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Hypolipidemic effect of ethanolic extracts of *Adansonia digitata* fruit pulp on hyperlipidemic albino rats

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ABSTRACT

Recently hyperlipidemia has become an overwhelming disorder, as food diminished for fibers rich in fats and carbohydrates. *Adansonia digitata* is an iconic tree of Africa, noteworthy has a considerable number of benefits for health and the environment. The present study was carried out to evaluate hypolipidemic properties of 96% maceration and Soxhlet ethanolic extracts of *A. digitata* fruit pulp. Serum lipid parameters; (cholesterol, triglyceride, high density lipoprotein (HDL-C), and low-density lipoprotein (LDL-C) were investigated. Twenty-four hyperlipidemic *Wister albino* rats (males) weighing 160-240g were divided randomly into four groups, six for each. All sub groups were orally administered extracts once daily for twenty-eight days by two doses (200 & 400) mg/kg.bwt from each maceration and Soxhlet extracts. Blood samples were investigated at 14 and 28 days. Both extracts significantly lowered serum cholesterol, triglycerides, and low-density lipoprotein, not affecting high density lipoprotein. Soxhlet extraction was more efficient, degree of effectiveness depends more on concentration and continuation of treatment. Phytochemical screening revealed presence of all constituents except anthracenes.

Keywords: *Adansonia digitata*, 96% Ethanolic extract, Maceration, Soxhlet, Hyperlipidemic, Hypolipidemic.

INTRODUCTION

Hyperlipidemia is one of life-threatening problems. Can be considered as a leading cause of cardiac complications e.g. Coronary heart disease (CHD), ischemic cerebrovascular disease, atherosclerosis and peripheral vascular disease [1]. Also, can be considered as a complication of one or more recent diseases as diabetes mellitus and obesity [2]. Obesity has become a global health problem; its incidence goes on rising relating to nutritional behavioral and lifestyle changes [3]. Accordingly, its complications like hyperlipidemia and others are continuously increased and became an epidemic problem [2]. Leading to increased morbidity and mortality among middle-aged and older peoples [1]. For that mentioned the need for hypolipidemic and weight controlling regimens have become urgent. Drugs which are used to treat hyperlipidemia act either through blocking or limiting the cholesterol biosynthesis (HMG CoA reductase inhibitors), block cholesterol absorption or lower triglycerides through stimulating lipoprotein lipase, lipidologists can also treat hyperlipidemia by high doses of nicotinic acid [4]. Complementary and alternative medicine (CAM) products, particularly herbal ones heavily contribute on aliment and treatment of major abnormalities [5], and consider more available, safer, less expensive, and not required prescription. Sudan is based on a unique variation of habits, ethnicities, and religions lead to the formation of a remarkable folk medicine. *Adansonia digitata* is one of the biggest and remarkable trees of the world, more distinctive to Africa (sub Saharan), belongs to the family Malvaceae, sub family Bombacaceae [6]. Is the perennial tree [7], every part is beneficial [8], and the whole tree represents a social symbol for its area [6]. In Sudan the tree spread in areas characterized by sandy soil, e.g. Kordofan and Darfur, mostly use as a water reservoir and its products provide income and employments [6]. The fruit pulp is the most important part of the tree, contain a high percent of vitamin C, habitually use as a beverage behind its numerous therapeutic benefits, e.g. antioxidant, antidiarrheal, ant-inflammatory, antipyretic, hepatoprotective [9], hypoglycemic [10] and hypolipidemic [11]. Hyperlipidemia occurs as a complication of diabetes due to deficiency of insulin, methanolic extract of fruit pulp can suppress hormone sensitive lipase in adipose tissue as a result of its ability to increase insulin level either through acting on secretory β cells of the pancreas [11] and/or enhancing glucokinase enzyme in the liver [10]. Consequently, leading to decrease the level of free fatty acid in plasma, which result in lowering the levels of cholesterol and triglycerides [11]. This work was aimed to examine the hypolipidemic effect of ethanolic extracts of *A. digitata* fruit pulp on hyperlipidemic *albino* rats, and the effect of extraction process on the degree of effectiveness.

MATERIALS AND METHODS

Plant materials

Fruit capsules of *A. digitata* were collected and brought from Elobied, Northern Kordofan State, Sudan. The fruits were authenticated in National Centre for Research, Institute of Aromatic Plants and Alternative Folk Medicine.

Sample preparations

The capsules were broken, fruit pulp was removed from the seed using mortar and pestle and sieved to obtain a fine powder free of fibers.

Extract preparations

Maceration: The powdered sample was soaked in ethanol 96% for 72hrs, with frequent shaking, filtration and the fresh solvent addition every 24hrs.

Soxhlet extraction: Fruit pulp was extracted with Ethanol 96% in a Soxhlet apparatus at 78°C. The process was continued until the solvent on chamber became transparent.

For both extracts, ethanol was evaporated using a rotary evaporator, and the residue was freeze-dried. The semi-solid reddish-brown extract was kept freshly in refrigerator.

Chemicals and Solvents

All chemicals were purchased from chemicals store of Faculty of Pharmacy - AL-Neelain University, and all are on analytical grade from; DUKSAN (Korea), CDH, SDFCL, Oxford Lab Chem, New delhi-110002, & LAB TECH CHEMICALS, (India).

Phytochemical screening

Phytochemical screening was carried out using the methods described by Sofowora^[12], Harbone^[13] and^[14] to chemically determine the types of constituents.

Experimental animals

Twenty-four hyperlipidemic albino rats weighing 160-240 g were purchased from Faculty of Veterinary medicine - University of Khartoum. Their hyperlipidemia was insured by serum lipid profile investigation. They were acclimatized for one week in the animal room at Faculty of Pharmacy-AL-Neelain University.

Treatment protocol

Rats were divided into four groups of six rats each and were given the two aqueous ethanolic extracts by the following treatment for 28 days:

- Group one: hyper lipidmic rats, given fruit pulp maceration extract (200mg/kg bwt.) once daily.
- Group two: hyper lipidmic rats, given fruit pulp Soxhlet extract (200mg/kg bwt.) once daily.
- Group three: hyper lipidmic rats, given fruit pulp maceration extract (400mg/kg bwt.) once daily.
- Group four: hyper lipidmic rats, given fruit pulp Soxhlet extract (400mg/kg bwt.) once daily.

Serum lipid profile was estimated three times, before starting treatment (to insure hyperlipidemia of rats), after fourteen and twenty-eight days of treatment.

Biochemical analysis

Serum lipid profile parameters; total cholesterol, triglyceride, low- and high-density lipoprotein cholesterol (LDL-C & HDL-C) were read by aid of clinical chemistry analyzer (Cobas c 311).

Statistical analysis

The results were statistically analyzed using GraphPad Prism. Software (2007) version 5.01, presented in Mean±S.E.M. The acceptable level of statistical significance was of p<0.05 and below.

RESULTS

Extraction yield was 11.7835% in maceration process, and 27.705% for Soxhlet extraction. Phytochemical screening showed remarkable presence of saponins, flavonoids, tannins, coumarins, sterols and terpens, but traces of alkaloids and absence of anthracenes. All constituents represent more existence in a Soxhlet than in maceration extract. Serum lipid profile parameters were followed up during the experimental period after 14 and 28 days. The following figures represent their levels versus each administered dose according to the extraction process:

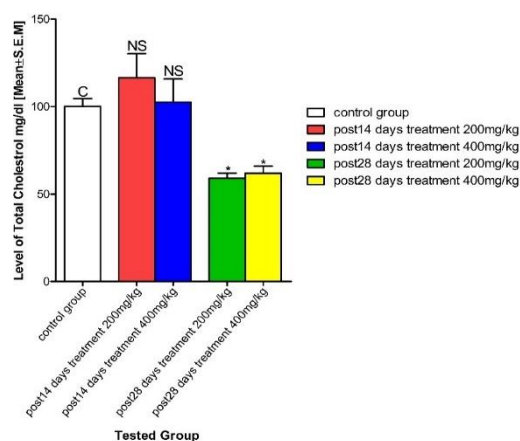


Figure 1: Effect of 96% aqueous ethanolic maceration extract of *A. digitata* fruit pulp on serum Total Cholesterol of *Wister albino* rat

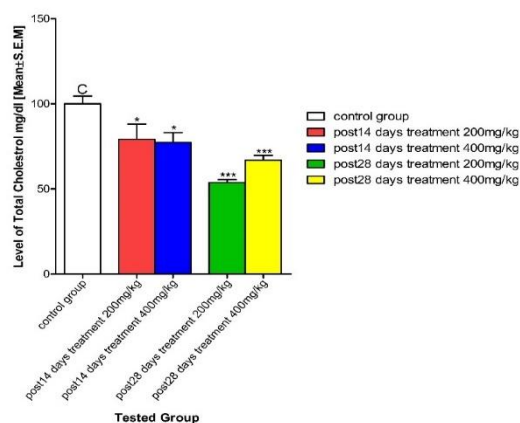


Figure 2: Effect of 96% aqueous ethanolic Soxhlet extract of *A. digitata* fruit pulp on serum Total Cholesterol of *Wister albino* rat

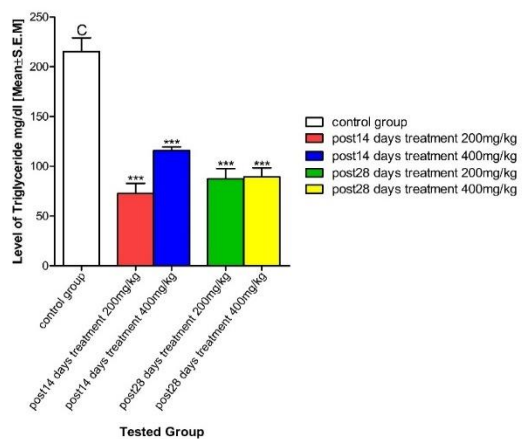


Figure 3: Effect of 96% aqueous ethanolic maceration extract of *A. digitata* fruit pulp on serum Triglycerides of *Wister albino* rat

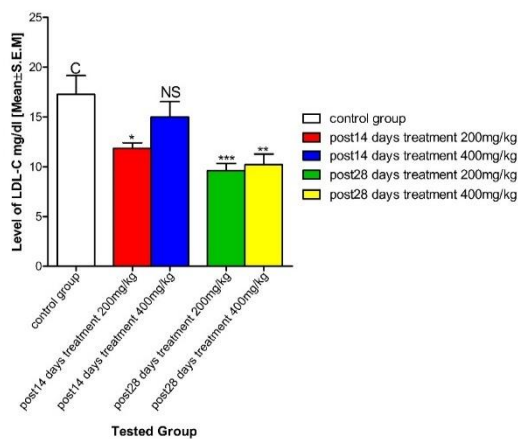


Figure 6: Effect of 96% aqueous ethanolic Soxhlet extract of *A. digitata* fruit pulp on serum low density lipoprotein cholesterol (LDL-C) of *Wister albino* rat

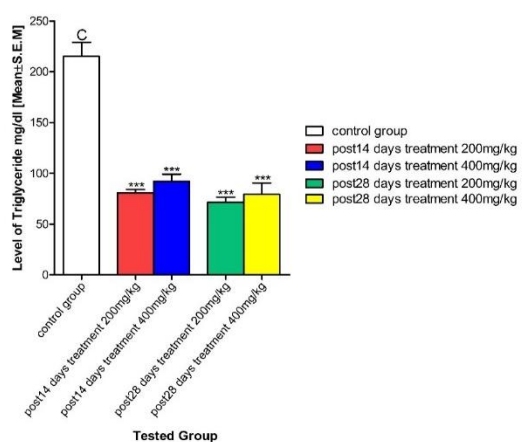


Figure 4: Effect of 96% aqueous ethanolic Soxhlet extract of *A. digitata* fruit pulp on serum Triglyceride of *Wister albino* rat

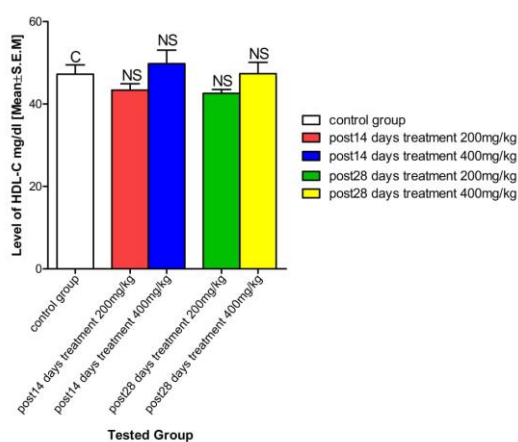


Figure 7: Effect of 96% aqueous ethanolic maceration extract of *A. digitata* fruit pulp on serum high density lipoprotein cholesterol (HDL-C) of *Wister albino* rat

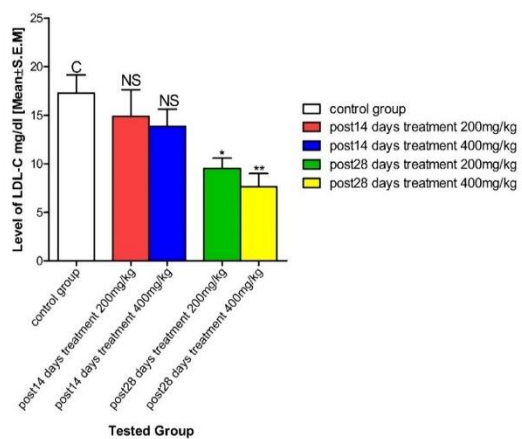


Figure 5: Effect of 96% aqueous ethanolic maceration extract of *A. digitata* fruit pulp on serum low density lipoprotein cholesterol (LDL-C) of *Wister albino* rat

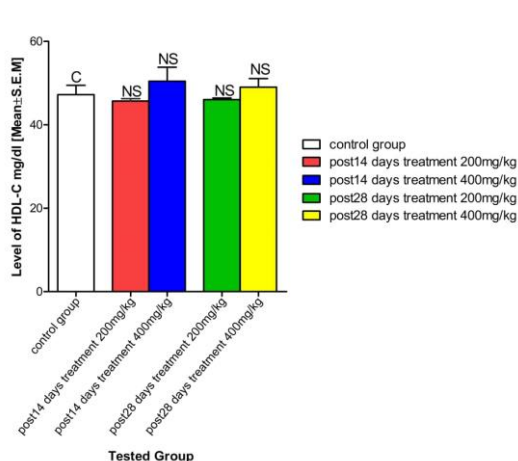


Figure 8: Effect of 96% aqueous ethanolic Soxhlet extract of *A. digitata* fruit pulp on serum high density lipoprotein cholesterol (HDL-C) of *Wister albino* rat

DISCUSSION

The obtained results showed the efficiency of both ethanolic extracts of *Adansonia digitata* fruit pulp to exert a remarkable hypolipidemic effect observed obviously on cholesterol, triglyceride, and LDL-C. Soxhlet was more efficient to extract more constituents of the plant than maceration, and also gave a higher percentage yield. Cholesterol level was decreased by both doses of both maceration and Soxhlet extracts. The effect of maceration extract appeared significantly by the end of treatment period (28 days) fig (1), opposed to Soxhlet extract which put its effect from the first fourteen days fig (2). Triglyceride level was decreased significantly by both extracts and both doses from first fourteen days, which continued till completion of twenty-eight days by equal significance fig (3) & (4). Similarly, to cholesterol, LDL-C was decreased significantly by completion of the treatment period (28 days). The maceration extract dose; 400mg/kg.bwt was a more efficient fig (5), while the effect of Soxhlet extract dose 200mg/kg.bwt appeared significantly from first fourteen days and continued by near high significance till completion of twenty-eight days fig (6). The fourth parameter HDL-C was significantly not affected along treatment periods neither for each extract nor each dose; fig (7), (8). The present study has strengthened the hypolipidemic activity of fruit pulp, and the results gone on agreement with the former one; Waziri *et al.*, (2014). However, the hypolipidemic effect of our extracts was more efficient, especially on triglyceride, although the level of HDL-C was not affected through both treatment periods. Phytochemical screening revealed remarkable presence of phenolics (flavonoids, tannins and coumains), terpens and saponins. Phenolics and terpinoids in addition to high percent of vitamin C, synergistically exert high antioxidant activity enable to suppress lipid peroxidation preventing formation of fatty streaks and exert hepatic protection^[15, 16]. Flavonoids, terpenes and other phytochemicals in fruit pulp can stimulate insulin secretion from pancreatic β cells, leading to decrease of free fatty acid in plasma, consequently suppress the formation of cholesterol and triglyceride^[10, 11]. Hypolipidemia of fruit pulp extract may also be due to the remarkable presence of saponins. Former reviewers found that saponins isolated from other medicinal plants have hypolipidemic and anti-obese activity, relating to their ability to inhibit pancreatic lipase enzyme additionally to their antioxidant activity^[17, 18, 19]. Fruit pulp of *A. digitata* also contains the percent of nicotinic acid^[20, 11] which can increase HDL, reduce TG and lipoprotein Lp (a)^[4]. Integrated presence of all these constituents in fruit pulp and its ethanolic extracts, also the agreement of our phytochemical screening and serum investigation results with former works of other reviewers not surprisingly justify the observed hypolipidemic effect on albino rats.

CONCLUSION

Ethanolic extract of *Adansonia digitata* fruit pulp can induce hypolipidemia at both levels of extraction. Soxhlet extraction gave concentrated extract effective more even in the short period. By the continuation of treatment either low doses or less concentrated (maceration) extract can reach the same level of hypolipidemia.

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