



Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.elsevier.com/locate/apjtb



Document heading

Hypolipidemic effects of aqueous extract of *Acalypha capitata* leaves in rats fed on high cholesterol diet

Nnodim Johnkennedy^{1*}, Emejulu Adamma², Nwadike Constance Nnedimma³

¹Department of Chemicalpathology Laboratory, General Hospital Owerri, Imo State, Nigeria

²Department of Biochemistry, Federal University of Technology, Owerri, Imo State, Nigeria

³Department of Medical Laboratory Science, Imo State University, Owerri, Imo State, Nigeria

ARTICLE INFO

Article history:

Received 5 August 2011

Received in revised form 27 August 2011

Accepted 25 September 2011

Available online 15 October 2011

Keywords:

Acalypha capitata

Lipid profile

Hypercholesterolaemia

ABSTRACT

Objective: To evaluate the hypolipidemic effects of aqueous extract of *Acalypha capitata* (*A. capitata*) leaves in rats fed on high cholesterol diet. **Methods:** Cholesterol diet was administered to Wistar rats at a dose of 40 mg per 0.2 mL 3 times daily for 14 days while the control received distilled water. These animals were treated with extract of *A. capitata* at doses of 100 and 200 mg/kg. Lipid profiles were observed and compared. **Results:** Administration of *A. capitata* caused significant decrease in cholesterol, triglyceride and low density lipoprotein-cholesterol when compared with the control ($P < 0.05$) which was dose dependent. Also, it was observed that high density lipoprotein-cholesterol was significantly increased when compared with the control. **Conclusions:** This observation suggests that the leaf extract of *A. capitata* could probably serve as a potential natural product for treatment of hyperlipidaemia.

1. Introduction

Historically, medical plants have been recognized to be of great importance to the health of individuals and communities. In many developing countries herbal preparations are assuming greater importance in primary health care. Folk medicine reportedly uses *Acalypha capitata* (*A. capitata*) as a herbal remedy for the management of hypertension in the southern part of Nigeria^[1]. Products of plant origin have been shown to be effective sources of chemotherapeutic agents without underlying side effects^[2,3]. *A. capitata* belongs to the family Euphorbiaceae. It is a popular outdoor plant that provides colour throughout the year. Its common names are copper leaves or three seeded mercuries^[4] and it is propagated by cuttings at any time of the year. It has leaves that are alternate, elliptic to oval, serrate and small conspicuous flowers. The leaves from some plants served as food, vegetable and the extracts are used as tonic in treatment of hypercholesterolemia in

the southern Nigeria^[5]. Hypercholesterolemia is reported as a major risk factor for cardiovascular disease which is the common cause of morbidity and mortality. Diet rich in cholesterol, age and hypertension are contributing factors to heart failure^[6].

High levels of low density lipoprotein cholesterol (LDL-C) are associated with hypercholesterolemia^[7]. Drugs like fibrates and bile acid sequestrants have been used several years for lowering cholesterol level. But high prevalence of their adverse effects led to the introduction of statin^[8]. Though statin has fewer side effects in recognition of the harmful effects associated with synthetic lipid lowering drugs, the zeal for herbal products with lipid lowering potential with minimal or no adverse effect becomes so significant. *A. capitata* is used as a herbal remedy for the management of hypertension in southern Nigeria. However, there is scarcity of scientific research to give credence to the use of this plant *A. capitata* in the treatment of hypercholesterolemia or related vascular diseases in herbal homes in southern Nigeria particularly Owerri, Imo State. Hence, this study was undertaken to provide scientific information on the use of *A. capitata* in the treatment of vascular diseases.

*Corresponding author: Nnodim Johnkennedy, Department of Chemicalpathology Laboratory, General Hospital Owerri, Imo State, Nigeria.
E-mail: johnkennedy23@yahoo.com

2. Materials and methods

2.1. Chemicals

Cholesterol was manufactured by Aldrich Chemical Co. Milwaukee, WI U.S.A and was purchased from the chemist in Ekenunwa market in Owerri, Imo State, Nigeria.

2.2. Plant material and extraction

The leaves of *A. capitata* were collected at the suburb of Owerri, near General Hospital Owerri. The plant was identified and confirmed by Dr. C Okeke of Department of Plant Biology and Biotechnology of Imo State University Owerri. They were washed, sundried and ground into powder for use. The dried leaves of *A. capitata* were milled to get a coarse powder used for the extraction. The powder was macerated in a 400 g percolator with 250 mL of distilled water. The mixture was allowed to stand for 48 hours after it was filtered. The filtrate was then placed in an oven to evaporate and the solid residue was referred to as extract. The appropriate concentrations of the extract were made in distilled water for the experiment. Hence, the following concentrations *i.e.* 100 and 200 mg were prepared.

2.3. Experimental design

The albino rats weighing (180–300 g) obtained from the Animal House of Imo State University were used in this investigation. The animals were kept in cages in a room and maintained at room temperature with a 12–hours light dark cycle for one week to acclimatize. The animals were randomly assigned to six experimental groups with six rats in each group. Animals in group I which served as normal control were given distilled water; group II and III were given 100 and 200 mg/kg b.w. of extract, respectively for 14 days; group IV received 0.4 mg/0.2 mL of cholesterol only; group V and VI received 0.4 mg/0.2 mL of cholesterol and were treated with 100 and 200 mg/mL of extract, respectively. In all groups, the extract was administered through oral route. This treatment was performed by oral compulsion. All animals

were allowed free access to food and water throughout the experiment.

2.4. Blood collection

Twenty four hours after the last doses were administered, the animals were anaesthetized with chloroform vapour, quickly brought out of the jar and sacrificed. Whole blood was collected by cardiac puncture from each animal into clean dry test tubes and EDTA containers. The blood in the clean dry test tubes was allowed to stand for about 15 minutes to clot and further spun in a Westerfuge centrifuge (Model 1384) at 10000 g for 5 minutes, serum was separated from the clot with Pasteur pipette into sterile sample tubes for the estimation of lipid profile.

The serum lipid profile was measured by the colorimetric method using Biosystem Kits: cholesterol (COD11505), triglyceride (COD11528), high density lipoprotein cholesterol (HDL-C) (COD 11523) and LDL-C (COD11579).

2.5. Statistical analysis

The results were expressed as mean \pm standard deviation. The statistical evaluation of data was performed by using one-way ANOVA (analysis of variance) followed by Duncan's multiple range test^[9].

3. Results

In the present study, it was observed that Wistar rats fed with high cholesterol diet for 14 days had higher plasma cholesterol and triglyceride as compared with control (Table 1). However, the rats fed with high cholesterol diet and extract of *A. capitata* were observed to have reduced serum cholesterol level which was dose dependent. Treatment with varied concentrations of *A. capitata* caused a significant elevation of serum HDL-C when compared with control. On the other hand, hypercholesterolemia Wistar rats administered with *A. capitata* showed a reduction in LDL-C for 14 days when compared with the control.

Table 1

Lipid profile of rats fed with high cholesterol and different concentrations of *A. capitata* leaf extract.

Groups	Cholesterol (mmol/L)	Triglyceride (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)
Group I	1.86 \pm 0.11	1.79 \pm 0.05	1.09 \pm 0.01	0.25 \pm 0.00
Group II	1.80 \pm 0.13	1.73 \pm 0.04	1.14 \pm 0.01	0.19 \pm 0.00
Group III	1.71 \pm 0.11	1.62 \pm 0.05	1.29 \pm 0.02	0.18 \pm 0.01
Group IV	2.91 \pm 0.16	2.43 \pm 0.06	0.02 \pm 0.02	0.31 \pm 0.01
Group V	2.01 \pm 0.13	1.99 \pm 0.07	0.98 \pm 0.02	0.28 \pm 0.00
Group VI	1.91 \pm 0.16	1.84 \pm 0.08	0.87 \pm 0.02	0.26 \pm 0.01

4. Discussion

In the southern Nigeria, particularly Owerri, Imo State, the medicinal use of herbs is phenomenal as there is hardly any local meal without herbs.

Evidently the use of *A. capitata* in our local communities as vegetable and its use in the treatment of hypertension are major reasons for giving various attentions to research in prognosis of cardiovascular disease risk factors^[10]. The presence of high cholesterol in diet has been linked to cause elevated plasma cholesterol and may increase aortic atherosclerosis. Few studies have indicated that diet treatment or drug therapy can reduce plasma cholesterol. Several efforts have been made to reduce the risk of cardiovascular disease through cholesterol regulation. Hence, the therapeutic benefits of plant foods have been the centre of different dietary studies^[11–13].

In the present study, it was observed that Wistar rats fed with high cholesterol diet for 14 days had higher plasma cholesterol and triglyceride as compared with the control. However, the rats fed with high cholesterol diet and extract of *A. capitata* were observed to have reduced serum cholesterol level which was dose dependent. This probably suggests that *A. capitata* leaf extract reduced the hepatic triglyceride and favoured the redistribution of cholesterol among the lipoprotein molecules. This is in line with the work of Oluwatosin *et al*^[5,12] in which *Vernonia amygdalina* reduces cholesterol levels in treated rats. The result clearly indicates that the administration of aqueous leaf extract of *A. capitata* produced a hypolipidemic effect. This shows that there are many bioactive constituents present in the extract and hence at the present, it is not certain which of them are responsible for the observed effects. It has been reported that flavonoids, tannins, and saponins play role in hypolipidemic effect^[14,15]. However, the treatment with varied concentrations of *A. capitata* caused a significant elevation of serum HDL cholesterol when compared with the control. This could be probably due to the fact that HDL extracts part of its anti atherogenic effect by counteracting LDL oxidation^[16,17]. This is in line with the work of Visavadiya and Narasimhacharya^[18]. On the other hand, hypercholesterolemia Wistar rats administered with *A. capitata* showed a reduction in LDL-C for 14 days when compared with the control. The major risk factors for cardiovascular disease include high level of LDL-C. In recognition of the fact that high level of LDL-C plays a major role in the atherogenic process, therapeutic intervention to lower the LDL-C becomes very relevant. Hence, *A. capitata* showed a beneficial effect by lowering serum LDL-C, total cholesterol and triglyceride as well as increasing the HDL-C. This probably shows that *A. capitata* could offer a beneficial role in patient with cardiovascular disease.

Conflict of interest statement

We declare that we have no conflict of interest.

References

- [1] Ikwuchi CJ, Ikwuchi CC, Onuka CF. *Acalypha wilkesiana* Muell. Arg. induced diuresis in salt loaded rats, implication for the management of edema, obesity and hyper tension. *J Appl Sci Environ Manag* 2009; **13**(4): 51–54.
- [2] Ikechukwu JC, Anyadiegwu A, Ugono EY, Okongbowa SO. Effects of *Acalypha wilkesiana* Muel. Arg. on plasma sodium and potassium concentration of normal rabbits. *Pak J Nutr* 2008; **7**(1): 130–132.
- [3] Inighe MO, Malomo SO, Adebayo JO. Hepatoprotective effect of the aqueous extract of leaves of *Acalypha racemosa* in carbon tetrachloride treated rats. *J Med Plant Res* 2008; **2**(10): 301–305.
- [4] Iwalokun BA, Efedede BU, Alabi–Sofunde JA, Oduala T, Magbagbeola OA, Akinwande AI. Hepatoprotective and antioxidant activities of *Vernonia amygdalina* on acetaminophen induced hepatic damage in mice. *J Med Food* 2006; **9**: 524–530.
- [5] Grubben GJH, Denton OA. *Plants resources of tropical Africa 2: vegetables*. Wageningen: Backhuys; 2004.
- [6] Oluwatosin AA, Olajumoke AJA, Michael AF. Lipid lowering effects of methanolic extract of *Vernonia amygdalina* leaves in rats fed on high cholesterol diets. *Vasc Health Risk Manag* 2008; **4**(1): 235–241.
- [7] Schaefer EJ, Lichtenstein AH, Lamon–Fava S, McNamara JR, Ordovas JM. Lipoprotein, nutrition aging and atherosclerosis. *Am J Clin Nutr* 1995; **61**: 726S–740S.
- [8] Krieger M. The “best” of cholesterol, the “worst” of cholesterol: a tale of two receptors. *Proc Natl Acad Sci USA* 1998; **95**: 4077–4080.
- [9] Miller CA. Update on statins and other lipid lowering drugs. *Geriatr Nurs* 2001; **22**: 276–277.
- [10] Duncan BD. Multiple range test for correlated and heteroscedastic means. *Biometrics* 1957; **13**: 359–364.
- [11] Edet EE, Akpanabiatu MI, Umoh IB, Itan EH. Effect of *Gongronema latifolium* crude leaf extract on some cardiac enzymes of alloxan–induced diabetic rats. *Afr J Biochem Res* 2009; **3**(11): 366–369.
- [12] Oladunmoye MK. Comparative evaluation of antimicrobial activities and phytochemical screening of two varieties of *Acalypha wilkesiana*. *Int J Trop Med* 2006; **1**(3): 1348–1356.
- [13] Zhang HW, Zhang YH, Lu MJ. Comparison of hypertension, dyslipidaemia and hyperglycemia between buckwheat seed–consuming Mongolia Chinese population in inner Mongolia china. *Clin Exp Pharmacol Physiol* 2007; **34**: 838–844.
- [14] Nwanjo HU. Efficacy of aqueous leaf extract of *Vernonia amygdalina* on plasma lipoprotein and oxidative status in diabetic rats models. *Niger J Physiol Sci* 2005; **20**: 39–42.
- [15] Ezekwe CI, Obidoa O. Biochemical effect of *Vernonia amygdalina* on rats liver microsomes. *Niger J Biochem Mol Biol* 2001; **16**(3): 1745–1798.
- [16] Yokozawa T, Cho EJ, Sasaki S. The protective the Chinese prescription kangen–karyu extract on diet induced hypercholesterolemia in rats. *Biol Pharm Bull* 2006; **29**: 760–765.
- [17] Hu SH, Liang ZC, Chia YC, Lien JL, Chen KS, Lee MY, et al. Antihyperlipidemic and antioxidant effects of extracts from *Pleurotus citrinopileatus*. *J Agric Food Chem* 2006; **22**: 2103–2110.
- [18] Visavadiya NP, Narasimhacharya AV. Ameliorative effect of *Chlorophytum borivillianum* root on lipid metabolism in hyperlipaemic rats. *Clin Exp Pharmacol Physiol* 2007; **34**: 244–249.