



Phytochemical Screening and Hypoglycemic Effect of Aqueous *Blighia sapida* Root Bark Extract on Normoglycemic Albino Rats

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Research Article

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ABSTRACT

Aims: To carry out phytochemical screening and investigate hypoglycemic effect of aqueous *Blighia sapida* root bark extract (ABRE) on normoglycemic Albino rats.

Study Design: Extraction and administration of bioactive extract.

Place and Duration of Study: Department of Biochemistry, Federal University of Technology, Minna, Niger State, Nigeria, between June, 2010 and September, 2010.

Methodology: Extraction of the air-dried ground root of *Blighia sapida* (100 g) was done with 80mls distilled water for 2 h. The extract (ABRE) obtained was then administered at concentrations of 100mg/ml and 200mg/ml per 1000g body weight of the rats. The normoglycemic albino rats were employed. Qualitative phytochemical screening was carried out according to the standard methods of Trease and Evans (2006). The animals were fed *ad libitum* with vital finisher made up of maize and soya beans mainly. Fasting blood taken after 16h over night fasting was used in this study.

Results: The phytochemical screening of ABRE shows the presence of alkaloids, saponins, cardiac glycosides, reducing sugar, carbohydrates, flavonoids, phenol and tannin; while the test for protein showed negative results. Administration of the aqueous of *B. sapida* root bark at intervals of 48h for 21 days resulted in decrease in the blood glucose levels of rats.

Conclusion: The findings of this study indicate that consumption of the ABRE exerts significant hypoglycemic effect in normoglycemic rats. These findings support the traditional use of ABRE for controlling diabetes. Further studies to isolate active principle(s) of the extracts as well as to elucidate their exact mechanism(s) of action are recommended.

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1. INTRODUCTION

Herbal preparations used for the treatment of diseases and its knowledge are handed down from generation to generation and has been used in healthcare delivery in many parts of Africa and the rest of the world. Effective health cannot be achieved in Africa, until orthodox medicine is complemented with traditional medicine (Elujoba et al., 2005). At least 89% of Africans depend on plant medicine for their healthcare. Plants have always been an exemplary source of drugs and many of the currently available drugs have been derived directly or indirectly from them.

Diabetes mellitus is a multifactorial disease which is characterized by hyperglycemia (Ugochukwu et al., 2003), lipoprotein abnormalities (Scoppla et al., 2001), raised basal metabolic rate (Nawata et al., 2004; Okwu et al., 2006), defect in reactive oxygen species scavenging enzymes and altered intermediary metabolism of major food substances (Unwin et al., 2001). Diabetes being a major degenerative disease is found in all parts of the world and it is becoming the third most lethal disease of mankind and rapidly increasing (Ogbonnia et al., 2008). It is affecting at least 15 million people and having complications which include hypertension, arteriosclerosis and microcirculatory disorders. Normally the body keeps blood sugar levels within a narrow range through the coordinated work of several organs and glands and their hormones, primarily insulin and glucagon. But factors such as disease or a poor diet can disrupt the mechanisms that regulate the sugar levels. Too much glucose results in hyperglycemia, one of the major symptoms of diabetes. Hyperglycemia (high blood sugar) is a condition in which an excessive amount of glucose circulates in the blood plasma. This is generally a glucose level higher than 10 mmol/l (180 mg/dl), but symptoms may not start to become noticeable until even higher values such as 15-20 mmol/l (270-360 mg/dl). However, chronic levels exceeding 7 mmol/l (125 mg/dl) can produce organ damage. Hyperglycemia causes many of the health problem associated with diabetes, including eye, kidney, heart disease and nerve damage. However, hypoglycemia is most common among people with diabetes, as too much insulin can cause blood sugar levels to fall (an insulin reaction). Hypoglycemia (low blood sugar) is a condition in which there is an abnormally low level of glucose (sugar) in blood. If left untreated, hypoglycemia can cause permanent neurological damage and death (Dailey, 2007; Bergqvist et al., 2008). Hypoglycemic agents have been used in the management of diabetes mellitus (DM).

Medicinal plants are increasingly being used in most parts of the world as hypolipidemic (Yadav et al., 2008), antihypertensive (Nworgu et al., 2008) and hypoglycemic agents (Farswan et al., 2009; Lee et al., 2009). Several plants and isolated compounds have been demonstrated to have anti-diabetic potentials (Li et al., 2004; Grover et al., 2000; Rahman and Zaman, 1989). For instance, *Momordica charantia* is used to treat diabetes (Marles and Farnsworth, 1995) and have been found to possess very high anti-diabetic potentials (Akhtar et al., 1981; Kar et al., 2003; Miura et al., 2001; Sarkar et al., 1996; Srivastava et al., 1993). The anti-diabetic potentials of numerous plants are well established in streptozocin- or alloxan-induced diabetic rats, mice and rabbit (Akhtar et al., 1981; Kar et al., 2003; Sarkar et al., 1996), genetically diabetic mice (Miura et al., 2001) and in humans with Type 2 diabetes (Srivastava et al., 1993).

There has been increasing demand for the use of plant products with anti-diabetic activity. The high cost, availability, uncertainty of use during pregnancy and undesirable side effects of synthetic drugs have been some of the factors leading to a strong preference for hypoglycemic drugs of plant origin, which are believed to be suitable for chronic treatments (Okigbo and Mmeka, 2006). In Nigeria, many medicinal plants are reservoirs of natural products with anti-diabetic potentials (Aboa et al., 2008; Gbolade, 2009; Saganuwan, 2009). *Blighia sapida* K. Kong (Family Sapindaceae) popularly known as Ackee (English), "Ila" (Nupe), "Isin" (Yoruba), "Gwanja kusa" (Hausa) and "Okpu" (Igbo) is used in traditional medicine for diabetes mellitus management and its possible role on pancreatic tissue. Its fleshy aril fruit is edible and is known to contain saponins, which are hemolytic. The pulp and leaves are used to treat eye conjunctivitis. The seeds are not edible, but the ashes of the dried husks and the seeds are used in the preparation of soap (Aderinola et al., 2007). In Nigeria, only few traditional treatments for diabetes have been subjected to scientific scrutiny (Momoh et al., 2011; Nda-Umar et al., 2011; Tanko et al., 2008), therefore, medicinal plants are frequently used by diabetic Nigerian natives because they are cheap and affordable hence this study is aimed at investigating the hypoglycemic effect of the aqueous root bark extract of *Blighia sapida* used in the management of diabetes.

2. MATERIALS AND METHODS

2.1 Plant material

Sample of *Blighia sapida* root was collected from a tree in Bida, Bida Local Government Area of Niger State, Nigeria. The roots were washed and chopped into small pieces using a stainless steel knife, and then dried under the laboratory condition for 3 days and ground into powder.

2.2 Extraction

Air-dried ground root bark of *Blighia sapida* (100 g) was extracted with 80 ml distilled water for 2 h and then concentrated on water bath. The extract was stored in a vial and wrapped with aluminum foil and kept in the fridge for further processing. Stock solution was prepared by adding 2 g of extract to 20 ml of distilled water in sample bottles resulting in extract concentrations used as 100 mg/ml and 200 mg/ml per 1000 g body weight of the rat.

2.3 Phytochemical Screening

Phytochemical tests were conducted on the aqueous extract of *Blighia sapida* to determine the presence of alkaloids, tannins, terpenoids, saponins, flavonoids, phenol, cardiac glycosides, and carbohydrates using standard protocols (Sofowara, 1993; Trease and Evans, 2006).

2.4 Animals

Albino rats weighing 120-200g which were obtained from the Department of Pharmacy, Ahmadu Bello University Zaria, Kaduna State, and the rats were kept in clean and dry plastic cages. The normoglycemic albino rats were grouped into three as follows:

Group 1 served as the control which was administered with distilled water orally.

Group 2 were normoglycemic rats which were administered orally with the extract at 100mg/ml of 1000g body weight.

Group 3 were normoglycemic rats which were administered orally with the extract at 200mg/ml of 1000g body weight. The administration was carried out every 24 h for 21days, after the 21days the glucose level was checked using a glucometer (wave sense pesto).

2.5 Methods

One hundred grams (100g) of the *Blighia sapida* root sample was added to 80mls distilled water in a beaker and placed on an extraction machine for 2hrs (with the boiling temperature set at 100°C). Thereafter, the mixture was filtered using cheesecloth and the filtrate poured into a separate beaker and placed on a water bath for few hours for the water to evaporate and for the final extract to be gotten, the extract was poured into a simple bottle of known weight of 6.89g, thereafter, the sample bottle and the extract were weight and the weight was 21.58g, if 6.89g of the sample bottle is deducted from the 21.58g of both the extract and sample bottle, the weight of the extract alone is 14.69g, a stock solution was prepared by adding 2g of extract to 20mls of distilled water in a different sample bottle. Thus the concentration of the extract was 100mg/ml and 200mg/ml to 1000g body of the rat.

Fasting blood collected after 16h over night fasting from tail vein was used for the investigation in this study.

2.6 Statistical analysis

All data were expressed as means \pm SEM. Student's t-test was used to compare the mean values of test groups and control. Differences in mean values were considered significant at $p < 0.01$.

3. RESULTS AND DISCUSSION

The results of phytochemical screening of *Blighia sapida* root bark shows the presence of alkaloids, saponins, cardiac glycosides, reducing sugar, carbohydrates, flavonoids, phenol and tannin; while the test for protein showed negative results (Table1). Rats maintained on the aqueous extract of *Blighia sapida* root bark showed a significant decrease of blood glucose on the normoglycemic albino rat. Higher decrease of blood glucose level was observed on rats placed on 100mg/kg bw of the extract followed by the rats placed on 200mg/kg bw, the rats placed on distilled water (control) maintained a standard blood glucose (Table 2). Table 3 gives the effect of the extract on the weight of the Albino rats. Rats placed on the distilled water (control) gained more weight than those maintained on the extract. However, more weight gain was observed on rats placed on 200mg/kg body weight followed by those placed on 100mg/kg body weight. Data obtained were subjected to test of significance (Student's t test) to determine if significance difference exists between the mean of the test and control.

Table 1. Phytochemical compositions of aqueous extract of *Blighia sapida* root bark

Parameters	Inference
Alkaloid	+
Flavonoids	+++
Saponins	+++
Protein	-
Phenol	+++
Tannins	+++
Cardiac glycosides	+++
Reducing sugars	+++
Carbohydrate	+

+ (slightly present), ++ (moderately present), +++ (highly present), – (absent)

Table 2. Blood glucose concentration of Albino rats placed on the aqueous extract of *Blighia sapida* root bark for 21days

Parameters	Control (A)	100mg/kg (B)	200mg/kg (C)
Glucose conc. (mg/dl) Before extract administration	157.67±0.34	159.00*±0.58	159.33*±0.88
Glucose conc. (mg/dl) After 21days	158.67±0.34	135.33*±11.47	138.67*±5.96

Data are Mean ± SEM, P<0.01

Table 3. Effect of aqueous extract of *Blighia sapida* root bark on weight of Albino rats

Parameters	Control (A)	100mg/kg (B)	200mg/kg (C)
Weight before extract administration (g)	143.3±6.77	142.67*±5.37	169.67*±3.72
Weight after 21days (g)	146.00±7.55	145.00*±7.01	173.67*±2.34
% difference in weight	2.09	1.40	2.35

Data are Mean± SEM, P<0.01

The metabolites shown in Table 1 were known to show biological activity as well as exhibiting physiological activity (Sofowara, 1993). Flavonoids are potent water-soluble antioxidants and free radical scavengers which prevent oxidative cell damage and have strong anticancer activity (Salah et al., 1995; Del-Rio et al., 1997; Okwu, 2004). Flavonoids also lower the risk of heart diseases. Saponins are capable of neutralizing some enzymes in the intestine that can become harmful, building the immune system and promoting wound healing. Alkaloids have been documented to possess analgesic, antispasmodic and bacteriocidal effects. Tannins hasten the healing of wounds and inflamed mucous membrane (Okwu and Okwu, 2004). Cardiac steroids are widely used in the treatment of congestive heart failure. The presence of these phytochemicals supports the medicinal uses of *B. sapida*. Effective control of the blood glucose level is a key step in preventing or reversing diabetic complications and improving the quality of life in both Type 1 and Type 2 diabetic patients (Abraira et al., 1995; Ohkubo et al., 1995). *B. sapida* has antidiabetic activity (Marles and Farnsworth, 1995). Administration of the aqueous of *B. sapida* root bark

at intervals of 48 h for 21 days resulted in decrease in the blood glucose levels of rats. The hypoglycemic properties of numerous Nigerian medicinal plants have been studied and the results indicated significant activities (Adenye and Agbaje, 2008; Gidado et al., 2005). It was reported by Bever (1980) that *B. sapida* contains two hypoglycins A and B that have strong hypoglycemic action in most animals and man. The hypoglycins act by inhibiting the β -oxidase enzymes, blocking the oxidation of long chain fatty acids, thus causing accumulation of unmetabolizable fatty acids making them unavailable for energy production. Reduction in blood glucose by these bioactive compounds from plants might act by one of several mechanisms. Some of them may inhibit endogenous glucose production (Eddouks et al., 2003) or interfere with gastrointestinal glucose absorption (Musabayane et al., 2006); some may have insulin-like substances (Gay and Flat, 1999); some may inhibit insulinase activity and some may increase secretion of insulin from the β cells of the pancreas i.e. pancreatotrophic action (Khan et al., 1990; Trevedi et al., 2004; Yadav et al., 2008), while others may increase beta cells in pancreas by activating regeneration of these cells (Jelodar et al., 2007).

4. CONCLUSION

This study indicates that consumption of the aqueous extract of *Blighia sapida* root bark exerts significant hypoglycemic effect in normoglycemic rats. These findings support the traditional use of aqueous extract of *Blighia sapida* root bark for controlling diabetics. Therefore, further studies to isolate active principle(s) of the extracts as well as to elucidate their exact mechanism(s) of action are recommended.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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