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The Effects of Ethanolic Leaf Extract of *Commiphora africana* (Buseraceae) on Lipid Profile in Rats

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Abstract: The effects of ethanolic leaf extract of *Commiphora africana* on some serum lipid profiles were investigated in rats. Graded concentrations of 0, 25, 50, 100 and 150 mg kg⁻¹ body weight of the extract were administered by gastric incubations for 24 h, 48 h and 10 days durations. The following lipid profiles were examined in the serum: total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol and triglycerides. After these durations of treatment there were significant decreases in total cholesterol (p<0.05), triglycerides (p<0.05) and LDL cholesterol (p<0.01), while there was a significant (p<0.01) increase in HDL cholesterol. The result therefore suggests that *Commiphora africana* ethanolic leaf extract possesses anti-lipidaemic properties and may be used for the management of cardiovascular disorders.

Key words: *Commiphora africana*, Anti-cholesterolaemic, Anti-lipidaemic, HDL cholesterol, LDL cholesterol

INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death for both men and women among all racial and ethnic groups (Smith, 2004). The elevation of serum total cholesterol and more importantly low density lipoprotein (LDL) cholesterol have been implicated as a primary risk factor for cardiovascular disease (Edijala *et al.*, 2005).

Medicinal plants have been used in Africa for many centuries and today almost every part of the world uses herbal plants for the treatment of different diseases (Adewunmi and Ojewole, 2004). A number of studies have shown that the reduction of LDL-cholesterol with medicinal plants will reduce the incidence of cardiovascular diseases and overall death rate (Schafer *et al.*, 1997).

Commiphora africana belongs to the family of Burseraceae and a group of plants commonly called Myrrh (Hanus *et al.*, 2005; Dalziel and Hutchinson, 1956). It is found on the dry sites and savannah forest of Africa. *Commiphora africana* is traditionally used to treat wounds, relieve painful swellings and menstrual pain (Hanus *et al.*, 2005). Aliyu *et al.* (2002) reported the

antimicrobial activity of *Commiphora africana* ethanolic leaf extract, which was also found to contain tannins, alkaloids, triterpenes, sterols and phenolic compounds. The methanolic leaf extract of *Commiphora africana* was found to possess dimethylterphthalene (Choudhury *et al.*, 2000) and a fairly high amount of sesquiterpenes among which α -oxobisabolene (61.6%) and γ -bisabolene (10%) were most important (Hanus *et al.*, 2005; Ayedoun *et al.*, 1998). The antilipidaemic, anticholesterolaemic and antiatherosclerotic properties of a number of *Commiphora* species have been extensively studied (Newall *et al.*, 1996; Michie and Cooper, 1991). *Commiphora myrrh* has been shown to exhibit hypolipidaemic activity (Malhotra *et al.*, 1977). The antilipidemic activity of *Commiphora mukul* (guggulipid) has been established. It exerts effective lipid-lowering activity by reducing total cholesterol, VLDL and LDL cholesterol while elevating HDL cholesterol level (Wang *et al.*, 2004). *Commiphora mukul* contains guggulsterone and has been found to lower cholesterol level by acting as an antagonist of the FXR bile acid receptor important in cholesterol metabolism (Urizar *et al.*, 2002).

Studies on the effects of *Commiphora africana* on lipid profile is lacking and the search for suitable medicinal plant among the *Commiphora* species against the high incidence of cardiovascular diseases becomes very imperative. Thus, the study is aimed at determining the effects of ethanolic leaf extract of *Commiphora africana* on some lipid profiles in rats.

MATERIALS AND METHODS

Plant material and experimental animal: *Commiphora africana* plant was collected from Kwa-Kwa village of Suleija in Niger State of Northern Nigeria. The plant was collected in October, 2004. It was transported in a black polythene bag immediately to the herbarium department of the National Institute for Pharmaceutical and Research Development (NIPRD), Idu-Abuja and was subsequently identified as *C. africana* by Mallam Ibrahim Muazam of the Herbarium Department, where a voucher specimen (No. 3592) was deposited.

Female Wistar albino rats (75) weighing 125-180 g and aged 8-10 weeks were used in the study. They were bred in the animal house (Department of Pharmacology) of the University of Jos, where this study was conducted.

Treatment of plant material: The leaves of *C. africana* were collected and air-dried in the laboratory of Biochemistry, University of Jos, for a week after which they were pounded in a mortar. Hundred gram of the pounded leaves were extracted in ethanol solvent using the soxhlet extraction apparatus. The extraction processes were allowed to continue for about 18 h; thereafter, the extract was concentrated using a rotary evaporator and finally dried in an open beaker (6 h duration). The yield was 6.73%. The extract was kept in clean, dried bottle and placed in a desiccator until ready for use.

Treatment of animals: In the experimental design, both acute and sub-chronic studies were carried out. In the acute studies (24 and 48 h) two sets of 25 female Wistar rats each were grouped into five (Groups A, B, C, D and E), each group consisting of five rats. Similarly, five groups of five Wistar rats each were used for the sub-chronic studies (Groups A, B, C, D and E). Animals in group A receive but distilled water, hence were used as the control group. Graded doses (i.e., 25, 50, 100 and 150 mg kg⁻¹ body weight) of the leaf extract were administered to rats in groups B, C, D and E, respectively, by gastric intubation for 24 and 48 h periods for the acute studies and 10 consecutive days for sub-chronic studies. The animals were maintained at room temperature

(i.e., 25±2°C) and fed with standard animal feed, grower's mash (Grand Cereals LTD) and they had free access to regular tap water.

Collection of blood and preparation of serum sample:

This was done according to the method described by Gatsing *et al.* (2005). At the end of the treatment period, the rats were anaesthetized using chloroform vapour prior to dissection. Blood was collected by cardiac puncture into serum separator tubes. The blood was allowed to clot by standing at room temperature for one hour and then refrigerated for another 1 h. The resultant clear part was centrifuged at 3000×g for 10 min, then the serum (supernatant) was isolated and stored at -30°C until required for analysis.

Determination of lipid profiles: The sera prepared above were used to estimate total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol and triglycerides.

Determination of total cholesterol: This was done according to the method of Braun (1984).

Determination of HDL cholesterol: This was done according to the method of Hiller (1987).

Determination of serum triglycerides: This was done according to the method of Stein and Myers (1995).

Determination of LDL cholesterol: The concentration of LDL Cholesterol was determined by the method described by NCEP (1988).

Statistical analysis: Statistical analyses were performed with the aid of SPSS for Windows software programme (Release 10.0). Group comparisons were done using the Student's t-test. A p-value of <0.05 was considered statistically significant.

RESULTS

Animals used in the study were apparently in good health, as they remained alert, consumed food and water freely and exhibited normal weight increases overtime. There was no loss of fur. They were observed to be less active during the daytime and more active in the night.

The results of the effects of *Commiphora africana* leaf extract on the lipid profiles after 24 h, 48 h and 10 days of treatment are summarized in Table 1, 2 and 3, respectively. Thus after 24 h of treatment, there were

Table 1: Effects of *Commiphora africana* leaf extract on some lipid profiles after 24 h of treatment

Groups	Dose (mg kg ⁻¹)	Triglycerides (mg dL ⁻¹)	Total cholesterol (mg dL ⁻¹)	HDL cholesterol (mg dL ⁻¹)	LDL cholesterol (mg dL ⁻¹)
A (control)	0	109.62±6.96	112.5±0.71	40.77±5.00	49.93±2.96
B	25	117.45±13.92	111.33±3.51	27.69±5.38	60.15±9.58
C	50	116.58±10.44	110.00±1.00	33.38±6.84	53.30±10.15
D	100	110.49±3.48	111.33±2.52	36.92±2.53	52.31±6.53
E	150	103.53±2.58	112.33±0.58	58.30±3.35 ^a	33.32±3.25 ^a

Tabulated values are Mean±SEM of 5 determinations. ^ap<0.05 vs control

Table 2: Effects of *Commiphora africana* leaf extract on some lipid profile after 48 h of treatment

Groups	Dose (mg kg ⁻¹)	Triglycerides (mg dL ⁻¹)	Total cholesterol (mg dL ⁻¹)	HDL cholesterol (mg dL ⁻¹)	LDL cholesterol (mg dL ⁻¹)
A (control)	0	113.00±11.00	111.00±1.41	46.9±6.22	41.5±2.35
B	25	107.00±0.00	107.33±0.58 ^a	43.1±7.31	42.83±5.29
C	50	104.00±3.00	109.33±1.02	45.8±18.29	42.73±3.24
D	100	123.00±7.57	109.00±0.00 ^a	46.1±4.74	38.30±5.72
E	150	112.57±16.00	107.33±1.33 ^a	49.8±3.95	35.10±3.25

Tabulated values are Mean±SEM of 5 determinations. ^ap<0.05 vs control

Table 3: Effects of *Commiphora africana* leaf extract on some lipid profiles after 10 days of treatment

Groups	Dose (mg kg ⁻¹)	Triglycerides (mg dL ⁻¹)	Total cholesterol (mg dL ⁻¹)	HDL cholesterol (mg dL ⁻¹)	LDL cholesterol (mg dL ⁻¹)
A (control)	0	98.7±1.6	112.5±0.4	39.6±0.5	54.4±0.3
B	25	94.6±8.2	111.3±2.0	49.7±4.7	42.7±0.4 ^b
C	50	100.6±11.2	110.0±0.6 ^a	36.5±0.7 ^a	53.4±1.2
D	100	117.2±9.5	111.3±3.0	38.8±3.2	49.6±0.3 ^b
E	150	82.7±4.8 ^a	110.6±0.3 ^a	66.3±0.1 ^b	29.5±0.2 ^b

Tabulated values are Mean±SEM of 5 determinations. ^ap<0.05 vs control ^bp<0.01 vs control

decreases in serum LDL cholesterol and triglycerides in all the groups and they appeared to be dose dependent, while HDL cholesterol showed increase which also appeared to be dose-dependent. These, however, were not statistically significant (p>0.05), as compared to control, except for the group that received 150 mg kg⁻¹ in which there were a significant (p<0.05) increase in HDL-cholesterol and a significant (p<0.05) decrease in LDL-cholesterol. Similarly, after 48 h of treatment with the extract, groups administered 25, 100 and 150 mg kg⁻¹ body weight showed significantly decrease levels of total cholesterol. In the same vein, after 10 days of treatment the group administered 50 mg kg⁻¹ body weight showed significant (p<0.05) decreases in total cholesterol and HDL cholesterol, while groups administered 25 and 100 mg kg⁻¹ showed significant (p<0.01) decreases in LDL cholesterol, as compared to control. The group that received 150 mg kg⁻¹ showed significant (p<0.05) decreases in triglycerides and total cholesterol, a significant (p<0.01) increase in HDL cholesterol and a significant (p<0.01) decrease in LDL cholesterol, as compared to control values.

DISCUSSION

Because of their minimal solubility in water or in plasma, lipids, except fatty acids, are packaged into structures called lipoproteins. The five kinds of lipoproteins are chylomicrons, very low-density

lipoproteins (VLDLs), intermediate-density lipoproteins, low-density lipoproteins (LDLs) and high-density lipoproteins (HDLs) (Rang *et al.*, 1995). Cholesterol is an important constituent of cell membrane and it is the precursor of steroid hormones and bile acids. High cholesterol level in the blood is, however, the major cause of cardiovascular disorders (i.e., atherosclerosis, myocardial infarction and coronary heart diseases) (Nduka, 1999). The degree to which elevated blood lipids contribute to heart disease is determined by their distribution among the various lipoprotein classes. High concentrations of all lipids except the HDLs are associated with an increased risk of atherosclerosis. High serum levels of triglycerides and LDLs (containing a high proportion of cholesterol) are associated with coronary artery disease (Eisenhauer *et al.*, 1998).

The reduction in the serum levels of triglycerides, total cholesterol and LDL cholesterol, especially at the dose of 150 mg kg⁻¹ administered for ten consecutive days corroborate the findings of Vogel *et al.* (2005), suggesting that the plant extract may contain hypolipidaemic and hypocholesterolaemic agents that might prove valuable for the management of cardiovascular diseases. The significant increase in serum level of HDL cholesterol further strengthens the fact that the plant extract may be used to reduce the risk factors of cardiovascular diseases, for it is established that high-density lipoproteins (HDLs) may exert a protective effect against atherosclerosis and may promote the mobilisation

and metabolism of cholesterol, thereby reducing its deposition in vessel walls (Eisenhauer *et al.*, 1998). HDL is known to offer some removal mechanism that gets rid of peripheral tissue cholesterol as well as cholesterol from VLDL and LDL. The phytochemicals including phenols, tannins, steroids, alkaloids, cardiac glycosides and diterpenes have shown potentials in the prevention and management of cardiovascular disorders (Tandon, 2005). Thus, the presence of phenols, tannins (Aliyu *et al.*, 2002) and dimethyl-terpenes (Hanus *et al.*, 2005) in *Commiphora africana* may be responsible for its antilipidaemic activity. Studies have also shown a mark reduction in serum LDL cholesterol level with the administration of phenolic tea (Tandon, 2005); this may further justify the reduction in serum LDL cholesterol level with the administration of *Commiphora africana* extract.

A ketosteroid has been identified as the active principle for the hypocholesterolaemic and hypolipidaemic activities of *Commiphora mukul* (guggulipid) and African and Indian bdellium, *Commiphora* species (Martinetz, 1993; Tripathi, 1975). Guggulipids prevents endogenous hypercholesterolaemia via the stimulation of the thyroid gland and has also been found to reverse the decrease in catecholamine and dopamine-p-decarboxylase activity that are associated with hypercholesterolaemia (Wang *et al.*, 2004; Srivastava, 1984). It is believed that guggul works by two distinct mechanisms: (1) by improving the liver's ability to process, metabolize and excrete cholesterol; (2) by improving thyroid functions by increasing T₄ to T₃ conversion (Wang *et al.*, 2004; Verna and Bordia, 1998). It seems that a similar mechanism may be involved with *Commiphora africana* in lowering serum cholesterol level.

In the light of the foregoing, it is evident that *Commiphora africana* ethanolic leaf extract may possess anticholesterolaemic and antilipidaemic properties and hence may be used in the prevention and management of cardiovascular disorders, within the limits that are non-toxic to the tissues. However, further studies should be carried out to determine the active principles and the exact mechanism involving the hypolipidaemic effects.

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