

Changes in Lipid Profile of Aqueous and Ethanolic Extract of *Blighia sapida* in Rats

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Abstract: Aqueous and ethanolic leaf extracts of *Blighia sapida* was assessed for some lipid profile parameters in normal albino rats. Daily administration of the extracts (50 and 100 mg/kg body weight) for 21 days showed that the extract significantly ($p < 0.05$) reduced the levels of total cholesterol, triglycerides and LDL-cholesterol in all the treated groups when compared with the control. While significantly ($p < 0.05$) higher value was observed for the HDL-cholesterol of all the treated groups when compared with the control, this effect was observed as dose dependent for aqueous extract. For the atherogenic indices, there was a significant ($p < 0.05$) increase in HDL-cholesterol/Total cholesterol ratio, while LDL-cholesterol/HDL-cholesterol and log (TG/HDL-CH) ratio showed a significant ($p < 0.05$) decrease in treated groups compared to the control group. These findings may be of clinical importance to individuals at risk of cardiovascular disease.

Key words: Aqueous extract, atherogenic indices, *Blighia sapida*, ethanolic extract, lipid profiles

INTRODUCTION

Blighia sapida is a plant belonging to the family of *Sapindaceae*. It is native to Western Tropical Africa and was introduced into Jamaica in the late 18th century. It has spread to other parts of tropical America but it is still more widely grown in Jamaica than elsewhere. It is commonly known as Ackee, in Nigeria, it is called Gwanja Kusa (Hausa), Isin (Yoruba) and Okpu (Igbo). It is an evergreen tree of about 33 to 40 ft (10-12 m) with a dense crown spreading branches. It's rather handsome, usually with a short trunk to 6ft (1.8 m) in circumference. Its bark is grey and nearly smooth (Morton, 1987).

The phytochemical screening of extracts of *Blighia sapida* shows the presence of some groups of phytochemicals such as saponins, reducing sugar, Phytosterols, and polyamide (Antwi *et al.*, 2009). Extracts of *Blighia sapida* are commonly employed in folk medicine to treat a wide range of disease conditions, especially in developing countries. In folk medicine practice, the bark pulp is used as liniment for oedema intercostals pains in Ivory Coast. The pulp and leafy types are used as eye drop in ophthalmic and conjunctivitis (Irvin, 1965). The roots are used in conjunction with *Xylopiya aethiopica* to terminate unwanted pregnancy (Abolaji *et al.*, 2007). In Brazil, repeated small doses of an aqueous extract of the seed have been administered to expel parasites. In Colombia, the leaves and bark are considered stomachic (Morton, 1987). Pharmacological screenings have been carried out on some constituents of the plant extract, the anti-diarrhoeal activity has been reported by Antwi *et al.* (2009).

However, cardiovascular diseases present some of the main health problems across the globe today, the major

ones being coronary heart diseases, stroke and hypertension (Bowman and Russell, 2001). Elevated plasma lipids are risk factors in cardiovascular problems. Hyperlipidaemia and other abnormal blood lipid profile are largely of genetic origin or due to unwholesome nutritional habits. Lipids and other substances accumulate on arterial wall, forming plaque, which occlude the vascular lumen and obstruct the blood flow to vital organs such as the heart, brain, liver, or kidney. Obstruction of blood supply to the heart, brain, liver or kidney cause coronary heart diseases, stroke or kidney failure, as the case may be.

The important lipids whose elevations are implicated in these disease conditions are cholesterol and triacylglycerols. Lipids are transported as lipid-protein complexes called lipoproteins, which are classified based on their density and charges. The High-density Lipoprotein cholesterol (HDL-c) transports lipids out of blood cells to the liver, while the Low Density Lipoproteins cholesterol (LDL-c) mobilizes lipids against the cells and blood vessels. Triacylglycerols have been found to be elevated along with total cholesterol elevation. Therefore, elevated low-density cholesterol, triacylglycerols and total cholesterol with reduced HDL-c will enhance the development of atherosclerosis and related cerebrovascular disorders (Nwanjo, 2004). The clinical consequences of these disease conditions are serious; and meaningful research efforts to improve the knowledge and understanding of the pathogenesis is essential; in order to provide a more rational approach to their prophylaxis and treatment (Kritchersky, 1970; Kucera *et al.*, 1972).

Despite the several studies on the different pharmacological activities of *Blighia sapida* much has not

Table 1: Effect of aqueous and ethanolic extracts of *Blighia sapida* on some lipids profile

| Parameters (mmol/l) | Control | 50 mg/kg of aqueous extract | 100 mg/kg of aqueous extract | 50 mg/kg of ethanolic extract | 100 mg/kg of ethanolic extract |
|---------------------------|------------------------|-----------------------------|------------------------------|-------------------------------|--------------------------------|
| Total cholesterol | 2.61±0.06 ^a | 2.45±0.03b ^c | 2.40±0.05 ^c | 2.34±0.05 ^c | 2.48±0.04 ^b |
| Triacylglycerol | 1.91±0.10 ^a | 1.46±0.19 ^c | 1.64±0.08 ^b | 1.47±0.08 ^c | 1.36±0.15 ^c |
| High density lipoproteins | 0.85±0.07 ^c | 1.21±0.16 ^b | 1.42±0.08 ^a | 1.28±0.18 ^{ab} | 1.21±0.12 ^b |
| Low density lipoprotein | 0.90±0.14 ^a | 0.57±0.14 ^b | 0.24±0.08 ^c | 0.39±0.19 ^{bc} | 0.65±0.18 ^{ab} |

Values are means of four determinations ±SD

Values with different superscript in the row differ significantly (p<0.05)

been done on its lipid profile; notwithstanding its wide spread use in folk medicine. This study is aimed at investigating the validity or otherwise of the use of the plant extract in atherosclerotic conditions in folk medicine.

MATERIALS AND METHODS

Collection and preparation of plant samples for analysis: This study was conducted in November, 2009 in Biochemistry Department Ahmadu Bello University Samaru-Zaria. The plant sample under study was collected around the garden/surrounding of Ahmadu Bello University, Samaru-Zaria, Kaduna State. The plant was identified at the Biological Science Departmental Herbarium, Ahmadu Bello University, Zaria, Nigeria. The leaves were sorted to remove the death ones, rinsed with cleaned water to remove debris and dust particles. The leaves were then collected and dried at room temperature for seven days. The dried leaves were milled to get a course-powdered sample used for the extraction. *Blighia sapida* powdered (100 g) sample was dissolved in 5000mls of methanol and distill water, they were allowed to stay for 48hours, after which it was filtered, and the filtrate was concentrated on a rotary evaporator at 45°C and to dryness using water bath. The concentrated extracts were then stored in a refrigerator until they were required.

Acute toxicity test: The acute toxicity of the extract was done using 30 albino rats divided into 6 groups of 3 rats each, with each group receiving a dose of the extract orally as described by Lorke (1983). The number of death in each group within 24 h was recorded. The geometric of the highest non-lethal dose (with no death) and the lowest lethal dose (where death occurred) was calculated and taken as the LD₅₀ values.

Experimental animals: Healthy Wister albino rats of both sexes weighing between 100-130 g were purchased from the experimental animal house of National Institute of Trypanosomiasis (NITR), VOM sub-station, Plateau state, Nigeria and kept in well aerated laboratory cages in Biochemistry Department Ahmadu Bello University, Zaria, Nigeria and allowed to adjust to the laboratory environment for a period of three (3) weeks before the commencement of the experiment. The animals were given grower and starter mash (Vital feeds) and water was also provided *ad libitum* during the stabilization period.

After this period, the test animals were subjected to oral administration of the aqueous and methanolic extracts (50 and 100 mg/kg) daily while the control group were given normal saline for a period of 21 days respectively. After this period, the animals were weighed, anaesthetized using chloroform and bled by cardiac puncture. The organs exercised and blood samples collected in a specimen bottle, the blood was allowed to clot and serum separated using pasture pipette into clean and labeled sample for determination of some parameters.

Serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triacylglycerol (TG) were determined by enzymatic methods as described by Stein (1987), The low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald *et al.* (1972). The atherogenic risk predictor indices were calculated using the formulae of Dobiasova and Frohlich (2001).

Statistical analysis: Data obtained were analyzed by the use of Student's t-distribution test and values for p<0.05 were considered statistically significant.

RESULTS AND DISCUSSION

The acute toxicity studies shows that at the highest dose of administration (5000 mg/kg) of both extracts did not kill any of the experimental animals. Thus LD50 value is greater than 5,000 mg/kg.

Table 1 below shows the result of the mean serum lipoprotein level of the animals. There was a significant (p<0.05) reduction in the level of total cholesterol, triglycerides and LDL-cholesterol levels, while significantly (p<0.05) higher values was observed for the HDL- cholesterol of all the treated groups when compared with the control. The mean values of atherogenic risk predictor indices [HDL-cholesterol/total cholesterol, LDL-cholesterol/HDL- cholesterol and log (triacylglycerol/HDL-cholesterol)] observed in the Fig. 1-3 shows that there was a significant (p<0.05) increase in HDL-cholesterol/total cholesterol ratio, while LDL-cholesterol/HDL- cholesterol and log (triacylglycerol/HDL-cholesterol) decrease for all the treated animals when compared with the animals in control group, the decrease for log (triacylglycerol/HDL-cholesterol) was found to be concentration dependent for ethanolic extract.

The LD₅₀ for oral of both extract has been reported by Antwi *et al.* (2009) to be greater than 5000 mg/kg for

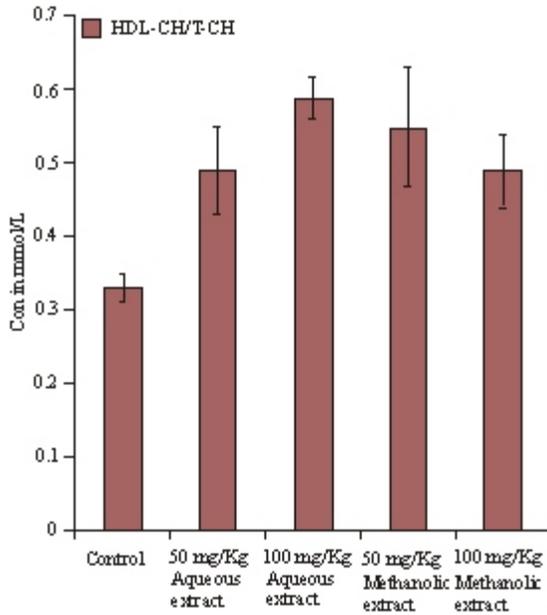


Fig. 1: The mean values of serum atherogenic (HDL-CH/T-CH) risk predictor indices of aqueous extract of *Blighia sapida* on normal rats

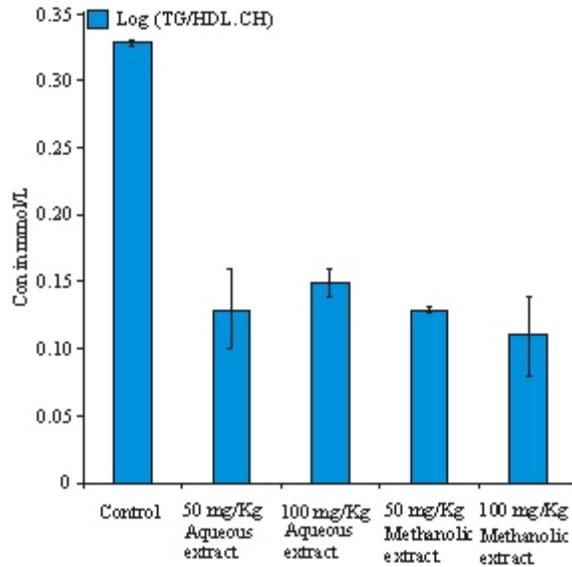


Fig. 3: The mean values of serum atherogenic (Log(TG/HDL-CH)) risk predictor indices of aqueous extract of *Blighia sapida* on normal rats

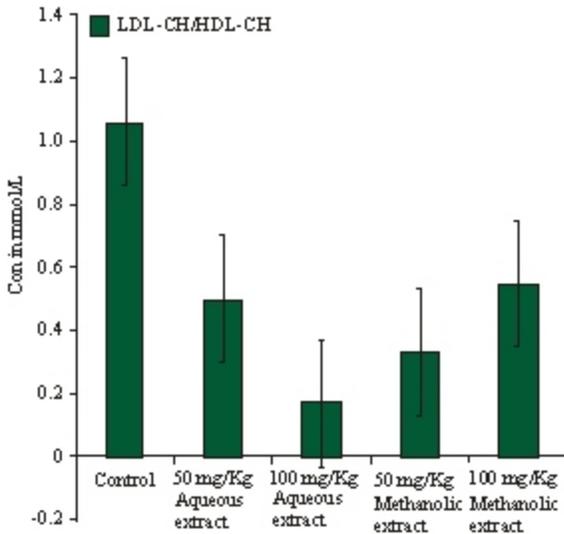


Fig. 2: The mean values of serum atherogenic (LDL-CH/HDL-CH) risk predictor indices of aqueous extract of *Blighia sapida* on normal rats

both mice and rats. Observations of animals over the next 12 days showed no adverse effects of treatment. LD₅₀ values are not reliable because the information it provides is of little use to humans for several reasons: species to species difference insensitivity give the LD₅₀ test little predictive capability for assessing toxicity in humans. The LD₅₀ measures only lethality, ignoring other advance effects, which often correlates poorly with mortality.

Thus, a chemical can have extremely harmful but non-lethal effect at doses far short of the LD₅₀ dosage (Lorke, 1983).

In this study, both the extracts of *Blighia sapida* has significant ($p < 0.05$) serum lipid lowering effect on the level of total cholesterol, triacylglyceride and low-density lipoprotein. The observed LDL-cholesterol effect may be attributed to the effect of saponins. Saponins are known antinutritional factors which reduce the uptake of certain nutrition especially cholesterol at the gut through intraluminal physiochemical interactions. Hence, saponins have been reported to have hypocholesterolic effect (Price *et al.*, 1987). Presence of saponins has been reported in the pant extract (Antwi *et al.*, 2009) and this saponin may explain the antilipidemic effect observed in this study.

The significantly lower cholesterol may have contributed to the observed significant high serum HDL-cholesterol in the animals, about 30% of blood cholesterol is carried in the form of HDL-cholesterol. HDL-cholesterol can remove cholesterol from antheroma within arteries and transport it back to the liver for its excretion or reutilization, thus high level of HDL-cholesterol protect against cardiovascular disease (Kwiterovich, 2000). The observed significance ($p < 0.05$) increase in HDL-cholesterol concentration upon the administration of the extract indicates that the extract doses have HDL-cholesterol boosting effect; this effect is concentration dependent for aqueous extract.

The extract significantly reduce LDL-cholesterol except for 100 mg ethanolic extract that shows no

significant ($p > 0.05$) reduction, LDL-cholesterol transport cholesterol to the arteries where they can be retained in artheria protoglycans starting the formation of plaques, LDL-cholesterol possess a risk of cardiovascular disease when it invades endothelium and becomes oxidized since the oxidized form is more easily retained by the proteoglycan, thus increase of LDL-cholesterol is associated with artherosclerosis, heart-attack, stroke, peripheral vascular disease (Crowwell and Otvos, 2004). The importance of this LDL-cholesterol lowering effect is that the extract may aid in the prevention or reduction of cardiovascular diseases. The significant reduction in the level of log (TG/HDL-cholesterol) portend a decrease risk of vascular disease, since high anterogenic index of log TG/HDL-cholesterol has been positively correlated with cardiovascular disease (Igwe *et al.*, 2007). The values of LDL-cholesterol/HDL-cholesterol ratio is less than 2.3 while the values of HDL-chol/Total cholesterol is greater than 0.3. These values are desirable and they are non anthogenic (Ojiako and Nwanjo, 2005).

CONCLUSION

This present study has clearly revealed that ethanolic and aqueous extract of *Blighia sapida* have been found to be hypolipidemic and anti-atherogenic in rat. The information obtained from this work shows that the plant extract could be useful in improving and management of complications associated with patients suffering from cardiovascular diseases. Thus, these findings are of clinical and nutritional relevance considering the divers uses of this plant.

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