

## Evaluation of the effect of *Gongonema latifolium* on serum electrolytes of Wistar rat induced with alcohol

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### ABSTRACT

Blood lipids especially high concentration of low-density lipoprotein cholesterol (LDL-C) is one of the leading risk factors for the development of the cardiovascular disease. The effect of ethanolic extract of *G. latifolium* on serum electrolytes was tested using wistar albino rats. The rats were procured and allowed to acclimatize for two weeks under good laboratory condition after grouping them into five groups. Electrolyte disorder was induced using 1ml/kg of 97% alcohol from group B to group E. The rat was treated with low and high dose of ethanolic extract of *G. latifolium* respectively. On sodium ion, the extract increased the ion from  $115.50 \pm 2.12\text{mmol/l}$  to  $127.50 \pm 3.54\text{mmol/L}$  in group E, Potassium ion increased from  $2.40 \pm 0.35\text{mmol/L}$  to  $4.10 \pm 0.42\text{mmol/L}$ , chloride ion was increased from  $60.50 \pm 3.53\text{mmol/L}$  to  $96.50 \pm 3.54\text{mmol/L}$ , calcium ion from  $2.40 \pm 0.42\text{mmol/L}$  to  $4.11 \pm 0.13\text{mmol/L}$ , magnesium ion  $13.21 \pm 2.26\text{mmol/L}$  to  $41.91 \pm 3.27\text{mmol/L}$ , bicarbonate ion  $22.00 \pm 1.41\text{mmol/L}$  to  $29.50 \pm 2.12\text{mmol/L}$ . In all there was no significant difference at  $p < 0.05$ . The plant extract of *G. latifolium* ameliorated serum electrolytes dysfunction and therefore recommended as an alternative treatment.

Keywords: *Gongonema latifolium*, electrolytes, Wistar rats and alcohol.

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### INTRODUCTION

*Gongronema latifolium* is a tropical rain forest plant found throughout Nigeria and other tropical countries such as Guinea-Bissau, Western Cameroon and Sierra Leone [1,2,3,4]. It has been used in the traditional system of medicine for various gastrointestinal disorders such as diarrhoea, ulcers and dyspepsia and in the management of diabetes mellitus [5,6,7]. The leaves have been reported to have a hypoglycaemic effect [8,9,10] by decreasing activity of glucokinase enzyme and levels of hepatic glycogen, hepatic and blood glucose. It is rich in fats, proteins, vitamins, minerals and essential amino acids. *Gongronema latifolium* is an herbaceous shrub, with flowers usually yellow and the stem yields characteristic milky exudates [11]. It is commonly grown in Nigeria and is locally called "Utasi" by Igbos. The Igbos in Nigeria use *G. latifolium* leaf extract, in the treatment of malaria, diabetes, and hypertension and as a laxative [12]. The studies on herbal medicinal plants and the use of plant leaves, stem, roots, seed and even the latex for human benefits is an age

long event. Phytochemical studies of *G. latifolium* show that the root contains polyphenols in abundance, alkaloids, glycosides and reducing sugars [13]. The leaves also contain saponins, alkaloids, flavonoids and tannins. The ethanolic extract of *G. latifolium* leaves is reported to possess antioxidant activity by increasing superoxide dismutase and glutathione peroxidase activities [14,15,16] and also reduces renal and hepatic oxidative stress, lipid peroxidation and increases the glutathione/gluthathione disulphide ratio [17,18]. The ethanolic extract of the root of *G. latifolium* increased white blood cell count and haemoglobin concentration in normal condition, while the leaves have a strong modulatory effect against hepatocellular damage induced by carbon tetrachloride. The plant also has anti-inflammatory property and also exhibits antimicrobial activities against various microbial pathogens [19,20]. The extract of the leaves may be used to prevent or reduce weight-loss, growth-depression and haematotoxicity in diabetic subjects.

Diabetes mellitus and diabetes-related complications have been on the increase despite great strides made in understanding and managing the disease.

The disease is characterized by hyperglycaemia, depletion of antioxidants and increased generation of reactive oxygen species [21,22].

#### Justification

*G. latifolium* is one of the plant species whose leaves and other plant part has shown remarkable effect in humans and animals treatment of ill. *G. latifolium* is highly nutritive with high amounts of proteins and carbohydrates and has antibacterial properties. *G. latifolium* has long been recognized as an African traditional remedy for a variety of ailments, such as hypertension, diabetes mellitus, malaria, mental and intestinal disorders. Several pharmacological activities of *G. latifolium* extracts have

been studied and reported, which provided experimental support for the empirical ethno-pharmacological use of this plant in folk medicine. Over the past two decades, different parts of *G. latifolium* have been found to contain saponins, anthraquinones, alkaloids,  $\beta$ -sitosterol, sitostenone, lupenyl esters, pregnance ester, glucosides, and essential oils and are essential in treatments and control of serum electrolytes in human and animal.

#### Objective

The objective of the study was to investigate the effect of *G. latifolium* on

serum electrolytes of wistar albino rats induced with alcohol.

#### MATERIALS AND METHODS

##### Biological Materials

The biological materials used include: *Gongronema latifolium* and male wistar rats. The rats age was 12 weeks and average weight 130-180 g were source from University of Nigeria Enugu Campus. It was acclimatized for seven days in the

Animal House of Brain Phosphorelationship Scientific Solution Services, Enugu. They were allowed access to feed and water *ad libitum* and under controlled 12/12 hour light and dark cycles.

##### *Gongronema latifolium*

Fresh leaves of *Gongronema latifolium* was obtained from Ake Agbani, Nkanu west Local Government Area, Enugu State, Nigeria. The leaves were identified and authenticated by Prof. C. I. Eze of the Department of Applied Biology and Biotechnology, ESUT. The leaves were

picked, sundried initially and then oven-dried in a Plus 11 oven and crush using laboratory blender. The ground leaf powder was store in a glass bottle with a plastic screw cap and kept in a refrigerator (4 °C).

##### Equipment and Reagents

The equipments and reagents employed on the course of

this work were of analytical grade.

##### Experimental Design

About twenty five (25) wistar rats housed in separate cages were used for this work. They were group into 5 different groups as thus; Group A (Blank Control). The rats were neither induced with 1.0 mg/kg of alcohol nor treated with any intervention. Group B (Negative Control). The rats were induced with 1.0 mg/kg of 97% alcohol and left untreated. Group C (Positive Control). The rats were induced with 1.0

mg/kg 97% of alcohol and treated with 20 mg/kg of omeprazol (standard ulcer drug). Group D (low-dose of extract). The rats were induced with 1.0 mg/kg of 97% alcohol and treated with 100 mg/kg of *G latifolium*. Group E (high-dose of extract). The rats were induced with 1.0 mg/kg of 97% alcohol and treated with 400 mg/kg of *G latifolium*.

##### Extract Preparation

The leaves of *G. latifolium* were sun dried to constant weight in the laboratory at

room temperature for two weeks. Thereafter it was ground with a milling

machine according to method describe by Soling and Klenneke (2015). This was further sieved with a 1.0 mm sieve size; 200 g was dissolved in a 4-litre percolate absolute ethanol (95%). The system was allowed to stand for 48 hours and it was

filter with a white filter cloth. The ethanol extract was allowed to evaporate to dryness at a room temperature. The dried extract was made into aqueous solution and was use for biochemical assay.

#### Evaluation of biochemical indices

The biochemical indices were evaluated using the method of [5].

#### Analysis of Blood Electrolytes

Twenty four hours after the last dose administration, the animals were anaesthetized with chloroform vapour, quickly brought out of the jar and sacrifice. Serum was use for electrolyte analysis. Ten microliter (10 µL) of distill water was pipette into labeled test tubes,

which was use as reagent blank, 10µL of sample and, then 10µL reagent standard. Pipette 1.0mL as reagent in sample blank. The serum was analyzed for electrolytes using audicom full auto electrolyte analyzer according to [4].

#### Statistical Analysis

The results were expressed as mean ± SEM and tests of statistical significance were carried out-using one-way ANOVA. The statistical package used was Statistical

Package for Social Sciences (SPSS for windows, version 20). Values of p<0.05 was considered significant.

### RESULTS

#### Serum Sodium Ion

The result of the effect of *Gongronema latifolium* on serum sodium ion of Wistar albino rats induced with alcohol showed as thus; Group A (blank control) had mean value of 134.00 ± 2.83 mmol/L, Group B had low sodium ion of 115.50 ± 2.12mmol/L, while Group C recorded Table 1: Effect of *Gongronema latifolium* on serum sodium ion of Wistar albino rats induced with alcohol

125.50 ± 2.12mmol/L. However Group D had 115.50 ± 3.54mmol/L and Group Ehad almost the same value as normal control 127.50 ± 3.54mmol/L, although in all there was no significant difference among the groups at p < 0.05 as shown in table 1 below.

Groups	Sodium (mmol/L)
A Normal control	134.00 ± 2.83 <sup>c</sup>
B Induced but untrated	115.50 ± 2.12 <sup>a</sup>
C Induced and treated with stardard drug	125.50 ± 2.12 <sup>b</sup>
D Induced treated with low dose of extract	115.50 ± 3.54 <sup>a</sup>
E Induced treated with high dose of extract	127.50 ± 3.54 <sup>b</sup>

In a column, mean values with different letter as superscript are significantly different (p<0.05)

#### Serum Potassium Ion

The result of the effect of *Gongronema latifolium* on serum potassium ion of Wistar albino rats induced with alcohol is showed as thus; Group A(blank control) had mean value of 6.50 ± 1.41mmol/L, Group B had low potassium ion of 2.40 ±

0.35mmol/L, while Group C recorded 4.10 ± 0.70mmol/L. However Group D had 3.10 ± 0.71mmol/L and Group E had 4.10 ± 0.42mmol/L, although in all there was no significant difference among the groups at p<0.05 as shown in table 2 below.

Table 2: Effect of *Gongronema latifolium* on serum potassium ion of Wistar albino rats induced with alcohol

Groups	Potassium (mmol/L)
A Normal control	6.50 ± 1.41 <sup>d</sup>
B Induced but untrated	2.40 ± 0.35 <sup>a</sup>
C Induced and treated with stardard drug	4.10 ± 0.70 <sup>c</sup>
D Induced treated with low dose of extract	3.10 ± 0.71 <sup>b</sup>
E Induced treated with high dose of extract	4.10 ± 0.42 <sup>c</sup>

In a column, mean values with different letter as superscript are significantly different (p<0.05)

Serum Chloride Ion

The result of the effect of *Gongronema latifolium* on serum chloride ion of Wistar albino rats induced with alcohol showed as thus; Group A (blank control) had mean value of 96.50 ± 0.71mmol/L, Group B had low Chloride ion of 60.50 ± 3.53mmol/L, while Group C recorded

99.50 ± 2.12mmol/L. However Group D had 82.50 ± 7.77mmol/L and Group E had 96.50 ± 3.54mmol/L, although in all there was no significant difference among the groups at p<0.05 as shown in table 3 below.

Table 3: Effect of *Gongronema latifolium* on serum chloride ion of Wistar albino rats induced with alcohol

Groups	Chloride (mmol/L)
A Normal control	96.50 ± 0.71 <sup>d</sup>
B Induced but untrated	60.50 ± 3.53 <sup>a</sup>
C Induced and treated with stardard drug	99.50 ± 2.12 <sup>c</sup>
D Induced treated with low dose of extract	82.50 ± 7.77 <sup>b</sup>
E Induced treated with high dose of extract	96.50 ± 3.54 <sup>c</sup>

In a column, mean values with different letter as superscript are significantly different (p<0.05)

Serum Calcium Ion

The result of the effect of *Gongronema latifolium* on Serum calcium ion of Wistar albino rats induced with alcohol is showed as thus; Group A(blank control) had mean value of 6.15 ± 0.07mmol/L, Group B was had low Calcium ion of 2.40 ± 0.42mmol/L, while Group C recorded

4.65 ± 0.35mmol/L. However Group D had 3.00 ± 0.42mmol/L and Group E had 4.11 ± 0.13mmol/L, although in all there was no significant difference among the groups at p<0.05 as shown in table 4 below.

Table 4: Effect of *Gongronema latifolium* on serum calcium ion of Wistar albino rats induced with alcohol

Groups	Calcium (mg/dl)
A Normal control	6.15 ± 0.07 <sup>d</sup>
B Induced but untrated	2.40 ± 0.42 <sup>a</sup>
C Induced and treated with stardard drug	4.65 ± 0.35 <sup>c</sup>
D Induced treated with low dose of extract	3.00 ± 0.42 <sup>b</sup>
E Induced treated with high dose of extract	4.11 ± 0.13 <sup>c</sup>

In a column, mean values with different letter as superscript are significantly different (p<0.05)

Serum Magnesium Ion

The result of the effect of *Gongronema latifolium* on Serum magnessium ion of Wistar albino rats induced with alcohol is showed as thus; Group A (blank control) had mean value of 55.14 ± 1.52mmol/L, Group B had low Magnesium ion of 13.21 ± 2.26mmol/L, while Group C recorded

46.24 ± 1.21mmol/L. However Group D had 30.90 ± 1.25mmol/L and Group E had 41.91 ± 3.27mmol/L, althoughin all there was no significant difference among the groups at p<0.05 as shown in table 5 below.

Table 5: Effect of *Gongronema latifolium* on serum magnesium ion of Wistar albino rats induced with alcohol

Groups	Magnesium (mmol/L)
A Normal control	55.14 ± 1.52 <sup>d</sup>
B Induced but untrated	13.21 ± 2.26 <sup>a</sup>
C Induced and treated with stardard drug	46.24 ± 1.21 <sup>c</sup>
D Induced treated with low dose of extract	30.90 ± 1.25 <sup>b</sup>
E Induced treated with high dose of extract	41.91 ± 3.27 <sup>c</sup>

In a column, mean values with different letter as superscript are significantly different (p<0.05)

Serum Bicarbonate Ion

The result of the effect of *Gongronema latifolium* on serum bicarbonate ion of Wistar albino rats induced with alcohol is showed as thus; Group A (blank control) had mean value of 41.50 ± 3.34mmol/L, Group B had 22.00 ± 1.41mmol/L, while

Group C recorded 25.50 ± 2.12mmol/L. However Group D had 19.50 ± 2.12mmol/L and Group E had 29.50 ± 2.12mmol/L, although in all there was no significant difference among the groups at p<0.05 as shown in table 6 below.

Table 6: Effect of *Gongronema latifolium* on serum bicarbonate ion of Wistar albino rats induced with alcohol

Groups	HCO <sub>3</sub> <sup>-</sup> (mmol/L)
A Normal control	41.50 ± 3.34 <sup>c</sup>
B Induced but untrated	22.00 ± 1.41 <sup>a</sup>
C Induced and treated with stardard drug	25.50 ± 2.12 <sup>b</sup>
D Induced treated with low dose of extract	19.50 ± 2.12 <sup>a</sup>
E Induced treated with high dose of extract	29.50 ± 2.12 <sup>b</sup>

n a column, mean values with different letter as superscript are significantly different (p<0.05)

### DISCUSSION

The liver is an organ involved in many metabolic functions and is prone to xenobiotic injury because of its central role in xenobiotic metabolism [23,24]. Administration of alcohol decreases the mean value of liver marker enzymes significantly as shown in table 1. This is in agreement with [25] who stated that exposure of hepatocytes to ethanol alters the membrane structure and functions by increasing the leakage of enzymes into the circulation. The results of this study show that the ethanol extract of *G. latifolium* leaf have some degree of hepatoprotective ability. Based on the results obtained it can be inferred that *G. latifolium* leaf extracts have some protective effect on the liver as shown by the reduction in the level of the liver enzymes thereby increasing sodium ion. Herbal remedies have contained variety of chemical constituents like polyphenol, flavonoids, alkaloids, glycoside [26]. These are present in *G. latifolium* which may be responsible for this effect although not part of this reseach objective. It can be inferred that the leaf of *G. latifolium* declines, as a result complications of ethanol consumption obviously these processes become impaired. Hence, in this study there was a significant (P < 0.05) alteration in selected serum electrolytes in the ethanol exposed rats. Sodium is the major positive ion in fluid outside of cells. It regulates the total amount of water in the body and the

transmission of sodium into and out of individual cells also plays a role in critical body function [27]. In this study there was no significant (p< 0.05) decrease in sodium level in ethanol exposed rats without treatment compared to group exposed and treated. This work was in line with [28,29,30] who observed decrease in exposed group may be attributed to the action of ethanol on antidiuretic hormone vassopresin that is inhibited by ethanol leading to the kidney passing water direct to the bladder without reabsorbed it. Hyponatremia is proposed to be due to an inappropriate production of antidiuretic hormone (vasopressin) by the leukemic cells. This leads to loss of sodium, this is quite consistent with earlier reports that ethanol intoxication leads to decrease plasma levels of sodium ions [31]. The effect of extract on electrolytes of ethanol exposed and treated animals were in agreement with report by [32,33] on effect of *G. latifolium* ethanol intoxicated. Whereas [34] also stated ethanol leads to production of reactive oxygen species conditions that can directly cause electrolyte imbalance. Potassium was not significantly reduced in ethanol exposed groups compared to treated groups. This no significant reduction in the level of potassium in ethanol exposed group showed that ethanol could lead to raised blood pressure in the users since potassium has been shown to have

protective effect against hypertension  $\text{Na}^+ - \text{K}^+$  ATPase also helps in the movement of these electrolytes across the membrane and ensures that there is a balance in the system [35,36]. Hence, the plant extract restored the level of  $\text{Na}^+$  and  $\text{K}^+$  to normal, there must be a balance between the two. If there is elevated  $\text{Na}^+$  ions which can lead to raised blood pressure and subjecting the rats to risk of cardiovascular diseases. Calcium is needed in the body to build and fix bones and teeth, it helps nerves to work. In this study the calcium level in ethanol exposed rats decreased significantly ( $P < 0.05$ ) compared to treated and normal control. Hence, the plant extract normalize the calcium level as indicated in this study in a dose dependent fashion. Calcium is important for nerve conduction and muscular contraction

In conclusion, this research finding affirmed that the administration of ethanolic extracts of *G. latifolium* caused a dose-dependent restorative and

#### CONCLUSION

Edoga and Eneje thus the weakness observed in ethanol exposed animals may be attributed to decrease in calcium level. Bicarbonate is a chemical (buffer) that keep the pH of blood from becoming too acidic or too basic. Bicarbonate test helps to evaluate and keep track of conditions that affect blood bicarbonate levels including liver, kidney and metabolic conditions [37,38,39]. A decrease in bicarbonate level in ethanol exposed rats indicates ethanol poisoning. When the bicarbonate levels are higher or lower than, it suggests that the body is having trouble maintaining its acid- base balance or that their electrolyte balance has upset, perhaps by loss or retention of fluid [40]. The plant extracts have proved therapeutic efficacy by restoring the level of bicarbonate towards normal in a dose dependent manner.

antioxidant ability thereby returning the alcohol-induced serum electrolytes values.

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