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Hypolipidaemic and Cardioprotective Activity of *Mammea africana*

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Abstract: The effect of ethanolic stembark extract of *Mammea africana* Sabine on total cholesterol, triglyceride and lipoproteins levels was studied on normal rats. The extract (30-90 mg kg^{-1}) was orally administered to rats for 21 days after which they were sacrificed and blood taken for analysis. The extract produced a significant ($p<0.05$) dose-dependent decrease in the levels of total cholesterol, triglyceride, LDL-cholesterol and VLDL cholesterol, with a significant ($p<0.05$) increase in the level of HDL-cholesterol. The stembark extract has the potential to produce hypolipidaemia as well as preventing the development of atherosclerosis.

Key words: Hypolipidaemic, cardioprotective, *Mammea africana*, lipoproteins

INTRODUCTION

Heart diseases have been implicated as leading causes of death for both men and women of all racial and ethnic groups (Smith, 2004). The elevation of serum total cholesterol and low density lipoprotein (LDL) cholesterol have been implicated as a primary risk factor for cardiovascular disease (Edijala *et al*., 2005). A number of plants have been used traditionally in the treatment of various cardiovascular diseases of which *Mammea africana* is one of them.

Mammea africana Sabine (syn. *Ochrocarpus africana* Oliv.) (Guttiferae) is a large forest tree of 50-100 feet high with bark often yellow with pale scales and resinous yellow sap (Daziel, 1956). The plant is widely distributed in Tropical Africa. The stem bark of the plant is used traditionally by the Ibibios of Niger Delta region of Nigeria in the treatment of hypercholesterolemia, internal heat and microbial infections. It is reported by Adjanohoun *et al*. (1996) to be used in the treatment of rheumatic pains, cough and hypertension. The antimalarial (Okokon *et al*., 2006), antidiabetic (Okokon *et al*., 2007) and vasorelaxant (Dongmo *et al*., 2006) properties of the plant have been reported. The chloroformic and ether stembark extracts are reported to possess cytotoxic activity on cell culture (Chapius *et al*., 1988). Ouahouo *et al*. (2004) reported cytotoxic coumarins with antimicrobial activity against *Staphylococcus aureus* from the plant stembark. The stembark has also been reported to contain 5-7-dihydroxy-8-(12-methyl-butryl)-4-N-pentyl coumarins (Carpenter *et al*., 1971; Crichton and Waterman, 1978; Carpenter *et al*., 1970) and Mesuxanthane B (Carpenter *et al*., 1971). The heartwood has been reported to contain xanthone (Carpenter *et al*., 1969), friedelin (triterpene) (Crichton and Waterman, 1978) and flavonoids (Carpenter *et al*., 1970). Alkaloids have been reported to be absent in the entire plants parts (Garflans *et al*., 1980). The present study was aimed at assessing the effect of the stembark extract on total cholesterol, triglyceride and lipoproteins levels of rats so as to evaluate its cardioprotective potentials.

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MATERIALS AND METHODS

Plant Material

Fresh stembark of *M. africana* were collected in November, 2004, from Anwa forest in Uruan area of Akwa Ibom State and authenticated by Dr. (Mrs.) Margaret Bassey, a taxonomist in Botany Department, University of Uyo, Uyo-Nigeria. Hebarium specimen was deposited at Faculty of Pharmacy, University of Uyo, Uyo with voucher No. FPHU 381.

The fresh stembark (4 kg) of the plant was dried on a laboratory table for 2 weeks and reduced to powder. The powder (300 g) was macerated in ethanol (500 mL) for 72 h. The liquid extract obtained was concentrated *in vacuo* at 40°C. The yield was 3.51%. The extract was stored in a refrigerator at 4°C until used for experiment reported in this study.

Animals

The animals used in the study were adult male and female albino wistar rats (150-220 g) obtained from University of Uyo animal house, Uyo, Nigeria. The animals were used after acclimatization period of 10 days to room temperature and relative humidity of 28±5°C and 50%, respectively. They were housed in standard cages and maintained on standard animal pellets (Pfizer livestock feeds, Aba, Nigeria) and water *ad libitum*. The study was approved by University of Uyo College of Health Sciences Animal Ethics Committee.

Experimental

The rats were weighed and randomly assigned on the basis of weight into 4 groups of 5 animals each. Animals in Groups A, B and C were orally administered with 30, 60 and 90 mg kg^{-1} of the extract respectively, while animals in group D were orally given normal saline 5 mL kg^{-1} and served as control. Administration of the extract continued for 21 days between 08:00 and 09:00 h each day. Twenty four hours after the last administration, the animals were anaesthesized with chloroform vapour and dissected. Whole blood was obtained by cardiac puncture from each rats and collected into sample bottles. Serum total cholesterol, triglyceride and High Density Lipo-protein (HDL) levels were measured by enzymatic colorimetric method using Randox kits. The concentration of Low Density Lipoprotein (LDL) cholesterol and Very Low Density Lipoprotein (VLDL) were calculated by the formula of Friedwald *et al*. (1972).

Statistical Analysis

All Data obtained were statistically analysed using one way ANOVA followed by Tukey-Kramer post test.

RESULTS AND DISCUSSION

The ethanolic stembark extract of *M. africana* produced a significant ($p<0.05$) decrease in the levels of total cholesterol, triglyceride, LDL-cholesterol and VLDL-cholesterol of the extract treated group compared to control after 21 days of administration of the extract in a dose dependent fashion. The reduction was more pronounced at the highest dose of the extract (Table 1). However, there was a significant ($p<0.05$) increase in the levels of HDL-cholesterol in a dose dependent fashion when compared to control.

Hyperlipidaemia has been implicated in the development of atherosclerosis (Kaplan, 1989). Accumulation of lipids in the arterial wall plays a crucial role in the development of atherosclerosis by impairing the endothelial function which can subsequently result in vasoregulation, platelet and monocyte adhesion, vascular smooth muscle cell growth and oxidization of LDL (Vogel, 1997;

Table 1: Effect of ethanolic stembark extract of *Mammea africana* on serum total cholesterol, triglyceride, hdl-cholesterol, ldl-cholesterol and VLDL-cholesterol

Group (n = 5)	Dose (mg kg^{-1})	Total cholesterol	Triglyceride	HDL-CHOL	LDL-CHOL	VLDL-CHOL
			(mmol L^{-1})			
Control		3.35±0.05	1.66±0.05	0.58±0.02	3.10±0.10	0.33±0.01
Extract	30 p.o.	2.85±0.05**	1.43±0.11*	0.68±0.03*	2.49±0.15**	0.29±0.05
	60 p.o.	2.83±0.15**	1.42±0.03**	0.72±0.06*	2.39±0.23**	0.28±0.01*
	90 p.o.	2.80±0.11**	1.41±0.03**	0.82±0.07*	2.26±0.24**	0.28±0.02*

Data are expressed as Mean±SEM, n = 5 *: $p<0.05$, **: $p<0.01$

Shaila *et al*., 1995). Lowering of the lipid levels could reduce the risk of Cardiac Heart Disease (CHD) by regression of atherosclerosis. Oxidation of LDL has been known to play a crucial role in atherogenesis or formation of atheroma. In the result of this study, there was a significant reduction in the levels of total cholesterol, triglycerides, LDL and VLDL-cholesterol of the extract treated rats which could have resulted from the antioxidant properties of the extract especially in the case of LDL and VLDL. This finding corroborates that of Okokon *et al*. (2007), who reported similar reduction in diabetic rats. Lowering of cholesterol levels in rats have been reported to be due to antioxidant activity of phytochemical compounds such as flavonoids (Igarashi and Onhuruma, 1995). HDL functions in the transport of cholesterol away from the peripheral tissues to the liver, thus preventing the genesis of atheroselerosis. The observed significant increase in the level of HDL, further points to the cardiac protective activity of the stembark extract.

CONCLUSIONS

In this study, it is evident that ethanolic stembark extract of M. africana possesses anticholesterolaemic and antihyperlipidaemic properties. Thus, the stembark maybe use in the prevention and management of cardiovascular disorders. However, further studies should be carried out to determine the active principles and the exact mechanism of hypolipidaemic effects.

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