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Research Article

Nephroprotective Effects of *Eucalyptus Camaldulensis Ethanolic* Leaf Extract In Wistar Rats

Dennis Amaechi [1*], Ini Patrick Ekpe[1], Uwanta Justus Okezie [1] and Iwebi Nissi Chukwuamaka[1]

[1] *Department of Medical Biochemistry, Veritas University, Abuja.*
[*] *Corresponding author: amaechitoexcel@yahoo.com*

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Abstract

Aim: This work is aimed at investigating the effects of the ethanol leaves extract of *Eucalyptus camaldulensis* on serum electrolytes level of Wistar rats.
Materials and Methods: Forty-five albino Wistar rats were randomly selected into 6 groups of 7 rats each. The animals in group 1 (control) were given only distilled water while those in groups 2, 3,4,5,and 6 served as a treatment group and received 150, 250, 350, 450 and 550mg/kg body weight of the extract respectively. This treatment was carried out within a 21 day period and on the 21 day, the animals were sacrificed by cardiac puncture and blood was collected into plain tubes for biochemical investigations.
Results: Administrations of the extract resulted in a significant ($p<0.05$) decrease of potassium of 250mg/kg (36.48 ± 10.20), 350mg/kg (26.03 ± 3.44), 550mg/kg (28.97 ± 2.76) except for group 4 (73.32 ± 21.51) and 5 (43.28 ± 5.77) respectively when compared to the control group. Similarly, the concentration of sodium for the control group is higher than for 150mg/kg (244.63104.4), 250mg/kg (106.82 ± 22.68), $350mg/kg$ (210.63 ± 113.00, and 550mg/kg (526.75 ± 108.01) respectively except for 450mg/kg (526.75 ± 108.01) compared to the control group. For chloride, this study showed no significant changes when compared with the control group.sub chronic administration of the extract does not show any significant changes in urea and creatinine.
Conclusion: *Eucalyptus camaldulensis* is not toxic to the kidney at the different concentrations administered. The extract may have nephro protective effects on Wistar rats.

1. Introduction

Plants are a major source of drug and contribute significantly to global health. Medicinal plants have been an important potential source of treatment. The uses of medicinal plants have been widely accepted in health systems across the globe, where they are used not only to treat illnesses but also as a potential resource for preserving overall health [1]. Plant medicine (phytomedicine) has been used in healthcare delivery in most African countries and the rest of the globe [2]. Effective health cannot be attained in Africa unless conventional medicine is complemented with traditional one. At least 80% of Africans depend on plant medicine for their healthcare.

These plants can be classified as either "wild plant species," which are those that grow naturally in selfmaintaining populations in natural and seminatural ecosystems and may exist without direct human intervention, or as "domesticated plants species," which are those that have developed as a result of human activities like selection or breeding and require management to survive [1]. Recent studies on herbal plants have greatly advanced our understanding of the pharmacological properties of several plants that are utilized in conventional medical systems. Thus, it is possible to characterize plants as the primary source of medicines, both as crude pharmaceuticals for the general public and as isolated active principles that must be administered in standardized dosage forms [1].

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According to [3], a significant proportion of the global population, over 80%, depends on plant-based medications to address their health needs. This is due to the abundance of diverse secondary metabolites found in plants, including tannins, terpenoids, alkaloids, flavonoids, and others [4].

The stronger the therapeutic potency of medicinal plants, the larger the concentration of the significant phytochemical. Nigeria is home to more than 300 recognized medicinal plants, yet the uses of these plants differ depending on the plant, the culture, the belief system, and other elements [5]. The tree *Eucalyptus camaldulensis*, commonly known as "red river gum," belongs to the Eucalyptus genus. It is native to Austria, where it is widely distributed, especially next to inland water channels. It is a plantation species found in many regions of the world, including Nigeria. In instance, *Eucalyptus camaldulensis* leaves are evergreen. The tree is between 24 and 40 meters tall with a sturdy trunk and smooth, buff or white-grey bark.

The plant is used medicinally in many different contexts. Its oil is used medicinally in Nigeria and several other countries of sub-Saharan Africa, especially as a cough and cold cure. Boiling gum with sugar and water creates a liquid drink that can be used as a general anesthetic for toothaches and to treat respiratory issues. Bark infusions are used as eye washes for certain ophthalmia cases and have been shown to be quite successful in treating diarrhea [6].

Eucalyptus camaldulensis young shoots are crushed, eaten, and applied topically to wounds and sores. Their infusions are used to treat severe headaches, aches, pains, and snake bites. It is also thought that the herb can effectively treat hypertension. Additionally, some antibacterial and antifungal activities were reported [7]. *Eucalyptus camaldulensis* is often used as an herbal cure for the conditions listed because of its therapeutic qualities. This plant, which the Igala people refer to as "ogwuiba," or fever medicine, is generally known as "zaity" in the northern region of Nigeria and is used to treat a variety of illnesses [4]. the purpose of this study investigates the effect of this medicinal plant *(Eucalyptus camadulensis)* leaves on serum electrolyte level of wistar rats, potentially offering a natural, affordable and easily accessible alternative for managing chronic kidney diseases.

2. Materials and Method

Materials

The following materials were used for the experiment work: Wister rats, weighing balance, feed, distilled water, rubber cages, water bath, lancet, sample chloroform, filter paper, dissecting kit, refrigerator, syringes and needle, a pair of scissors and forceps, Randox glucose kit dissecting board, blood sample, methylated spirit (ethanol) *Eucalyptus camaldulensis* leave and one touch glucometer Johnson-Johnson, company, China).

Collection and Preparation

Fresh sample of the plants that make up *Eucalyptus camaldulensis* were collected at Zuma II of Bwari Area Council, Abuja, Nigeria. The leaves were washed, air dried, blended to a powered form and sieved. The sieved sample weighing 1,000g was soaked in 2000ml of 95% ethanol for 48hours after which it was sieved using a Muslin cloth and afterwards filtered through a whatman filter paper. The filtrate was concentrated using a rotary evaporator at 50°c and further concentrated with a thermostatic water bath at 50 0C. The concentrate (paste) was collected, weighed, and kept in sterile bottles and stored at 4 °C until usage.

Experimental Design

Forty two male and female adult Wister rats were used for the experiment. The Forty two male and female Wister rats were obtained from an animal Farm in Kaduna State, Nigeria. The rats were housed in the Animal House of Veritas University Abuja to acclimatize for two weeks. While being acclimatized, rats were fed with standard rat feed and deionized water and maintained at standard laboratory conditions of 12/12hour light-dark periodic alternations, temperature: 22-28°C and 40-50% relative humidity (USNIH 2019). The rats were randomly selected two days to the commencement of the experiment and allocated into six (6) groups. The first groups is control group while the remaining groups were the test groups with different amount of eucalyptus extract. 150mg/kg, 250mg/kg, 350mg/kg, 450mg/kg, and 550mg/kg respectively. Each group containing seven animals except for the control group containing five animals. The rats in each group were fed with Growers' feed mash (Top Growers feed Ltd Nigeria) and water.

Administration of Extract

On day one of experiment, the five groups with seven rats per group were allocated into their various groups in such a way that the difference in body weight within and between members of a particular group does not exceed $\pm$20% of the average weight of sample population of rats. The five group rats with seven rats per group were orally administered specific measurement of required feed, water, solution and *Eucalyptus camaldulensis* extract as shown below using an oral gavage (Orogastric tube).

Sacrifice of Animals

On day 22, all the animals were anaesthetized with chloroform twenty-four hours after the last day of extract administration and humanely sacrificed. Blood was collected from the heart by cardiac puncture using 2ml syringe into a set of labeled plain bottles electrolytes analysis. Each sample of blood was centrifuged at 3,000rpm for 15minutes, the serum were collected into the respective labelled plain bottles. The serum was refrigerated and used to carry out biochemical analysis. The organs; Liver, kidney pancreas and testis were excised and preserved in 5% Formaldehyde for histological examinations.

Table 1: Experimental Design .

Groups	Number of Rats	Group Title	Treatments Administered
Group One	7 7	Neutral control /model control	Rat chow and distilled water
Group Two	7	Treatment Group 1	150mg/kg of *eucalyptus camaldulensis* extract
Group Three	7	Treatment Group 2	250mg/kg of *eucalyptus camaldulensis* extract
Group Four	7	Treatment Group 3	350mg/kg of *eucalyptus camaldulensis* extract
Group Five	7	Treatment Group 4	450mg/kg of *eucalyptus camaldulensis* extract
Group Six	7	Treatment Group 5	550mg/kg of *eucalyptus camadulensis* extract

These treatments were conducted daily and observations noted for the 21 days

3. Results

Table 2: Effect of *Eucalyptus camaldulensis* on Serum electrolytes in Wistar rats.

	Potassium (k^+)mE/L	Sodium (Na^+) MEq/L	Chloride (cl^-) MEq/L	Urea (BUN) mmol/L	Creatinine (mm/L)
Control group	38.76 ± 7.70	360.98 ± 162.29	217.83 ± 17.76	216.80 ± 23.21	74.66 ± 15.18
150mg/kg	36.48 ± 10.20	244.63 ± 103.47	201.39 ± 25.12	286.72 ± 12.53	58.58 ± 28.83
250mg/kg	26.03 ± 3.44	106.82 ± 22.68	200.52 ± 10.49	220.93 ± 43.95	37.87 ± 21.74
350mg/kg	$73.32 \pm 21,51$	210.63 ± 113.00	161.30 ± 14.86	228.32 ± 23.00	45.52 ± 24.45
450mg/kg	28.97 ± 2.76	526.75 ± 108.01	141.52 ± 16.85	162.32 ± 6.67	85.21 ± 1.21
550mg/kg	48.28 ± 5.77	364.21 ± 140.74	181.57 ± 14.57	111.81 ± 21.86	84.61 ± 1.19

Values are presented as Mean ±SEM. *significantly different from control (D. Water), p<0.05.

a=values have significant difference within and down the groups at $p \geq 0.05$. b=values have significant difference within and down the groups at $p \geq 0.05$. c=values have significant difference within and down the groups at $p \geq 0.05$. d= values have significant difference within and down the groups at $p \geq 0.05$. e-= values have significant difference within and down the groups at $p \geq 0.05$. f= values have significant difference within and down the groups at $p \geq 0.05$.

The biochemical assessment of electrolyte levels of Albino Wistar rats treated with ethanol extract of *Eucalyptus calmadulensis* leaves are presented on Figure 1, 2, 3 and while urea and creatinine levels are presented on Figure 4 and 5 respectively. The results obtained for Potassium were for groups 1 (control), group 2 (150mg/kg), group 3 (250mg/kg), group 4 (350mg/kg), group 5 (450mg/kg) and group 6 (550mg/kg) respectively. Potassium level results showed 38.76 ± 7.70, 36.48 ± 10.20, 26.03 ± 3.44, $73.32 \pm 21.51\%$, 28.97 ± 2.76, 48.28 ± 5.77 for groups 1, 2, 3, 4, 5 and 6 respectively. Similarly, the results obtained for Sodium were 360.98 ± 62.29, 244.63 ± 104.4,106.82 ± 22.68,210.63 ± 113.00, 526.75 ± 108.01, and 364.21 ± 140.74 for groups 1, 2, 3, 4, 5 and 6 respectively. For Chloride, the results gave 217.83 ± 17.76, 201.39 ± 25.12, 200.52 ± 10.49, 161.30 ± 14.86, 141.52 ± 16.85, and $181.57 \pm 14.57$for various groups administered the extract. The result for urea showed 216.80 ± 23.21, 286.72 ± 12.53, 220.93 ± 43.95, 228.32 ± 23.00, 162.32 ± 6.67 and 111.81 ± 21.86, while results obtained for creatinine shows 74.66 ± 15.18, 58.58 ± 28.83, 37.87 ± 21.74, 45.52 ± 24.45, 85.21 ± 1.21 and 84.61 ± 1.19 respectively for each group.

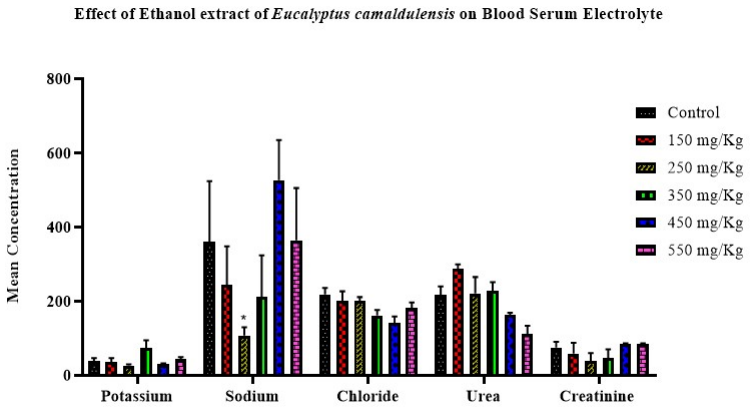
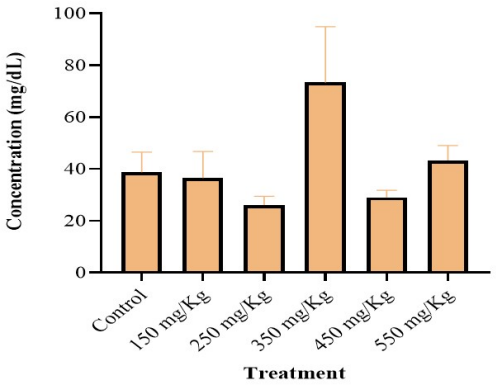


Figure 1: Effect of *Eucalyptus camaldulensis* Ethanol Leave Extract on Potassium



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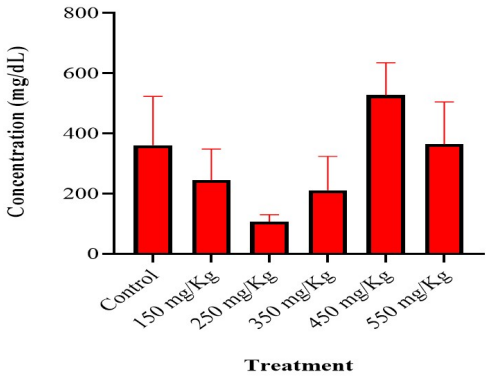

Figure 3: Effect of *Eucalyptus camaldulensis* Ethanol Leave Extract on Sodium

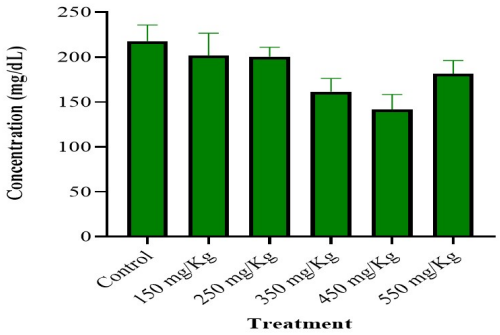

Figure 4: Effect of *Eucalyptus camaldulensis* Ethanol Leave Extract on Chloride

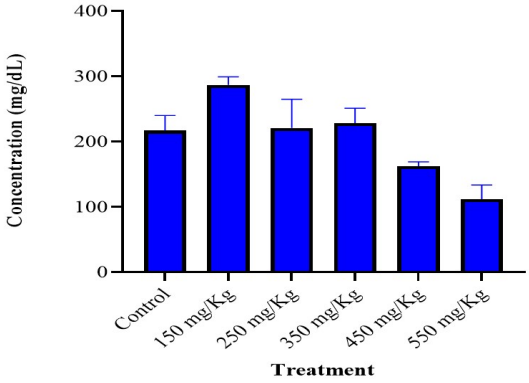

Figure 5: Effect of *Eucalyptus camaldulensis* Ethanol Leave Extract on Urea

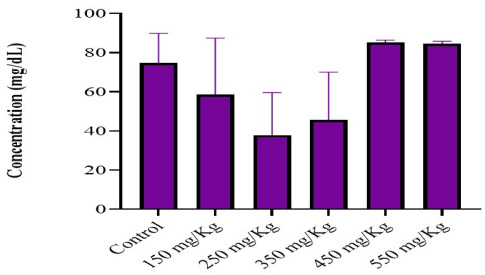

Figure 6: Effect of *Eucalyptus camaldulensis* Ethanol Leave Extract on Urea

4. Discussion

Electrolyte imbalance, or water-electrolyte imbalance, is an abnormality in the concentration of electrolytes in the body. Electrolytes play a vital role in maintaining homeostasis in the body. Electrolyte imbalances can develop by consuming too little or too much electrolytes as well as excreting too little or too much electrolyte. Electrolyte disturbances are involved in many disease processes, and are an important part of patient management in medicine. The causes, severity, treatment, and outcomes of these disturbances can differ greatly depending on the implicated electrolyte [8], most serious electrolyte disturbances involve abnormalities in the levels of sodium, potassium or calcium. Other electrolyte imbalances are less common and often occur in conjunction with major electrolyte changes.

Chronic laxative abuse or severe diarrhea or vomiting can lead to dehydration and electrolyte imbalance. People suffering from malnutrition are at especially high risk for an electrolyte imbalance. Severe electrolyte imbalances must be treated carefully as there are risks with overcorrecting too quickly, which can result in arrhythmias, brain herniation, or re-feeding syndrome depending on the cause of imbalance [9].

The kidney is a principally responsible organ for retention and excretion of electrolytes and fluid in healthy individuals But other mechanisms like hormonal interactions of antidiuretic hormone, aldosterone and parathyroid hormone and other factors such as physiological stress is said to play an important role in regulating fluid and electrolyte balance in humans Studies about the clinical prevalence of electrolyte imbalances often report that these disorders are frequently seen in elderly and critically ill patients, and occur in the progression of diseases such as diabetes mellitus, acute or chronic renal failures.

The effect of *eucalyptus camaldulensis* was assessed in this study by analyzing some electrolytes (potassium, sodium, chloride) urea and creatinine concentration. The serum electrolyte concentration of potassium of 250mg/kg (36.48 ± 10.20), 350mg/kg (26.03 ± 3.44), 550mg/kg (28.97 ± 2.76) were lower than the control group except for group 4 (73.32 ± 21.51) and 5 (43.28 ± 5.77) as shown on Figure 1 The significant reduction observed for potassium in all experimental units when compared to the control group after three weeks of administration of the extract could be attributed to the fact that the extract contains some important bioactive phytochemical constituents that helps in balancing sodium-potassium pumps in the cell membrane which might have helped in maintaining the normal potassium concentration gradient. This is in agreement with the work done by [10] on assessment of Kidney Function.

Similarly, the concentration of sodium for the control group is higher than for 150mg/kg, 250mg /kg, 350mg /kg and 550mg/kg respectively except for 450mg/kg as shown on Figure 2. The significant decreased observed for these concentration administered could be attributed to increased excretion due to the absence of aldosterone regulation. This could also attributed to the fact that the significant decrease in plasma concentration did not affect the chlorine level at the same 250 mg/kg dose. Abnormal concentration of sodium in the blood can affect the osmotic pressure of the body fluid which is related to blood pressure [11].

The serum electrolyte concentration of the chloride group of 2,3,4,5,6, respectively showed significant increase compared to Group 1 as shown on Figure 3. The significant decrease in chloride may be due to the administration of ethanol extract of *Eucalyptus camaldulensis* when compared with control. This is in agreement with the work done by [6] on assessment of Kidney Function Indices in Male Albino Wistar Rats Administered Ethanol Stem Extract of Dennettia tripetala (Pepper fruit).

Urea and creatinine are important markers in the evaluation of kidney functions and monitoring the effectiveness of drug treatment. While urea, produced in the liver, is a byproduct of protein metabolism, creatinine, generated from creatine, is a byproduct of muscle metabolism (Acharya et al., 2024). Both are reliable biomarkers in the functional status of the kidney, liver and maintenance of body fluid. Elevated urea levels may be indicative of the body trying to conserve water in dehydration, high protein metabolism that can affect the kidney function at. An elevated creatinine level is suggestive of impaired kidney function. In this case, sub chronic administration of the extract does not show any significant changes in urea and creatinine suggesting that the extract is not toxic to the liver and kidney function.

The electrolytes blood test is a test done to assess the levels of the major electrolytes [3]. It is routinely ordered to give an insight into a possible electrolyte imbalance, which could be causing a variety of health conditions. Electrolytes plays significant role in several body processes, such as controlling fluid levels, acid-base balance (pH), nerve conduction, coagulation and muscle contraction Fluid and electrolytes homeostasis are usually maintained within narrow limits and therefore it must be kept at a level that is suitable for normal biochemical and physiological functions .It is observed from this study that the plant extract of *Eucalyptus camaldulensis* has showed their potential in maintaining and regulating renal marker (some electrolytes urea and creatinine).

5. Conclusion

This study revealed that *Eucalyptus camaldulensis* ethanol leave extract may have some nephroprotective protective effects which may be used in managing kidney problems.

References

[1] Oladeji. O.(2016). the characteristics and roles of medicinal plants: Some important medicinal plants in nigeria. *National production Industry*, 12(3):102.

[2] Dennis Amaechi, E. O. Udosen, E. E. Edet, E. E. Asanga, and I. E. Mbakwe. Lipid profile status of streptozotocin induced diabetic rats treated with ethanolic leaf extract of solenostemon monostachyus. *Journal of Medicinal Plant Research*, 9(8):289–293, 2015.

[3] Dennis Amaechi, I. P. Ekpe, B. N. Yisa, and T. F. Adamgbe Phytochemical. Profiling (gcms) of the leaf extract of mangifera indica and its hypolipidemic effect on serum lipid profile in streptozotocin induced diabetic wistar rats. *Asian Sci. Bull.*, 2(1):17–23, 2024.

[4] Dennis Amaechi, B. N. Yisa, I. P. Ekpe, P. I. Nwawuba, and Phytochemical AlacksRabbi. Screening, anti-obesity and hepatoprotective activities of ethanol leaf extract of jatrophatanjorensis in wistar rats. *Asian Journal of Applied Chemistry Research*, 12(4):20–26, 2022.

[5] M. Heinrich, J. Barnes, S. Gibbon, and E. M. Williamson. Fundamentals of pharmacognosy and phototherapy. In D. Kingdom, editor, *A*, pages 211–219. 2003.

[6] Dennis Amaechi, Etu A. Felix, I. P. Ekpe, G. E. Udosen, and B. N. Yisa. The ameliorative effects of solanummelongena (garden egg), solanumlycopersicum(tomatoes) and caucus carrots sub.sativus extracts on lipid profile against lead induced toxicity in wistar rats. *European Journal of Pharmaceutical and Medical Research*, 7(11):70–73, 2020.

[7] E. AsangaEdet, A. EseyinOlorunfemi, and EkanemAniebiet N. andAmaechi Dennis. Changes in serum zinc, magnesium and copper in sickle cell patients: A case study in jos, nigeria. *World Journal of Pharmaceutical Sciences*, 4(5):195–199, 2016.

[8] I. P. Ekpe and D. A. Apata. Dennis amaechi. the effects of methanol leaf extract of corchorusolitorius on the liver function and lipid profile of albino wistar rat. *European Journal of Pharmaceutical and Medical Research*, 8(11):13–19, 2021.

[9] Dennis Amaechi, E. O. Udosen, V. S. Ekam, and I. P. Ekpe. Effects of methanolic root extract of holarrhena floribunda on the lipid profile and sex hormones in wistarrats. *Asian Journal of Research in Biochemistry*, 3(3):1–7, 2018.

[10] I. P. Ekpe, E. O. Udosen, Amaechi Dennis, and B. N. (2018) Yisa. Impact of ethanolic extract of tecomastans and costusafer leaves on lipid profile status of streptozotocin induced diabetic wistarrats. *International Journal of Sciences*, 7(08).

[11] I. P. Ekpe, Dennis Amaechi, B. N. Yisa, and O. G. Osarhiemen. Evaluation of the effects of aqueous fruit extract of tamarindusindica on body weight, lipid profile, some electrolytes and urea of wistar rats. *Journal of Pharmaceutical research International*, 33(59A): 444–45, 2021.