



# Effect of Aqueous Leaf Extracts of *Justicia Carnea* on Selected Serum Electrolytes and Kidney Histology of Lincomycin Intoxicated Rats

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**ABSTRACT:** Antibiotics are pharmaceutical agents known to treat bacterial infections by either killing or inhibiting the growth of bacteria. One of such antibiotics commonly used in Nigeria is lincomycin which is a lincosamide antibiotic derived from actinomycetes, *Streptomyces lincolnensis*. Due to ready availability, most antibiotics are frequently abused especially by the uneducated class leading to resistance by disease causing pathogens as well as other serious undesirable side effects. *Justicia carnea* is herb used in Nigerian folk medicine in the management of various health conditions. In the present study, its effect on serum Sodium, Potassium, Calcium and kidney histology of lincomycin intoxicated rats was evaluated as a way of assessing its potency at management of renal diseases. A total of thirty male albino rats were divided into six groups of five rats each. Rats in group 1 served as the normal control and received no extract. The rats in the remaining five groups served as test groups, and were all exposed to lincomycin toxicity by means of administration of the antibiotic at the single oral dose of 250mg/kg body weight. Rats in group 2 were left untreated, while rats in groups 3, 4, 5 and 6 were treated with aqueous leaf extracts of *Justicia carnea* at respective oral doses of 100mg/kg, 200mg/kg, 400mg/kg and 800mg/kg. All treatments lasted for 21 consecutive days. At the end of the treatment, blood samples were collected for serum electrolyte test while the kidney samples were harvested for histological examination. Results showed that lincomycin toxicity resulted to significant elevations in serum sodium and potassium levels and a converse reduction in serum calcium levels compared with the values for the control rats. Treatment of antibiotic intoxicated rats with the extracts of *Justicia carnea* was however observed to reverse the antibiotic induced changes in the values of the parameters, an effect which occurred in dose-dependent manners. Histological investigation showed that at the antibiotic intoxication elicited some deleterious effects on the kidney cellular integrity of rats, an effect which was however gradually reversed by herbal treatment. The plant sample was therefore concluded to be a potential candidate for the development of new drugs for the management of renal diseases.

**KEYWORDS:** *Justicia carnea*, Serum, Electrolytes, Lincomycin, kidney Toxicity, Rats.

## I. INTRODUCTION

Plants have been used in traditional medicines since time immemorial. It has been estimated that 70-80% of world population relies on herbal medicine for their primary healthcare needs (Adenuga *et al.*, 2020). *Justicia carnea* is a herb that grows up to 2 metres tall, and remains one of the most appreciated of the sweet green vegetables of Africa. It grows in many African countries including Togo, Benin, Sierra Leone, Cameroon and DR Congo (Osioma & Hamilton, 2017). *Justicia carnea* is used traditionally in treating a number of conditions ranging from respiratory tract infection, fever, diabetes, liver diseases, diarrhea, arthritis, rheumatism, anaemia, cancer, HIV and diabetes (Correa and Alcantara, 2012). It is also used in the treatment of various conditions such as vaginal discharge, epilepsy, dyspepsia, mental disorder, headache, inflammation. They are also used as analgesics, sedatives, hallucinogens, depressors and somniferous agent (Correa & Alcantara, 2012). *Justicia carnea* is rich in a number of metabolites like flavonoids, alkaloids, glycosides etc. Maintaining serum electrolyte levels within normal ranges is essential for normal physiological functions, especially in the kidneys. However, numerous factors, including dietary imbalances and medical conditions, can disrupt these levels, leading to a variety of health issues. While conventional therapies are available, there is a need for alternative, more natural treatments that have fewer adverse effects. *Justicia carnea* is a plant traditionally used for medicinal purposes in



various cultures. The present study is aimed at evaluating its effect on the selected serum electrolytes and kidney histology of Ibuprofen intoxicated rats.

## II. MATERIALS AND METHODS

### A. Sample Collection and preparation

*Justicia carnea* leaves were collected from a farmland in Nekede, Owerri, Imo state. The leaves were identified by a botanist in the department of Biological Sciences, Federal University of Technology Owerri. After examination, only the healthy leaves were selected, washed, dried under shed, ground to fine powder, allowed to cool and bottled in moisture-proof container ending use.

A 500g portion of the ground leaves was measured out and soaked in 1000ml of water and left for 48 hours at 20°C after which it was filtered using cheese cloth followed by Whatman No. 1 filter paper

### B. Experimental Design

Twenty (30) healthy, adult male albino rats were used for the study. They were purchased from Nano farms, Irete, and allowed to acclimatize for 7 days prior to the start of the experiment. After acclimatization, they were randomly distributed into six (6) groups of five (5) rats each. The animal care and handling was done according to the United States National Institute of Health Principles of Laboratory Animals Care (NIH, 1978). Rats in the control group received normal saline at the dose of 10ml/kg body weight. The rats in all other groups (groups 2-6) were exposed to kidney toxicity via the administration of lincomycin at a single oral dose of 250mg/kg body weight. Rats in group 2 (lincomycin intoxicated) were left untreated, while those in groups 3-6 were treated with the plant extract at respective oral doses of 100mg/kg, 200mg/kg, 400mg/kg and 800mg/kg. The treatments lasted for 21 consecutive days, after which the animals were sacrificed. Blood and kidney samples were collected in sterile sample bottles for study

**Table 1: Experimental design**

Groups	Number of rats	Treatments
1 (Control)	5	Normal saline (10ml/kg b.w)
2	5	Lincomycin
3	5	Lincomycin + Extract(100mg/kg)
4	5	Lincomycin + Extract( 200mg/kg)
5	5	Lincomycin + Extract(400mg/kg)
6	5	Lincomycin+ Extract(800mg/kg)

Serum Sodium and Potassium concentrations were determined using flame emission photometry method of Unachukwu *et al.* (2018), while Calcium levels were determined by AAS as described by Moraes *et al.*, (2013).

The histological investigation study was done by the method of Akparie (2004)

**C. STATISTICAL ANALYSIS**

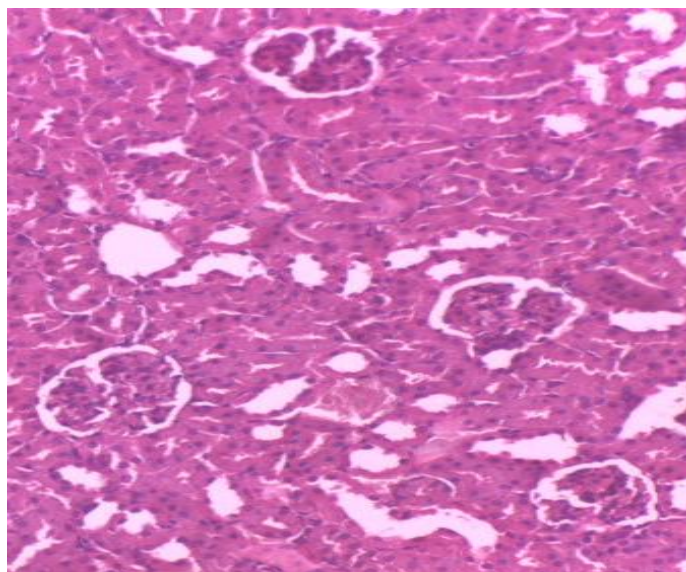
Result data were expressed as Mean  $\pm$  Standard Deviation (SD) for five separate determinations. The analysis of variance (ANOVA) for a completely randomized design was used and the values was considered significant at  $P < 0.05$

**III.RESULTS****Table 2: Effect of aqueous leaf extract of *Justicia carnea* on serum sodium, potassium and calcium of albino rats**

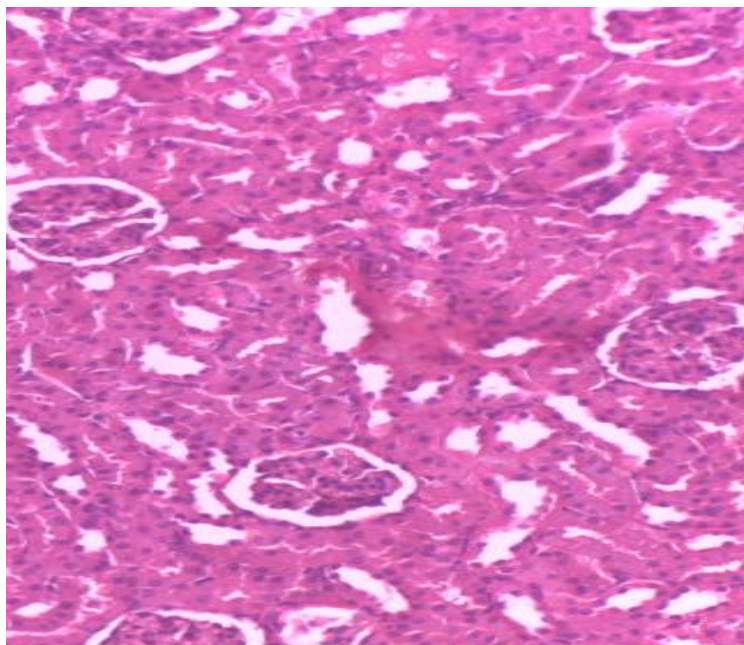
Groups	Sodium (mmol/L)	Potassium (mmol/L)	Calcium (mmol/L)
1	138 $\pm$ 1.6 <sup>a</sup>	4.8 $\pm$ 0.3 <sup>d</sup>	2.8 $\pm$ 0.3 <sup>f</sup>
2	176 $\pm$ 0.9 <sup>b</sup>	7.6 $\pm$ 0.5 <sup>e</sup>	1.2 $\pm$ 0.1 <sup>g</sup>
3	168 $\pm$ 1.6 <sup>c</sup>	6.5 $\pm$ 0.9 <sup>e</sup>	1.5 $\pm$ 0.2 <sup>g</sup>
4	151 $\pm$ 1.4 <sup>c</sup>	6.0 $\pm$ 1.0 <sup>e</sup>	1.9 $\pm$ 0.4 <sup>g</sup>
5	148 $\pm$ 0.6 <sup>c</sup>	5.6 $\pm$ 0.7 <sup>e</sup>	2.5 $\pm$ 0.3 <sup>f</sup>
6.	141 $\pm$ 2.3 <sup>a</sup>	5.0 $\pm$ 0.2 <sup>d</sup>	2.6 $\pm$ 0.1 <sup>f</sup>

Data represent Mean  $\pm$  SD (n=5)

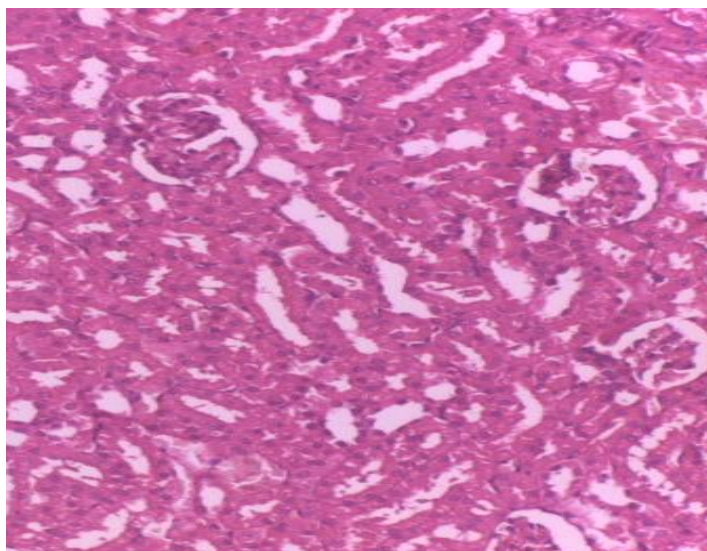
Values in the same column with different superscripts are significantly different ( $p < 0.05$ )



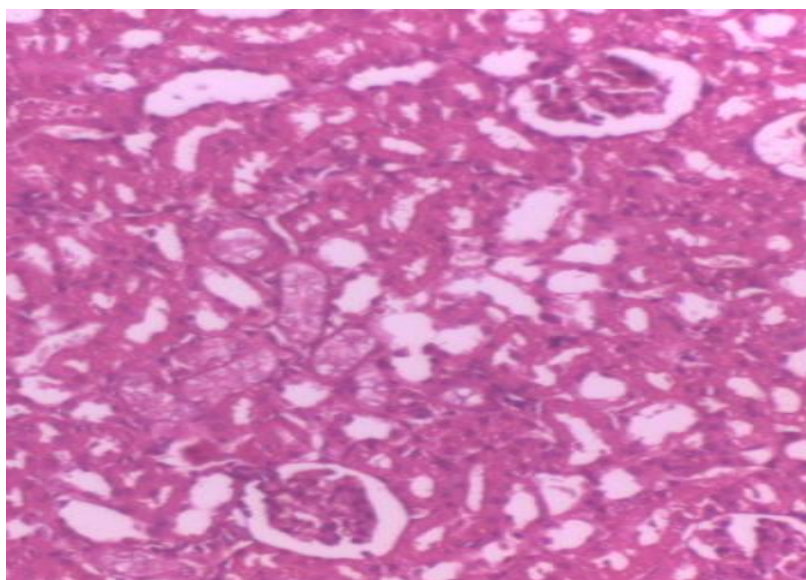
Picture 1: Section of kidney of rat kept on normal saline (normal Control), Showing well preserved renal cells (H&Ex400).



Picture 2: Section of kidney of lincomycin intoxicated rat left untreated, showing signs of cellular swelling and progressive vacuolization (H&Ex400)



Picture 3: Section of kidney of lincomycin-intoxicated rat treated with leaf extract at the dose of 200mg/kg b.w. showing essentially preserved renal cells (H&Ex400)



Picture 4: Section of kidney of lincomycin-intoxicated rat treated with leaf extract at the dose of 400mg/kg b.w., showing essentially preserved renal cells (H&Ex400)

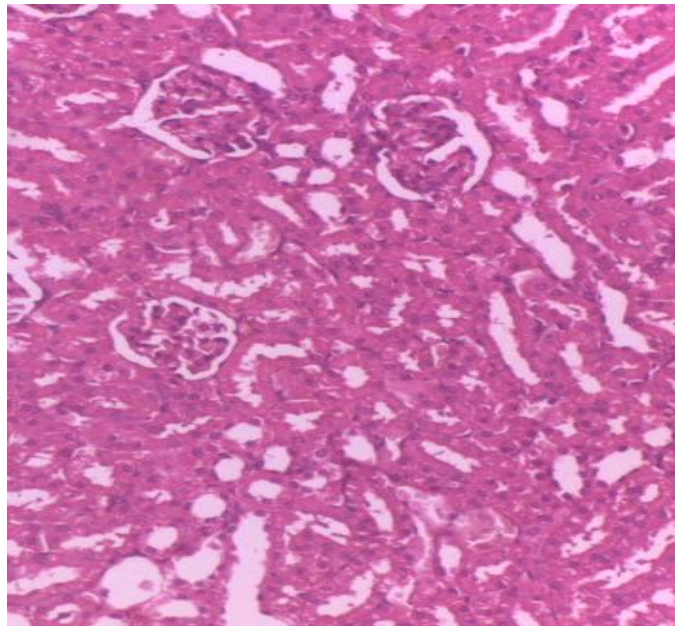


Plate 5: Section of kidney of lincomycin-intoxicated rat treated with leaf extract at the dose of 800mg/kg b.w., showing essentially preserved renal cells (H&Ex400)

#### IV. DISCUSSION AND CONCLUSION

Serum sodium is a crucial electrolyte in the body, playing a vital role in various physiological processes. These important key roles include: helping to regulate the amount of water in the body and maintain proper fluid balance, it aids in nerve transmission and muscle contraction, it influences blood pressure (elevated levels can lead to hypertension), it helps access dehydration status especially in critically ill patients, it helps to regulate acid-base balance.

Abnormal serum sodium levels (hyponatremia or hypernatremia) can indicate underlying medical conditions, such as kidney disease, heart failure, or hormonal imbalances. Monitoring serum sodium levels is essential for diagnosing and managing various health disorders.

From the results of this study, Lincomycin intoxication resulted to increased serum sodium concentrations ( $p < 0.05$ ). This condition may be brought about by dehydration or kidney disease elicited by excess dose of lincomycin (Pohl and Zimmermann, 2017). Hypernatremia or High serum sodium remains the most frequent electrolyte disorder in hospitalized patients (Clare *et al.*, 2023). On treatment with leaf extracts of *Justicia carnea*, reduced serum sodium levels were recorded, to the tune of  $141 \pm 2.3$  at the highest extract dose level. Potassium is a serum electrolyte that regulates and maintains cardiac, nerve and muscle functions. It also maintains homeostasis and regulates blood pressure. Results of this study showed that lincomycin toxicity lead to increased serum potassium level, a condition known as hyperkalemia. Lincomycin overdose might have brought about hyperkalemia by induction of oxidative stress, inhibition of kidney transporters, alteration of kidney blood flow, crystal nephropathy etc. Treatment with the extract of *Justicia carnea* resulted to significant reductions in serum potassium levels ( $p < 0.05$ ). This observation is in line with an earlier report by Farese *et al.*, (1991) who reported that licorice root extracts elicited significant reductions in serum potassium levels in rats. Calcium is a serum electrolyte that aids muscle contraction, nerve transmission and also plays crucial roles in bone health. Lincomycin intoxication in the experimental rats significantly reduced serum calcium levels. Low blood calcium can lead to muscle cramps, tingling and numbness, seizures and weakened immune system. Lincomycin might have brought about the reductions in serum calcium by any mechanism ranging from impairment of calcium absorption, inhibition of calcium transporters. Increased calcium excretion, alkalosis, etc. Treatment of the antibiotic intoxicated rats with the extract of *Justicia carnea* resulted to significant improvements in serum calcium levels. Results of this study also corroborates other research findings where some plant extracts have been reported to improve serum calcium levels in animal subjects (Clare *et al.*, 2009, Zang *et al.*, 2011., Li *et al.*, 2010). From the histological examinations, the kidneys of rats in group 2, intoxicated with lincomycin and left untreated presented features ranging from cellular enlargement to



vacuolization. This observed toxicity of lincomycin on the renal cells corroborates the observation with the serum electrolytes which also serve as indices of renal function.

Kidney problems also known as renal diseases, can be caused by a variety of factors, including genetics, life style and environmental exposures. The two most common types of kidney problems are acute kidney injury and chronic kidney disease. Acute kidney injury is typically caused by a sudden decrease in kidney function while chronic kidney disease (CKD) is a long term condition that can lead to kidney failure (Hemmelgarn *et al.*, 2017). Kidney problem or disease can lead to a number of negative health outcomes. The Kidneys are responsible for filtering waste products from the blood and maintaining the balance of water, salts and other substances in the body. When they become damaged, they may not perform these functions properly. This can lead to symptoms including fatigue, loss of appetite and issues in urination, in extreme conditions, leading to kidney failure and need for dialysis or transplant (James *et al.*, 2014). Extracts of *Justicia carnea*, being well tolerated and showing potency at reversing the antibiotic- induced toxicities in the animals, implies that it is safe for use and remains a potential candidate for the development of renal protective drugs.

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