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# FREE RADICAL SCAVAGING ACTIVITY AND ANTIDIABETIC PROPERTY OF ETHANOL STEM BARK EXTRACT OF *Uapaca togoensis* IN ALLOXAN INDUCED DIABETIC ALBINO RATS

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## ABSTRACT

Diabetes mellitus is a disease of worldwide significance and increasing prevalence. This places a demand on researchers to find a solution to it through ethnomedicine. This study investigated the toxicological, antioxidant, anti-diabetic property and hyperlipidemic effect of *Uapaca togoensis* stem bark extract in alloxan induced diabetic wistar rats. Thirty (30) albino rats were assigned into six groups (A-F) of five rats each. Group A was not induced and used as positive control/nondiabetic group, while groups B-F were induced with alloxan at 150mg/kg administered via intraperitoneally (i.p). Group B used as diabetic control was not treated but allowed access to feed and water. C, D and E were treated with 300mg/kg, 700mg/kg and 1000mg/kg of *Uapaca togoensis* stem bark extract respectively; while group F was treated with standard drug (glibenclimide) at a dose of 5mg/kg. The doses were administered orally and the treatment lasted for 7 days. Results indicated that the extract have hypoglycemic activity on the diabetic rats. Modified method of Lorke was employed to ascertain the extract toxicity and the result however indicated that the extract was safe for the test rats up to 5000mg per body weight dose. DPPH, FRAP and Hydrogen peroxide assays were used to assess the antioxidant activities of the extract. The results were significant at $p<0.05$ at all concentrations compared with the standard (vitamin C) and the % inhibitory activities were almost the same with Vitamin C in hydrogen peroxide method. This was an indication that *Uapacatogeonsis* extractpossess antioxidant properties.

KEY WORDS: Antioxidant, acute toxicity, antidibetic, glibenclimide, hyperlipidemic

## INTRODUCTION

It is ironic that nitrogen and oxygen, which are indispensable elements for life, under certain situations have severe deleterious effects on the human body. They form active compounds referred to as reactive oxygen species (ROS) and reactive nitrogen species (RNS) which are free radicals [1]. These free radicals are derived from both endogenous and exogenous sources; the endogenous sources include mitochondria, peroxisomes, endoplasmic reticulum, phagocytic cells etc. Although free radicals have physiological importance (serve as part of signal transduction pathway or a part of cell defense mechanisms in normal physiological state), an imbalance between them and cells antioxidants compound may result to oxidative stress and have toxic effects on the cells [2].

Research has indicated that almost all plant of medicinal importance has excellent antioxidant potential. The interest in the exploration of



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exogenous plant antioxidants grew from the fact that oxidative stress is responsible for the development and progression of several life-threatening diseases, such as neurodegenerative and cardiovascular disease [2]. When consumed, exogenous antioxidants could boost endogenous antioxidant defenses (notably, glutathione) of the body; as a result, counter the undesirable effects of oxidative stress [3].

Complications which arise from chronic hyperglycemia have also been linked to oxidative stress [4]. Plants biochemical are implicated in the management of hyperglycemic activities; these products are relatively cheap, and readily available with fewer side effects [5-6]; this suggested the need to continually explore and scrutinized them for their effects as hypoglycemic agents [7].

Diabetes produces disturbances in lipid profiles and especially, an increased susceptibility to lipid peroxidation [8]. In the last stages of diabetes, lipid metabolism is affected and seen as hyperlipidemia and hypercholesterolemia which are risk factors in atherosclerosis [9].

*Uapaca togenensis* called Charcoal" or "Somon" tree, *Kaffafago* in Hausa, *Obia* in Igbo, *Ajebge*in Yoruba and Shase - war in Tiv [10-11], is a small to medium sized tree with an evergreen or semi deciduous growth habit depending on the prevailing environmental growth conditions. Leaves are simple, large and alternate, leathery, strongly ribbed, dark green and with rounded tips. Young leaves are covered with curly hairs on the under surface. Its wood is light with white sapwood and has reddish brown heartwood. It is dioeciously with staminate flowers borne in dense clusters while female flowers are solitary. It is difficult to distinguish the male from female ones when they are juvenile. The male and female flowers are greenish-yellow and inconspicuous. The fruits (3 - 4 cm diameter), rich in dietary nutrients usually ripen towards the end of the dry season [12] and the fruits are used to make wines, gins or fruit juices.

*U. togoensis* trees are widely distributed throughout the coastal plain of Southern Africa and parts of the Democratic Republic of Congo [13].

Various parts of the plant have been used in folk medicine for wide variety of remedies such as fever, rheumatism, vomiting, fatigue and epilepsy [14]. Previous pharmacological studies revealed that extracts of *Uapaca togoensis* possesses antifungal, antimocrobial, antiplasmodial, analgesic, anti-inflammatory, cytotoxic and antimicrobial properties [15-19]. The methanol stem bark extract from the plants was reported to be relatively safe to mice up to a dose of 5000mg/kg while tannins, flavonoids saponnins, steroids, triterpenes, alkaloids and cardiac glycosides were the phytochemicals present [19]. So far there is no scientific information on the plant as regard to its antihyperglycemic activity. The current study therefore, evaluated the antihyperglycemic and antioxidants activity of



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the plant's stem bark extract using *in-vivo and in vitro* models respectively.

## MATERIALS AND METHODS

### *General*

Centrifuge (Denley B5400, England),Jenway 6310 UV-visible spectrophotometer were used. Rotary evaporator, Glibenclamide (5mg/kg) and Normal saline (were purchased from a pharmaceutical shop).Accu-Check Active Glucometer (Roche Diabetes Care GmbH Stand Hofer Strasse 11668305 Mannheim, Germany), Absolute ethanol 99.9% (JBH). 1, 1-diphenyl-2-picrylhydrazyl radical, DPPH and Trichloroacetic acid were obtained from Sigma-Aldrich, anhydrous ferric chloride, potassium ferricyanide, anhydrous sodium carbonate, potassium persulphate, $K_2S_2O_8$ and Ascorbic acid were obtained from BDH Chemical Laboratory, England, UK. All chemicals were of analytical grade.

### *Collection of Plant*

The stem bark of *Uapaca togeonsis* was obtained from wild at Mbalumun-Nanev in Kwande local government area, Benue state, Nigeria. The plant was authenticated by Joseph Waya of Botany Department, Benue State University, Makurdi, Nigeria, and the specimen's Voucher No: 233 was deposited at the Herbarium unit.

### *Experimental Animals*

Thirty albino rats of the Wistar strain weighing between 70-140g were used for the study. They were obtained from the animal holding unit, College of Health Sciences Benue State University Makurdi. The animals were housed in wooden cages and acclimatized for two weeks in the animal house department of chemical sciences university of Mkar. They had been maintained under standard conditions (room temperature 25$^o$C±3$^o$C, humidity 35-60%, light and dark period 12/12 hours. All animals had regular supply of clean drinking water and food.

### *Methods*

### *Preparation of Plant Extracts*

Dried stem bark of *Uapaca togenensis* was crushed to powder using a mortar and pestle. The crushed plant sample was weighed and soaked in 99.90% alcohol and allowed to stand for 72 hours with occasional shaking at different intervals. The extract was decanted, filtered (using Whatman No. 1 filter paper) and concentrated at 40$^o$C via rotary evaporator. Residual solvent in the extract was evaporated completely using water bath. The crude extract was kept in the refrigerator for experimental studies.

### *Phytochemical Screening*

Preliminary qualitative and quantitative phytochemical screening was performed to identify and quantify the presence of some



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bioactive compounds and in ethanol stem bark extract of the *Uapaca togeonsis*. The methods employed in the phytochemical analysis were those described by [20-21].

***Assessment of Antioxidant Activity***

Ethanol stem bark extract of *Uapaca togeonsis* was screened for antioxidant active using 1,1-dipheny-2-picryl hydroxyl (DPPH) quenching assay, Hydrogen peroxide radical, and Ferric Reducing Antioxidant Power (FRAP) respectively.

***DPPH Radical scavenging Assay***

This test was measured as described by **[22]**. The extract solutions (25, 50, 75, 150 and 300 µg/ml) in ethanol (1 ml) were transferred into 1ml of DPPH solution (0.2mM in ethanol) and allowed to stand at room temperature for 30min. The absorbance of the solution was measured at 517nm. The ability of the extract to scavenge the DPPH radical was calculated using the equation:

DPPH scavenging activity (%) = $(A_o - A_1) / A_o$ x100

Where $A_o$ is the absorbance of the blank (control) and $A_1$ is the absorbance of the sample. The blank contained ethanol (1 ml) and sample solution (2 ml). Ascorbic acid was used as standard.

***Hydrogen peroxide scavenging Assay***

The hydrogen peroxide scavenging assay was carried out following the procedure of Ruch *et al* **[23]**. A solution of $H_2O_2$ (43mM) was prepared in 50 mm phosphate buffer (0.1M, pH 7.4). The extract solutions (25, 50, 75, 150 and 300 µg/ml) in phosphate buffer (3.4 ml) were mixed with 43mM $H_2O_2$ solution (0.6 ml). The absorbance value of the reaction mixture was recorded at 230nm. Ascorbic acid was used as standard.

$H_2O_2$ scavenging activity (%) = $(A_0 – A_1)/ A_o$ X 100

Where $A_o$ is the absorbance of the blank (control) and $A_1$ is the absorbance of the sample. The blank contained phosphate buffer and sample solution.

***Ferric Reducing Antioxidant Power (FRAP) Assay***

The ability to reduce ferric ions was measured using the methods described by Benzie and Strain **[24]**. 300mM sodium acetate buffer (pH 3.6), 10.0mM tripyridyl triazine (TPTZ) solution and 20mM $FeCl_3.6H_2O$ solution were mixed in the ratio10:1:1 by volume to give FRAP reagent. Sample solutions (25, 50, 75, 150 and 300 µg/ml) were added to this reagent (3 ml) and the reaction mixture incubated at 37$^o$C for 30 min. The increase in absorbance at 593nm was measured. Fresh working solution of $FeSO_4$ was used for calibration. The antioxidant capacity based on the ability to reduce ferric ions of sample was calculated from the linear calibration curve and expressed as millimole (mmol) $FeSO_4$ equivalent per gram of sample. Ascorbic acid was used as standard.

***Determination of Medium Lethal Dose ($LD_{50}$) of the Plant Extract***



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The $LD_{50}$ of the extract was determined by the method described by [25] with little modification in terms of dosage. Nine albino rats (71-106 g) of either sex were divided into three groups of three rats each. They were first administered orally with ethanol stem bark extract of *Uapaca togenensis* dissolved in normal saline at varying doses of 500, 1000 and 2000 mg/kg body weight and monitored for 24 hours for gross behavior and mortality. In the second phase, another set of nine rats also in a group of three each were also administered with 2500, 3500 and 5000 mg/kg dose and monitored for 24 hours for mortality and sign of toxicity. The $LD_{50}$ was calculated as:

$$LD_{50} = (a \times b)^{1/2}$$

where a is highest dose that gave no mortality and b is lost dose that produced mortality.

***Experimental Protocol and Design***

Thirty rats assigned into six groups of five rats each were used for diabetic study. The experimental protocol followed was that approved by the Institutional Animals Ethics Committee (IAEC) and animal care in accordance with the guidelines of the European convention for the protection of vertebrate animals and other scientific purpose ETS-124.

***Induction of Diabetes Mellitus***

The rats were subjected to 12 hour fast. Diabetes was then induced in the rats by intra-peritoneal injection of 130 mg/kg body weight alloxan reconstituted in normal saline and were left on 5% glucose to prevent hypoglycemia [26]. Forty eight hours after, diabetes was confirmed in rats that had fasting blood glucose level (FBGL) of 230 mg/dl and above. FBGL was estimated using one touch Accu-check glucometer with blood obtained from the tail vein of the rats.

***Treatment of Diabetes Rats and Determination of Blood Glucose Level, (BGL)***

The rats were divided into six groups of five rats each with their tails marked for easy identification. The animal in the various groups with the exception of group A and B (which serves as normal and diabetes control and fed with feed and water only throughout the experimental period), were treated. Animal in group C, D and E were treated daily with the extract of *Uapaca togeonsis* at 500 mg, 1000 mg and 1500 mg/kg weight doses respectively for seven days. Group F was treated with standard drug (Glibenclamide 5mg/kg) also for seven days as shown in Table 1. The drugs were administered orally and the blood sugar levels were measured by the glucose- oxidase principle [27] using one Touch Basic Accu-check (active) Glucometer test strips.

**Table1: Experimental Design and Treatment Schedule for Anti-hyperglycemic Study of the Extract of *Uapaca togeonsis***



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| Group | Number of animals | Treatment | Dosage |
|---|---|---|---|
| A. Normal Control | 5 | Normal saline | - |
| B. Diabetic control | 5 | Normal saline | - |
| C. Diabetic treated | 5 | *U. togeonsis* | 300 mg/kg |
| D. Diabetic treated | 5 | *U. togeonsis* | 700 mg/kg |
| E. Diabetic treated | 5 | *U. togeonsis* | 1000 mg/kg |
| F. Diabetic treated | 5 | Standard drug (glibenclamide) | 5 mg/kg |

***Collection and preparation of Serum samples for Lipid profile Analysis***

Blood samples were collected from overnight fasted animals via cardiac puncture into plain tubes and were allowed to clot and the serum was separated by centrifugation using Denley BS400 centrifuge (England) at 3000 rpm for 10 minutes. The serum was collected and then assay for lipid profile.

***Lipid Profiles Assay***

These were determined spectrophotometrically, using enzymatic colorimetric assay kits (Randox, Northen Ireland) as follows;

***Assay for Serum Total Cholesterol***

The serum level of total cholesterol was quantified after enzymatic hydrolysis and oxidation of the samples as described by method of Stein [28]. 1000µl of the reagent was added to each of the sample and standard. This was incubated for 10 minutes at 20-25ºC after mixing and the absorbance of the sample (A) and standard (A standard) was measured against the reagent blank within 30 minutes at 546 nm. The value of TC present in serum was expressed in the unit of mg/dl.

$$TC\ Concentration = \frac{A\ sample}{A\ standard} \times 196.86\ mg/dl$$

***Assay for Serum Triglyceride***

The serum triglyceride level was determined after enzymatic hydrolysis of the sample with lipases **[29]**. 1000µl of the reagent was added to each of the sample and standard. This was incubated for 10 minutes at 20-25ºC after mixing. The absorbance of the sample (A sample) and standard (A standard) was measured against the reagent blank within 30 minutes at 546 nm. The value of triglyceride present in the serum was expressed in the unit of mg/dl.

$$TGL\ Concentration = \frac{A\ sample}{A\ standard} \times 194.0\ mg/dl$$

***Assay for Serum High Density Lipoprotein Cholesterol***



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The serum level of HDL-C was measured by the method of **[30]**. Low-density lipoproteins (LDL and VLDL) and chylomicron fractions in the sample was precipitated quantitatively by addition of phosphor tungstic acid in the presence of magnesium ions. The mixture was allowed to stand for 10 minutes at room temperature and centrifuged for 10 minutes at 4000 rpm. The supernatant represented the HDL-C fraction. The cholesterol concentration in the HDL fraction, which remained in the supernatant, was determined. The value of HDL-C was expressed in the unit of mg/dl.

***Determination of Serum Low-Density Lipoprotein Cholesterol***

The serum level of (LDL-C) was measured according to protocol of Friedewaldet al**[31]** using the equation below:

$$LDL - C = TGL, HDL - C$$

***Statistical Analysis***

Data obtained were expressed as Mean ± SEM and analyzed using the Analysis of Variance 'ANOVA' via the Statistical Package for Social Scientists, SPSS Version 21. Values at $p < 0.05$ were regarded as significant compared with appropriate controls.

## RESULTS AND DISCUSSION

***Results***

***Phytochemical Screening of Uapaca togoensis***

Results of phytochemical screening of the extract is as presented in Table 2

***Acute Toxicity ($LD_{50}$) Study of Ethanol Extract of Uapaca togoensis***

The result is as presented in Table 3. No death was observed in all doses however, those administered with 5000 mg/kg showed mild signs of weakness, itchiness, decreased food and water intake within the first 2 hours after administration.

**Table2: Phytochemical Screening of Crude Ethanol Extract of *Uapaca togoensis* Stem Bark**



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| **Phytochemials** | ***Uapaca togoensis*** | |
|---|---|---|
| | **Constituents** | **Quantity** |
| Alkaloids | + | 8.00±0.80 % |
| Carbohydrates | + | ND |
| Cardiac glycoside | + | ND |
| Steroids | + | ND |
| Phenols | + | 4.20±1.12 mg/g |
| Tannins | + | 0.35±1.02 mg/100g |
| Flavonoids | + | 10.67±2.31 % |
| Diterpines | + | ND |
| Saponnins | + | 20.00±0.00 % |
| Phytosterols | + | ND |
| Amino acids and Protein | + | ND |

**NB:** ND implied 'not determined', + = present

**Table3: Acute Toxicity ($LD_{50}$) Study of Ethanol Extract of *Uapaca togoensis***

| **Group** | **Number of Rats** | **Dose (mg/kg)** | **Number of death** |
|---|---|---|---|
| **A** | **4** | **500** | **Nil** |
| B | **4** | **1500** | **Nil** |
| C | **4** | **2500** | **Nil** |
| D | **4** | **3000** | **Nil** |
| E | **4** | **5000** | **Nil** |

***Antidiabetic Study***

Table 4 presented the result of Effect of ***Uapaca togoensis*** stem bark extract on the Blood glucose level of the rats.



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**Table 4: Effect of Ethanol Stem Bark Extract of *U. togoensis* on Blood Glucose Level (mg/dl) of Diabetic Rats**

| Group | Day0 | Day1 | Day2 | Day3 | Day4 | Day5 | Day6 | Day7 |
|---|---|---|---|---|---|---|---|---|
| A | 78.75±4.89 | 78.75±4.85 | 77.25±4.66 | 76.50±4.03 | 81.00±2.12 | 90.00±3.72 | 89.21±2.05 | 90.01±3.75 |
| B | 334.25±17.55* | 379.00±9.42* | 420.75±20.13* | 450.75±17.67* | 447.00±19.66* | 515.00±8.53* | 516.23±10.50* | 514.00±7.53* |
| C | 434.05±44.68[b] | 443.95±23.94[b] | 489.71±16.78[b] | 474.22±23.58 | 489.01±30.24 | 475.30±44.45[a] | 435.68±39.40[ab] | 401.08±21.42[a] |
| D | 398.56±22.74[b] | 443.95±23.94[b] | 445.76±16.78[b] | 443.60±50.69[ab] | 453.69±30.70 | 426.67±28.66[a] | 400.36±27.07[a] | 377.66±28.59[a] |
| E | 433.09±65.36[b] | 443.95±23.94[b] | 468.11±43.06[b] | 488.29±52.78 | 406.12±57.96[ab] | 399.22±62.95[a] | 344.86±52.82[a] | 317.12±48.85[a] |
| F | 552.50±9.25 | 568.75±7.57 | 501.12±13.65 | 469.75±19.88 | 419.67±15.60[b] | 369.00±10.68[b] | 342.58±30.05[b] | 294.75±4.23[b] |

Result is significant at $p<0.05$ and expressed as mean±SEM; *= significant compared to normal control; a = significant compared to diabetic control; b = significant compared to standard drug. A = Normal control/Positive control; B = Diabetic control; C = Diabetic treated (300mg/kg); D = Diabetic treated (700mg/kg); E = Diabetic treated (1000mg/kg); F = Standard drug (Glibenclamide, 5mg/kg).

**Table 5: Effect of Ethanol Stem Bark Extract of *U. togoensis* on the lipid profile of diabetic rats**

| Group | cholesterol, mg/dl | Triglyceride, mg/dl | HDL, mg/dl | LDL, mg/dl |
|---|---|---|---|---|
| Positive control | 51.71±0.81[b] | 178.78±0.51[b] | 63.12±0.60[b] | 77.31±1.91[b] |
| Diabetic control | 95.48±0.56[a] | 190.16±4.08[a] | 56.81±0.10[a] | 87.50±0.55[a] |
| Diabetic treated (300mg/kg) | 72.76±6.63[b] | 61.43±1.53[bc] | 38.80±0.00 | 26.92±4.23[bc] |
| Diabetic treated (700mg/kg) | 80.80±0.91[b] | 40.68±0.91[bc] | 37.55±6.39 | 35.12±2.35[bc] |
| Diabetic treated (1000 mg/kg) | 67.28±6.00[b] | 17.74±3.08[bc] | 32.11±3.31 | 32.12±2.35[bc] |
| Standard drug (5mg/kg) | 54.12±0.23[b] | 170.20±0.76[ab] | 67.37±0.28[b] | 69.40±0.24[ab] |

Results are expressed as mean ± SEM (n=5) and significant at $p< 0.05$; a =significant compared with positive control; b = significant compared with negative control, c = significant compared with standard drug.



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The effect of the extract on the lipid profiles of the rats was dose dependent. There was significant reduction (lowest value obtained at 1000mg/kg) in total cholesterol, total triglycerides and LDL compared to the diabetic control. The extract however has negative effect on the HDL as it decreased continually with increased in dose.

**Table 6: DPPH, Hydrogen peroxide and FRAP Free Radical Scavenging Assay of ethanol Crude Extract of *Uapaca togoensis* Stem Bark**

| Concentration, ug/ml | DPPH (%) | | HYDROGEN PEROXIDE (%) | | FRAP (%) | |
|---|---|---|---|---|---|---|
| | *U. togeonsis* | Vitamin C | *U. togeonsis* | Vitamin C | *U. togeonsis* | Vitamin C |
| 25 | 48.35±0.11 | 46.93±0.12 | 55.56±0.07 | 57.21±0.03 | 48.48±0.02 | 24.69±0.01 |
| 50 | 62.94±0.07 | 49.32±0.01 | 57.48±0.03 | 57.52±0.04 | 90.75±0.14 | 61.48±0.02 |
| 75 | 73.99±0.05 | 68.35±0.09 | 59.71±0.02 | 58.64±0.14 | 140.33±0.02 | 73.71±0.01 |
| 150 | 93.30±0.05 | 70.04±0.04 | 60.31±0.02 | 65.16±0.01 | 257.84±0.02 | 156.87±0.01 |
| 300 | 97.60±0.00 | 78.07±0.06 | 68.30±0.03 | 71.45±0.09 | 185.06±0.02 | 171.13±0.01 |
| IC50 | =38.05 µg/ml | =47.48 µg/ml | =48.87 µg/ml | =48.34 µg/ml | | |

DPPH and FRAP free radical quenching ability of the extract were higher at all concentrations compared to vitamin C used as standard.

***Discussion***

*Uapaca togoensis* has been widely reported to have pharmaceutical potentials **[15]**. However, no report has been documented on the antidiabetic studies of the plant. This study therefore investigated free radical scavenging activity, antidiabetic and anitlipidemic property of ethanol stem bark extract of *Uapaca togoensis* in alloxan induced diabetic wistar rats.

Acute toxicity study of the extract (Table 3) showed that the extract was relatively safe up to 5000 mg/kg dose on experimental rats; indicative that it could be relatively safe for humans. This result agreed with the previous study **[19]** on methanol stem bark extract of the same plant.

Result from antidibetic study (Table 4) showed that the extract significantly($p < 0.05$) reduced blood glucose level at all doses compared to the diabetic control/negative control(most especially the 1000mg/kg dose).The diabetic rats without treatment (Diabetic control) showed significant



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increase ($p < 0.05$) in the levels of total cholesterol (TC), total triglycerides (TG) and low density lipoprotein (LDL), and a significant decrease ($p < 0.05$) in the level of high density lipoprotein (HDL) compared to positive control(Table 5). The alteration in the lipid parameters of the test rats was in conformity with diabetic condition **[32]**. There was slight increase in total triglyceride level, low density lipoprotein (LDL) cholesterol; significant increase ($p < 0.05$) in total cholesterol level and slight decrease in the level of high density lipoprotein (HDL) of the diabetic rats compared to the normal control (non-diabetic rats).However, upon treatment with *U. togoensis* extract and glibenclamide, the trend in the lipid parameters reversed; there was significant decrease ($p < 0.05$) in TC, TG and LDL and a significant decrease ($p < 0.05$) in HDL level compared to diabetic untreated rats. This was an indication that *U. togoensis* could be a potential source of hypoglycemic and antilipidermic agent. This could be possible because of various classes of phytochemicals contained therein.

The presence of phytochemical compounds of pharmaceutical repute was revealed in the stem bark extract of *U. togoensis*. The results were as presented in Tables 2.The extract showed the presence of alkaloids, flavonoids, phenols saponnins and tannins among others; this result agreed with that reported by**[19]**on the methanol stem bark extract. Quantitative result showed the sample has higher saponnins content (**20.00±0.00 %**) followed by flavonoids (**10.67±2.31 %**) and tannins (**0.35±1.02%**) the least.

Free radical scavenging activity of the extract was investigated (Table 6). The results indicated that ethanol stem bark extract of *Uapaca togoensis* has a significant (at $p < 0.05$) free radical quenching activity that was concentration dependent. DPPH percent inhibitory activity was significantly higher than Vitamin C used as standard (IC50 = 38.05 µg/ml against 47.48 µg/ml). Hydrogenperoxide ($H_2O_2$)and FRAP percent inhibitory activities was also significant (at $p < 0.05$).The minimum inhibitory concentration IC50 for hydrogen peroxide assay was = 48.87 µg/ml as against 48.03 µg/ml for vitamin C. FRAP inhibitory activity was significantly higher than vitamin C used as standard. The result on antioxidant potentials was tandem to Olorukooba et al**,[19]**on the methanol stem bark extract of the same plant. The antioxidant activity of the extract could be attributed to the presence of alkaloids, diterpines, and high flavonoids and saponnins contents which have been suggested for the antioxidant property in previous studies **[32-34]**.Recent report supported the fact that pro-oxidant conditions exist in diabetic patients [4]. The presence of these phytochemicals with good antioxidants property therefore, suggested that extracts of *Uapaca togoensis* could be a source of natural antioxidants to limit free radical damage occurring in patients by acting in a synergistic manner and inhibit the destruction of cells.



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## CONCLUSION

This study suggested that ethanol stem bark extract of *Uapaca togoensis* is safe at doses up to 5000mg/dl. The extract showed glucose lowering effect, possessed very good lipid reducing and antioxidant activity; therefore, could be a natural source of hypoglycemic, antilipidermic and antioxidant agents.

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