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Biochemical Studies of the Effects of *Nauclea Latifolia* Ethanolic Root Extracts in Rats

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Abstract

The plant *Nauclea latifolia* (Smith) (Family: *Rubiaceae*) also known as 'Pin Cushion tree' or 'African Peach' is a struggling shrub, native in tropical Africa and Asia where the use of folk medicine is prevalent and the search for herbal cure is but common practice. Extraction of the root of *Nauclea latifolia* with ethanol yielded the ethanol extract. The acute toxicity study on the ethanol extract in mice established an intraperitoneal LD_{50} greater than 4000mg/kg. Thus, the ethanol extract could generally be regarded as safe. The phytochemical analysis of the *Nauclea latifolia* ethanol extract indicated the presence of flavonoids, saponins and reducing sugars. The result of the liver function test, alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase enzymes and the serum concentrations of conjugated and total bilirubin measured suggest mild damage of the liver hepatocytes of rats treated with ethanolic extract of *Nauclea latifolia* root when compared to the control. Increased serum enzyme concentrations could be associated with

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hepatocellular damage. The result of urea and creatinine indicate that the kidney may be damaged when compared to the control group. The extract caused a slight but non significant increase ($p > 0.05$) in blood glucose concentration as administration of the extract continued at days 28 and 42. The present study established that the continuous administration of the ethanol crude extract of *Nauclea latifolia* is lethal to the hepatocytes and kidneys.

Keywords: Biochemical parameters, *Nauclea latifolia,* Phytochemical analysis, Ethanolic Extract and toxicity, White blood cells, Alanine aminotransferase, Bilirubin, Liver function test

INTRODUCTION

Medicinal plants are of value to mankind due to their rich contents in a wide range of minerals, primary and secondary metabolites, which have numerous reported therapeutic properties (Cheikhyoussef *et al*., 2015). Phytochemicals identified from traditional medicinal plants present an exciting opportunity for the development of new types of therapeutics. Phytochemicals can offer a new avenue to greatly impact the onset and progression of chronic diseases, oxidative stress and ageing. The phytoprotectants act as bioenhancers of several physical and biochemical processes (Krishnaswamy, 2008). *Nauclea latifolia* is a multi-stemmed tree that grows to an altitude of 200 meters. It is commonly known as pin cushion tree and African peach in English and sold by the trade name *Opepe* in Nigeria (Udobi and Umoh, 2017). Locally, in South-South of Nigeria, it is known as *Itu* by the Itsekiris in Edo state and *Mbomibong* by the Ibibios and Effik in Akwa-Ibom State. In Hausa, Northern Nigeria, it is known as *Tafashiya* or *Tafiyayaiga* and *Uche* by the Igedes in Benue state, Nigeria. In Ibo, South Eastern Nigeria, it is known as *Ubulinu* or *Ovoroilu* and *Egbeyesi* or *Egbesi* in Yoruba, South West Nigeria (Balogun *et al*., 2016; Udobi and Umoh, 2017). Ethnomedicinal usages include for hypertension and diabetes (Balogun *et al*., 2016). In Northern Nigeria, cold infusion of the stem bark is used as diuretic and anthelmintic. It is used as mouth antiseptic, chewing stick, as remedy against gastric pain and tuberculosis (Udobi and Umoh, 2017). Usage as antimalarial, antipyretic and aphrodisiac, wound healing plant and as a vermifuge have been reported (Udobre *et al*., 2013). Almost all parts of the plant are useful in disease treatment. Frequency of usage in ethno-medicine is: roots > stem > bark > leaf (Balogun *et al*., 2016). Pharmacological assays have confirmed effectiveness as antiinfective agent in malaria treatment (Udobre *et al*., 2013; Iyamah and

Idu, 2015), antipyretic, anti-inflammatory and antinociceptive (Abbah *et al*., 2010; Taïwe *et al*., 2014) anthelminthic agent (Agyare *et al*., 2014; Tittikpina *et al*., 2016) anticonvulsant and anxiolytic (Bum *et al*., 2009), antidiabetic (Gidado *et al*, 2009) and anti-hypertensive (Odey *et al*., 2012); antibacterial (Egwari *et al*., 2010) and anti-trypanosomal (Ugwu *et al*., 2016); wound healing (Udobre *et al*., 2013) and antidiarrheal activity (Owolabi *et al*., 2010).

MATERIALS AND METHODS

Animal material

The experimental animals used for the study were male and female Wister albino rats (weights 103-230g). The rats were obtained from the animal house of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka and were kept for seven days to acclimatize and given feed and water *ad libitum*.

Plant material

Nauclea latifolia roots were obtained from a forest in Okpome-Agbada Nenwe, Aninri Local Government Area of Enugu State, Nigeria. The roots were authenticated by Mr. Njokuocha in the Department of Botany, University of Nigeria, Nsukka. The roots were dried at room temperature in the absence of sunlight for one week, cut into bits and were ground to coarse powder using a hammer mill.

Extraction procedure

Preparation of ethanolic extract

About 500g of the powdered root of *Nauclea latifolia* was soaked in 3.4 liters of 70% ethanol. The mixture was left to stand for twenty-four hours with occasional stirring. The mixture was later extracted using a soxhelet extractor to obtain the ethanol extract. The extract was concentrated over a water bath at a temperature of 25 to 30^{o}C to obtain 46g (9.2%) of the ethanol extract.

Determination of concentration of extract

A crucible was weighed and a known weight of the extract was poured into the crucible and their combined weight determined before heating. The crucible was heated until all its content was charred. After heating, the crucible was re-weighed with its content and the

weight recorded. The concentration of the solid extract was then determined from the two weights.

Experimental design

A total of sixty Wister albino rats were used in this study. The rats were randomly divided into four (4) groups of 15 rats each.

Group 1: the control group was administered normal saline

Group 2: was administered 10 mg/kg of the ethanolic extract

Group 3: was administered 50 mg/kg of the ethanolic extract

Group 4: was administered 250 mg/kg of the ethanolic extra

The extracts were administered by dissolving accurately measured doses in water and feeding the rats orally on a daily basis for 42 days. At the end, the rats were sacrificed and some internal organs removed, fixed and later used for histopathological studies.

Acute toxicity test (LD_{50})

The median lethal dose (LD_{50}) of the ethanol extract was determined in rats using the oral route of administration (OECD, 1995). A total of thirty albino Wister rats were randomly divided into six groups of five rats. Each rat was kept in a separate clean stainless cage and provided with water and feed *ad libitum*. The rats in the various groups were injected intraperitoneally with increasing doses of 250, 500, 1000, 2000 and 4000mg/kg body weight of the *Nauclea latifolia* ethanolic extract while the control group received an equal volume of distilled water. The rats were allowed to feed and were closely observed for mortality and toxic signs for 5 days. No death was recorded. Since the extract did not cause any death in the rats at concentrations above 4000mg/kg, the ethanolic extract of *Nauclea latifolia* was considered non toxic (OECD, 1995).

Cytotoxicity test (LC_{50})

The method of Meyer *et al.,* 1982, modified by Mclanghlin *et al*., 1991, was used to study the cytoxicity of *Nauclea latifolia* ethanolic extract. *Artemia salina* eggs obtained from Dr. A.O. Onaga, of the department of veterinary pharmacology and physiology, were incubated in natural sea water (from Bar Beach, Lagos Nigeria) in a dam-well under room condition. Forty-eight hour naupli (10 in each well) were incubated in known concentrations of 10, 100 and 1000ppm of the extract for 24 hours. All tests were conducted in triplicate. The

dead nauplii were subtracted from 10 and the data were analysed using profit analysis (Finner Program, DOS) to determine the LC_{50} at 95% confidence interval. Weak nauplii were noted as an indication of central nervous system depressions while the control was incubated in sea water, the incubation medium.

Phytochemical Analysis

The preliminary analysis involved testing for the presence or absence of the following plant constituents: alkaloids, flavonoids, reducing sugars, saponins, tannins, acidity, oils and terpenoids using the method of Harborne, 2008.

Test for the presence of Alkaloids

Exactly 0.2 grammes of the ground dried roots of *Nauclea latifolia* was boiled with 5 milliliters of 2% hydrochloric acid on steam bath. The mixture was filtered using Whatman No.1 filter paper. One milliliter of the solution was treated with 2 drops of Drahendroff reagent (Bismuth potassium iodide solution). A red precipitate indicated the presence of alkaloids (Harborne, 2008).

Test for the presence of reducing sugars

Exactly 0.1g of the ground dried roots of *Nauclea latifolia* was shaken vigorously in 5ml of distilled water and filtered. One ml portion of the filtrate was added to equal volumes of Fehling's solution A and B and then shaken vigorously. A brick red precipitate indicated the presence of reducing sugars.

Test for the presence of Flavonoids

Approximately 0.2g of the ground dried sample was heated with 10ml of ethylacetate in boiling water for 3 minutes. The mixture was filtered and the filtrate used for the test. Four milliliters of the filtrate was shaken with one milliliter of 1% Aluminium chloride solution and observed. A yellow coloration in the ethylacetate layer indicated the presence of flavonoids.

Test for the presence of Tannins

Exactly 2g of the ground material was boiled in 5ml of 45% ethanol for five minutes. The mixture was cooled and filtered. To 1ml of the filtrate was added 3 drops of Lead sub-acetate solution. A gelatinous precipitate indicated the presence of tannins.

Test for the presence of Saponins

The ground sample (0.1g) was boiled in 6ml of distilled water for 5 minutes. The mixture was filtered while still hot. The filtrate was then used for the following tests:

i. Emulsion test:

To one milliter of the filtrate was added 2 drops of Olive oil and shaken. Formation of emulsion indicated the presence of saponins.

ii. Frothing test:

One milliter of the filtrate was mixed with 4ml of distilled water and then shaken vigorously. Observation of stable frost on standing showed the presence of saponins.

Tests for Acidity

Extract (0.1g) was placed in a clear dry test tube and sufficient distilled water added. This was warmed on a water bath and then cooled. A strip of water-wetted litmus paper was dipped into the filtrate. A red color on the litmus paper indicated acidity.

Tests for Oils

The plant extract (0.1g) was dropped on a filter paper and kept to dry. The filter paper was then observed for the presence of oils.

Tests for Terpenoids

The ethanol extract (0.5 ml) was evaporated to dryness on a water bath and heated with 3 mls of concentrated sulphoric acid for ten minutes on a water bath. A grey color was a positive indicator.

Biochemical Assay Methods

Glucose Concentration

A one-touch glucometer (Lifescan, USA) and test strips were used for this assay. The principle of the reaction is based on the glucose oxidase reaction. The blood glucose estimation involves the reaction between glucose in the blood and oxygen in the presence of glucose oxidase, which is immobilised in the test strip, to yield gluconic acid and hydrogen peroxide. The hydrogen peroxide subsequently oxidizes the dye in a reaction mediated by peroxidase to produce a blue-colored product. The intensity of the color

produced is proportional to the glucose concentration in the blood. The color intensity was read instantly from the one-touch glucometer.

Determination of Alkaline phosphatase (ALP)

The principle of this method is based on the reaction between serum alkaline phosphatase and a colorless substrate of phenolphthalein monophospate, giving rise to phosphoric acid and phenolphthalein which at alkaline pH values, turn to pink that can be determined photometrically. The blank and sample test tubes were set up in duplicates. Into the sample test tubes, 0.5ml distilled water and 0.01ml substrate were pipetted respectively and mixed thoroughly. Into the blank tube, 0.5ml distilled water and 0.01ml of substrate were incubated at 37°C for 5 minutes. From the standard test tube, 0.1ml was withdrawn and used as blank. From the sample tube, 0.05ml was withdrawn and incubated at 37°C for 20 minutes. The absorbance of the sample and the standard were measured against the blank at 550 nm.

ALP Calculation

Alkaline phosphatase was calculated as follows:

$$\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times 30 = \text{conc. of ALP (in U/L)}$$

Determination of Alanine Aminotransferase (ALT)

The blank and sample test tubes were set up in duplicates. Into the blank sample tubes 0.1ml distilled water and 0.5ml serum were pipetted respectively. To these was added 0.5ml solution from one of the kit containing phosphate buffer, L-alanine and ά-oxoglutarate at the concentrations specified above. The mixtures were thoroughly mixed and incubated for exactly 30 minutes at 37°C. Five milliters of the solution containing 2, 4-dinitrophenylhydrazine (0.2 mmol/L) was added in each tube; mixed thoroughly and incubated for exactly 20 minutes at 25°C. Sodium hydroxide (2.5ml) was then added and the solution mixed and absorbance of the sample read against the blank after 5 minutes. The activity of ALT (U/L) was read up from the standard reference table.

Determination of Aspartate Aminotransferase (AST)

The blank and sample test tubes were set up in duplicates. Into the sample tube was pipetted 0.1ml of sample and 0.5ml of solution-1. Into the blank tube was pipetted 0.5ml of solution-1 which was then mixed thoroughly and incubated for 30 minutes at 37°C. Then 0.5ml of solution-2 and 0.1ml of sample were pipetted into blank test tube. Also 0.5ml of solution-2 was pipetted into sample tube; mixed thoroughly and allowed to stand for 20 minutes at 25 °C. Twenty five milliliters of sodium hydroxide was added into each test tube and mixed thoroughly. The absorbance was then read at 550nm against the blank after 5 minutes. The activity of AST (U/L) was read up from the standard reference table.

Determination of Total Bilirubin (TB)

The blank and sample test tubes were set in duplicates. Into the blank sample tube, 0.2ml of reagent-1, one milliliter of reagent-3 and 0.2ml of sample were pipetted. Into sample test tube, 0.2ml of reagent-1, 0.05ml of reagent-2, one milliliter of reagent-3 and 0.2ml of sample were pipetted. The different tubes were mixed thoroughly and allowed to stand for 10 minutes at 25°C. Then one milliliter of reagent-4 was added to each of the test tubes. The tubes were allowed to stand for 10 minutes at 25°C and the absorbance read at 578nm against the blank.

TB Calculation

Total Bilirubin (μmol/L) = 185 x A_{TB} (578nm)

Total Bilirubin (mg/dL) = 10.8 x A_{TB} (578nm)

(A_{TB} = Absorbance of Total Bilirubin; 185 and 10.8 are constants)

Determination of Conjugated Bilirubin (CB)

The blank and sample test tubes were set up in duplicates. Into the sample blank test tube, 0.2ml of reagent-1, two milliliters of sodium chloride (9g/dL) and 0.2ml of sample were added. Into the sample test tube, 0.2ml of reagent-1, 0.05ml of reagent-2, two milliliters of sodium chloride (9g/dL) and 0.2ml of sample were added. The contents of the test tubes were mixed thoroughly and allowed to stand for 5 minutes at 20°C and the absorbance read at 546nm against the blank.

CB Calculation

Conjugated Bilirubin (μmol/L) = 246 x A_{CB} (546nm)

Conjugated Bilirubin (mg/dL) = 14.4 x A_{CB} (546nm)

(A_{CB} = Absorbance of Conjugated Bilirubin; 246 and 14.4 are constants)

Determination of Serum Urea

This assay was carried out according to the method of Chaney and Marbach (1962) as outlined below. Three test tubes were labelled blank, standard and sample respectively and the solutions were added.

The tubes were set up in duplicates and the contents were mixed thoroughly and incubated for 10 minutes at 37°C. Solution-2 and distilled water (25ml) were respectively added to each tube and the contents shaken vigorously and incubated for 15 minutes at 37 °C. The absorbance of each tube was read against the blank at 510nm.

Calculation

The urea concentration in the serum was calculated using the formula:

$$\text{Urea conc. (mol/L)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \text{conc. of standard}$$

Determination of Serum Creatinine

Exactly 0.1ml of the sample was pipetted into a clean, labeled tube and 1.0ml of trichloroacetic acid (TCA) was added to it, mixed and then centrifuged at 250 rpm for 10 minutes. The supernatant was decanted and reserved for use. By this procedure the sample had been deproteinised. The assay procedure was then carried.

The mixtures were prepared in duplicates; thoroughly mixed and allowed to stand for 20 minutes. The absorbance of the samples and standard were read against the blank at 540nm.

Calculation

The concentration of Creatinine in serum was calculated as follows:

$$\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \text{Concentration of standard (mg/dL)}$$

RESULTS

Extraction

The ethanolic extract weighed 46g, thus gave 9.2% yield from the 500g raw plant material used.

Phytochemical Analysis

The qualitative phytochemical tests carried out on the ethanolic extract of *N. latifolia*, showed the presence of the following compounds.

Compound	Concentration in Extract
Alkaloids	-
Reducing sugars	+++
Flavonoids	++
Tannins	-
Saponins	+
Acidity	-
Fats and Oils	-
Terpenoids	++

NB: + => Present in trace concentration
++ => Present in moderately high concentration
+++ => Present in very high concentration
- => Absent

Effect of *Nauclea latifolia* extract (NLE) on liver enzymes and markers

Effect of NLE on Alanine transaminase

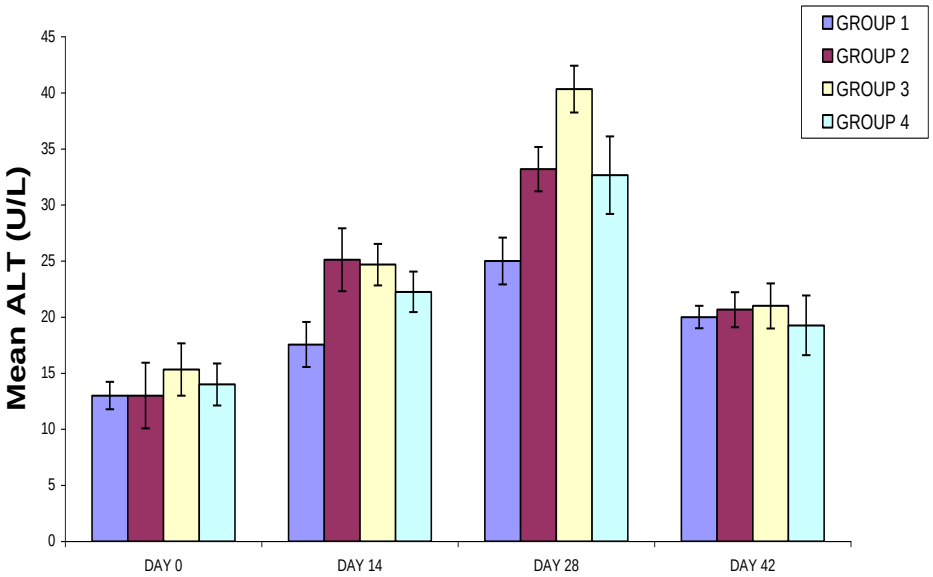


Figure 1: Effect of extract on Alanine transaminase

On days 0 and 42, the ethanolic extract of *N. latifolia*, had no significant effect ($p > 0.05$) on the concentration of ALT in rats compared to the control. On days 14 and 28, ALT activity was observed more in group-2 (10 mg/kg) and group-3 (50 mg/kg) showing a significant increase ($p < 0.05$) in the concentration of ALT compared to the control.

Effect of NLE on Aspartate transaminase

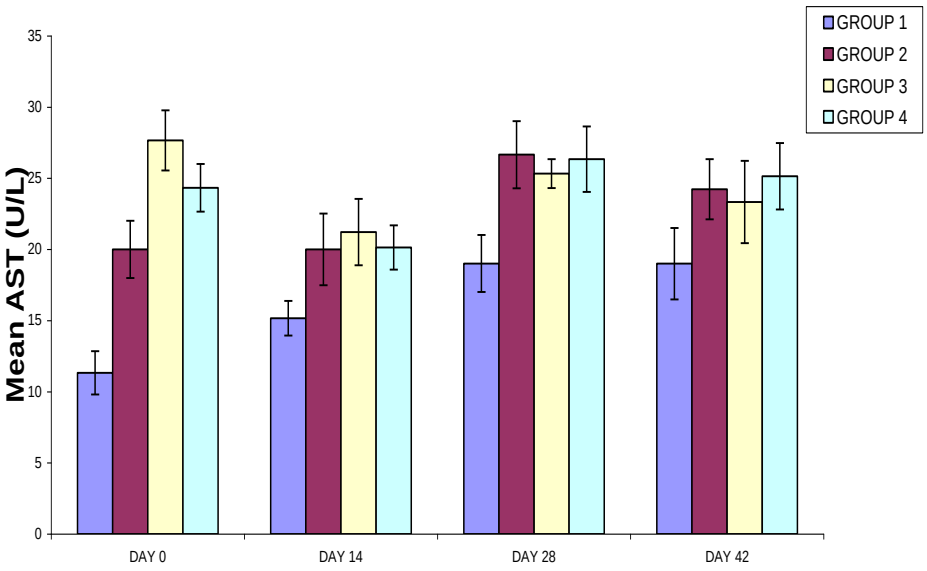


Figure 2: Effect of extract on Aspartate transaminase

The administration of the ethanolic extract of *N. latifolia* caused a significant increase ($p < 0.05$) in AST concentrations in all the treatment days compared to the control group. There was a remarkable dose-dependent increase in AST activity from day 14 to day 42. This implied that the administration of ethanolic extract had an increased effect on AST concentration by doses and by number of days.

The effect of NLE on Alkaline Phosphatase

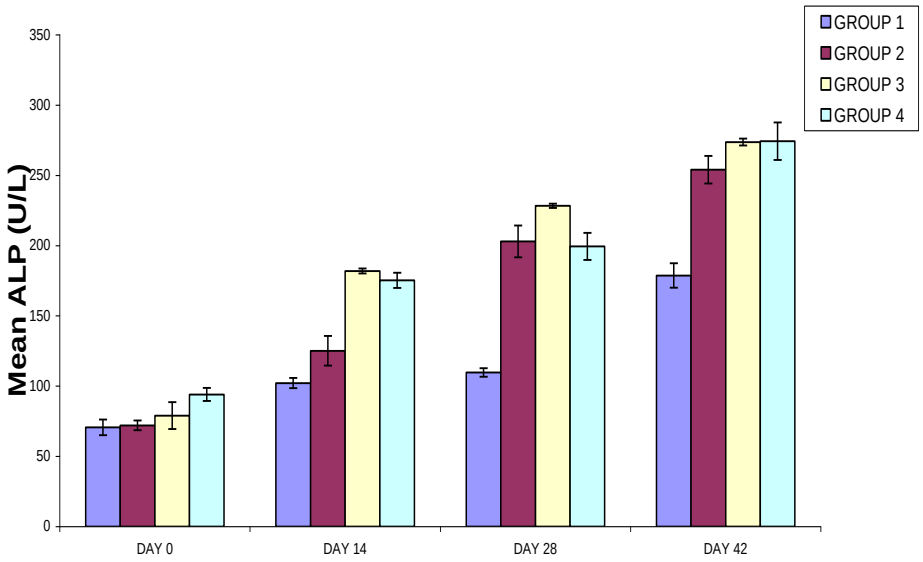


Figure 3: Effect of extract on Alkaline phosphatase

The ethanol extract had no effect on the concentration of ALP ($p > 0.05$) on day 0 compared to the control but on days 14, 28 and 42, the extract caused a significant increase ($p < 0.05$) in the concentration of ALP compared to the control implying that continuous administration of the ethanol extract caused an increase in the ALP concentration.

Effect of NLE on Total Bilirubin

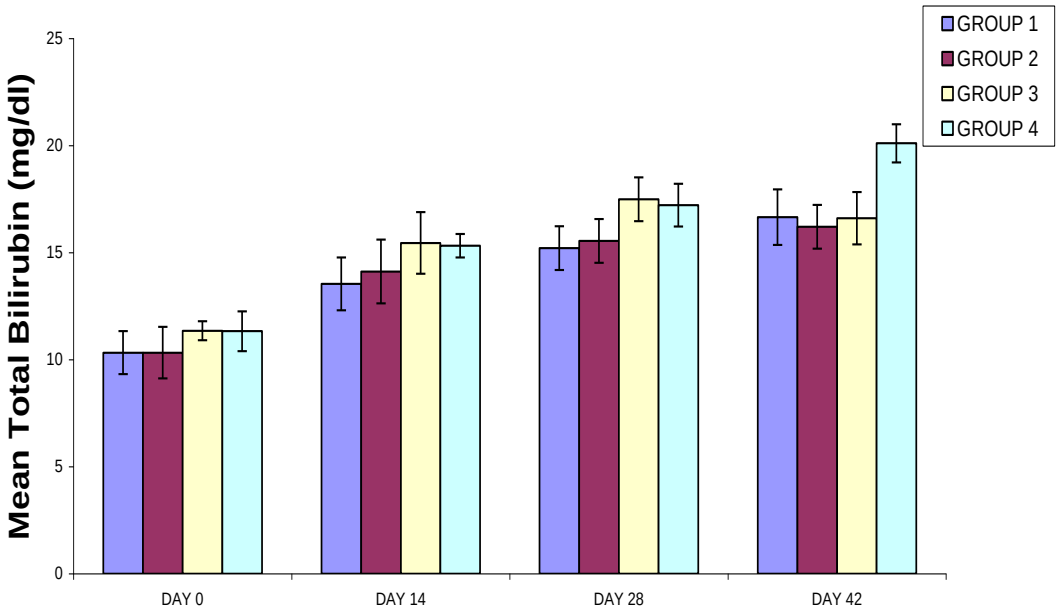


Figure 4: Effect of extract on Total Bilirubin

On day 0, the Total Bilirubin levels showed no significant difference ($p > 0.05$) in groups-2, 3 and 4. There were slight increases in the level of Total Bilirubin among all groups from days 14, 28 to 42 when compared to the control group while group-4 (250 mg/kg) on day 42 had a significantly higher concentration of Total Bilirubin compared to other groups.

Effect of NLE on Conjugated Bilirubin

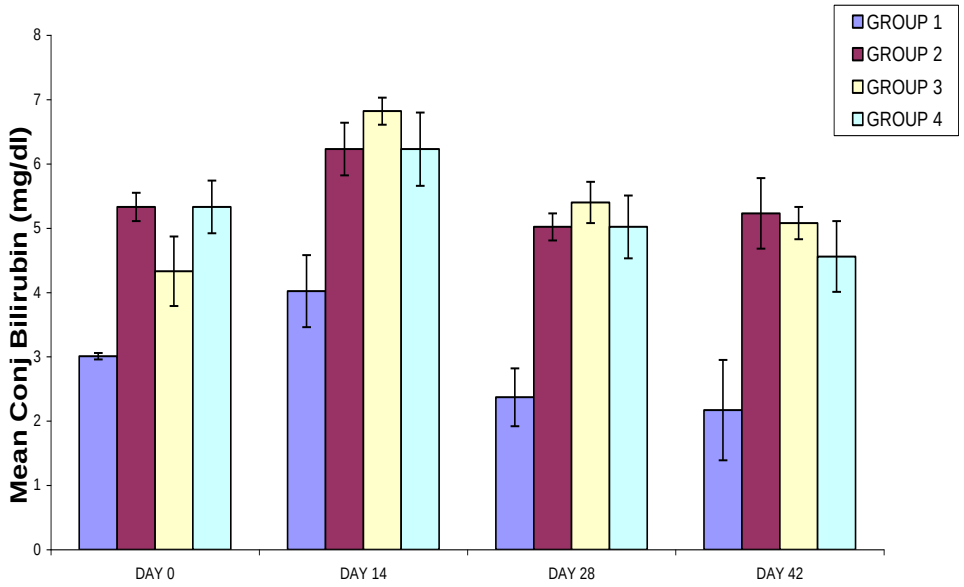


Figure 5: Effect of extract on Conjugated Bilirubin

Conjugated Bilirubin levels of rats treated with ethanolic extract were significantly higher ($p < 0.05$) than those of the control rats across all the days. The highest concentrations were observed on day 14 with group-3 showing the highest concentration. There was a gradual decline from day 14 in Conjugated Bilirubin concentration among the four groups.

Effect of NLE on Renal function

Effect of NLE on Creatinine

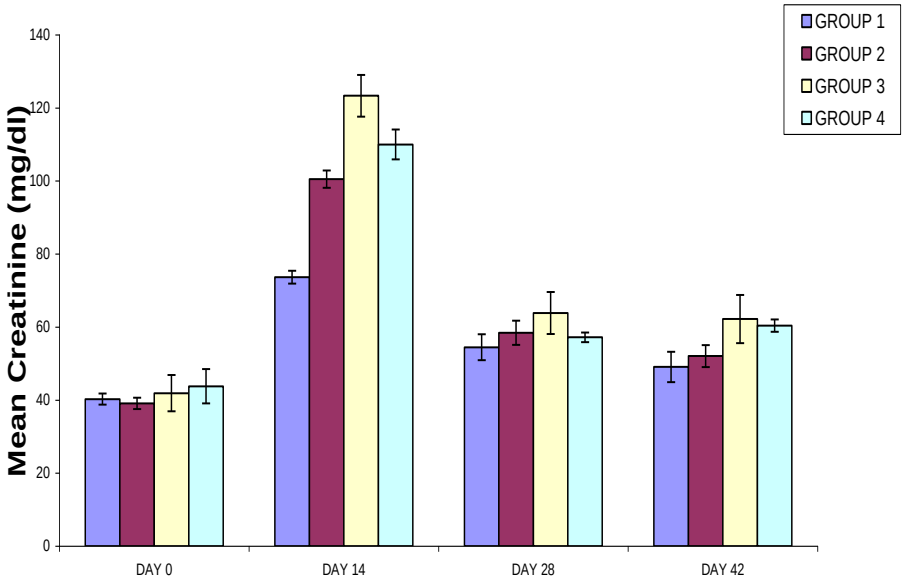


Figure 6: Effect of extract on Creatinine

The ethanol extract showed no significant difference ($p > 0.05$) in the creatinine concentration on day 0. On day 14, the extract caused a significant increase ($p < 0.05$) in the concentration of creatinine compared to the control. On days 28 and 42, groups-2 and 4 had no significant differences ($p > 0.05$) in the creatinine concentration while in group-3, it was significantly higher than in the control group.

Effect of NLE on Urea

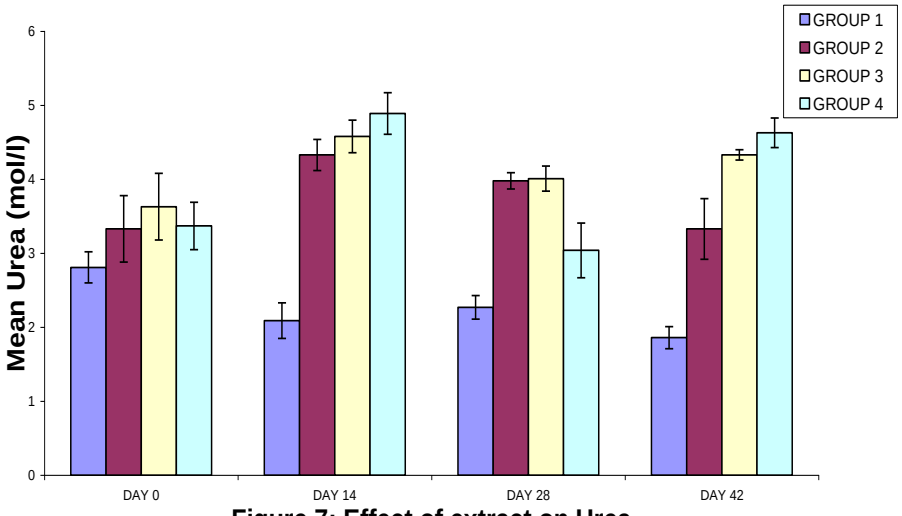


Figure 7: Effect of extract on Urea

On day 0, there was no significant difference in the Serum Urea levels of the different groups compared to the control but as administration continued, there were significant increases ($p < 0.05$) in the Urea levels on days 14, 28 and 42 when compared to the control group. This implied that continued administration of the extract caused an increase in the urea level.

Effect of NLE on Glucose concentration

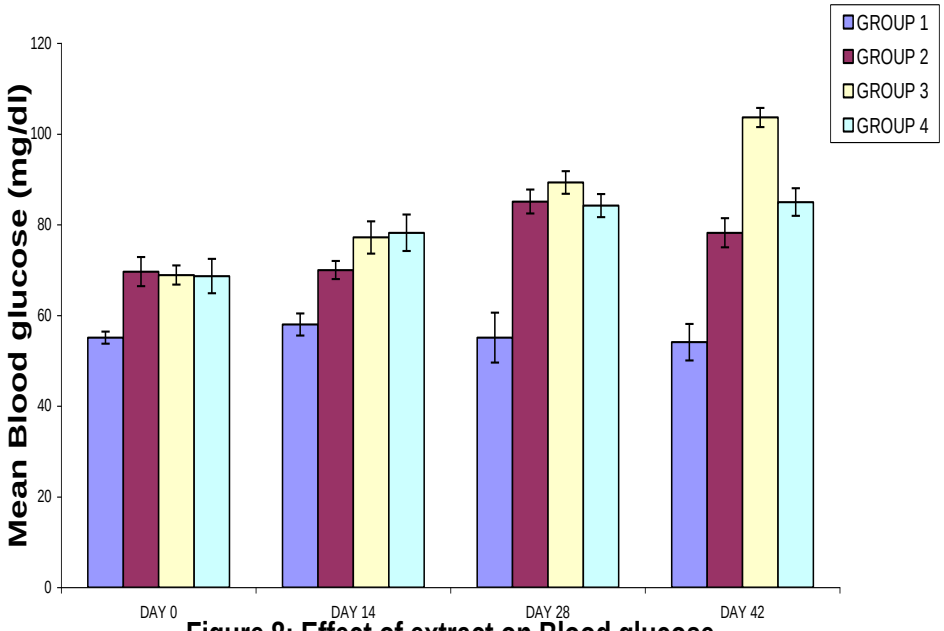


Figure 8: Effect of extract on Blood glucose

Blood glucose concentration of rats treated with ethanol extract was significantly increased ($p < 0.05$) in all the days compared to the control rats. The increase in blood glucose concentration was higher on days 28 and 42. On day 42, the glucose concentration in group-3 was highest compared to all the other groups and to the control.

DISCUSSION

Since time immemorial, man has continued to depend on plant-based products to treat and manage diseases without understanding the mechanisms of action and adverse effects of some pharmaceutically bioactive principles (Uche *et al.,* 2020). Available information over the years revealed that improper intake of herbal products can cause severe liver and kidney injuries, acute and chronic abnormalities, anaemia, cirrhotic transformation, and necrosis

(Uche *et al*., 2020). Hence, our investigation into the biochemical alterations associated with oral administration of ethanol extracts of *Nauclea latifolia* roots in Wistar rats became necessary. The acute toxicity study of the ethanol extract in rats established an intraperitoneal LD_{50} greater than 4000mg/kg. Thus, the ethanol extract could be generally regarded as safe (Lorke, 1983). Phytochemical analysis of *N. latifolia* root extract showed the presence of sugars, saponins, terpenoids and flavonoids. This is in agreement with the work of Ezekiel, *et al.,* 2010. The constituents identified belong to various classes of phytochemicals which are known to possess a wide range of pharmacological activities (Handecoeur *et al,* 2018). Thus, the anti-inflammatory, anti-oxidant, hypocholesteromic, antibacterial activities reported for phthalates, aromatic hydrocarbons and fatty acids such as pentadecanoic acid, may suggest the rationale for the traditional uses of *N. latifolia* (Rahuman *et al*, 2000, Kumar *et al*, 2010, Aparna *et al*, 2012,). Furthermore, flavonoids have been widely described in the literature as vasodilator compounds (Egbung *et al*., 2013). The saponins and flavonoids are also said to have other medicinal properties in animals (Okwute and Ohiakwu, 2021). These substances are known to have beneficial hematological and immunological properties. The antioxidant properties of flavonoids protect blood vessels especially weak and fragile capillaries against damage (Asekun *et al*., 2004; Odukoya *et al.,* 2007). However, high concentrations of the substances are toxic and may impair body metabolism. (Wieslwas *et al*., 1999). Hideyuki *et al*. (2003) reported the presence of indole alkaloids in the roots of *N. latifolia,* but no alkaloids were found in his study. This may probably be due to environmental variation in the areas where the plants were obtained (since the methods used for testing for alkaloids were the same).

Liver function tests (ALT, AST, ALP, total protein and bilirubin) provide information about the state of the liver by describing its functionality, cellular integrity and link with the biliary tract (Chanda *et al*., 2015). The results of the liver function tests in which serum enzyme activities of alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase and the serum concentrations of conjugated and total bilirubin were measured seem to suggest a mild damage of the liver hepatocytes of rats treated with ethanol extract of *Nauclea latifolia* root when compared to the control. Alanine amino transferases (ALT), a cytosolic enzyme whose activities increase as a result of cellular membrane damage, as well as aspartate amino transferase (AST) are used for the detection of hepatocellular damage in animals (Ozer *et al*., 2008). The results of cytotoxicity analyses of *Nauclea latifolia* showed that it is non-hepatotoxic at 4000mg/kg but, caused significant

increases in the levels of ALT, AST and ALP. Besides the liver, AST is found in many other organs including heart, kidney and brain. Thus a high level of AST does not always indicate that there is a liver problem. Alkaline phosphatase (ALP) is a standard biomarker of biliary tract obstruction (Thapa and Walia, 2007). High levels of this enzyme in the serum may indicate cardiac infarction, muscle injury and hepatic necrosis (Debebe *et al*., 2017). Therefore, a high level of these enzymes observed in rats treated with *Nauclea latifolia* in this study, probably indicates that its prolonged and excessive use may be hepatotoxic. Transient increase of this enzyme may also be noticeable in all types of liver problems. Based on the results obtained, the extract of *Nauclea latifolia* may be slightly toxic. However, since the knowledge of pharmacokinetics of a drug, apart from the dose, is also required in determining the degree of toxicity, toxicological studies on the extract are still being determined. More human and animal experimental studies are still needed to clarify this issue.

The extract caused a slight but not significant increase ($p > 0.05$) in blood glucose concentration as administration of the extract continued on days 28 and 42. This can be explained simply by the high concentration of reducing sugars observed during the phytochemical analysis. However the result of high glucose concentration observed in this work, can be compared with that of Gidado *et al*, 2005, who observed a significant decrease ($p < 0.05$) in blood glucose concentration in diabetic rats after administration of aqueous extracts of Nauclea *latifolia* leaves. This could be due to varying concentrations in the leaves of the plant and the length of administration of the extract, as this research work elapsed 42 days while Gidado *et al*, 2005, used 24 days. Also, Gidado *et al,* 2005 used the leaves while in this research work, the roots were used. Thus during the process of detoxification and deamination, some non detoxified compounds in the ethanol extract may have destroyed the hepatocytes which are involved in detoxification than the kidney cells which are more involved in excretion.

CONCLUSION

In conclusion**,** the present study revealed elevated levels in biochemical parameters such as ALT, ALP, AST and serum albumin upon administration of crude extract of *nauclea latifolia*. The reported bioactivities of the plant, including the results of biochemical parameters in this work, may largely be due to the presence of these secondary metabolites. Elevated

levels in biochemical parameters could be as a result of the effect of *Nauclea latifolia* extract on the liver and kidney functions respectively. Hence, it can be deduced that prolonged administration of *Nauclea latifolia* could lead to hepatic or renal toxicity and abnormalities.

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