG Chan, Richmond W, Paul C. Fu; Enzymatic determination of total serum cholesterol. 1974; 20(4):470-475.
17. Warnick GR, Benderson J, Albers JJ. “Dextran sulfate-Mg2+ precipitation procedure for quantitation of high-density lipoprotein cholesterol”. 1982; 28(6):1379-1388.
18. Friedewald WT, Levy RI, Fredrickson DS. “Estimation of the concentration of Low-density Lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. 1972; 18(6):499-502.
19. Fossati P, Prencipe L. “Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide”. 1982; 28(10):2077-2080.
20. Trease GE, Evans WC. Pharmacognosy. 11th edition, Baillier Tindall, London, 1989, 45-50.
21. Mendis S, Puska P, Norrving B. “Global atlas on cardiovascular disease prevention and control. 1st edition. Geneva: World Health Organization in collaboration with the world Heart Federation and the World stroke Organization, 2011, 3-18.
22. Harvard Health Letter; The pollypill could reduce cardiovascular disease by 80 percent. Harvad Health Publishing: Harvard Medical School, 2004.
23. Reddy PV, Sarkar L, Urooj A. “Inhibition of 3-hydroxy-3-methylglutaryl coenzyme A(HMG-CoA)

reductase (ex vivo) by medicinal plants from Western Ghats" Annals of Phytomedicine. 2014; 3(1):56-61.
24. Gholamhoseinian A, Shahouzehi B, Sharifi-Far F. "Inhibitory activity of some plant methanolic extracts on 3-ahydroxy-3-Methylglutaryl coenzyme A reductase". International Journal of Pharmacology. 2010; 6(5):705-711.
25. Kapinova A, Stefanicka P, Kubatka P, Zubor P, Uramova S, Kello M, *et al*. "Are plant-based functional foods better choice against cancer than single phytochemicals? A critical review of current breast cancer research". Biomed. Pharmacother. 2017; 96:1465-1477.
26. Kapinova A, Kubatka P, Golubnitschaja O, Kello M, Zubor P, Solar P, *et al*. Dietary phytochemicals in breast cancer research: Anticancer effects and potential utility for effective chemoprevention'. Environ. Health prev. Med, 2018, 23-36.
27. Brown MS, Goldstein JL. "A receptor-mediated pathway for cholesterol homeostasis" Science. 1986; 232(4746):34-47.
28. Wie MB, Won MH, Lee KH, Shin JH, Lee JC, Suh HW, Song DKm, *et al*. "Eugenol protects neuronal cells from excitotoxic and oxidative injury in primary cortical cultures". Neuroscience Letters. 1997; 225(2):93-96
29. Mohsin A, Shah AH, Al-Yahya MA, Tariq M, Tanira MOM, Ageel AM, *et al*. Analgesic, antipyretic activity and phytochemical screening of some plants used in traditional arab system of medicine". Fitoterapia. 1989; 60(2):174-177
30. Artiss JD, Zak B. "Measurement of cholesterol concentration". In N Rifai, GR Warnick, MH Dominiczak (eds) Handbook of Lipoprotein Testing. AACC Press, Washington, 1997, 99-114.
31. Hayek T, Ito Y, Azrolan N. "Dietary fat increases high density lipoprotein (HDL) levels both by increasing the transport rates and decreasing the fractional catabolic rates of HDL cholesterol ester and apolipoprotein (Apo) A-I. Presentation of a new animal model and mechanistic studies in human Apo A-I transgenic and control mice". J Clin Invest. 1993; 91:1665-71.
32. Watts GF, Barrett PH, Juying J. Differential regulation of lipoprotein kinetics by atorvastatin and fenofibrate in subjects with the metabolic syndrome. Diabetes. 2003; 52:803-11.
33. Frenais R, Ouguerram K, Maugeais C. "Effect of dietary omega-3 fatty acids on high-density lipoprotein apolipoprotein AI kinetics in type II diabetes mellitus". Atherosclerosis. 2000; 157:131-5.
34. Grundy SM. "Hypertriglyceridemia, insulin resistance, and the metabolic syndrome Am J Cardiol. 1999; 83:25F–9F