



## ISRG PUBLISHERS

Abbreviated Key Title: isrg j. multidiscip. Stud.

ISSN: 2584-0452 (Online)

Journal homepage: <https://isrgpublishers.com/isrgjms/>

Volume – III, Issue - VII (July) 2025

Frequency: Monthly



## RENAL TOXICITY OF CALADIUM HORTULANUM LEAF EXTRACT ON WISTAR ALBINO RATS.

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| Received: 04.07.2025 | Accepted: 09.07.2025 | Published: 15.07.2025

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### Abstract

**Introduction:** This study highlights the subacute kidney toxicity of Wistar albino rats exposed to *Caladium hortulanum* leaf extract.

**Methods:** Twenty-four (24) rats were randomly divided into 4 groups labelled A, B, C and D and kept in a well-ventilated room. Group A served as control and these rats were treated with distilled water. Rats in the groups B, C, and D were treated with 3 different doses of the sample (1.5, 3.5 and 5.0ml/KgBW) respectively. Samples were administered once daily for 14 and 28 days consecutively. Animals were sacrificed 24 hours after the last treatment. Blood samples were collected into heparinized sample bottles for analysis.

**Results:** Serum urea and creatinine concentrations increased in a dose dependent manner at all durations of administration. The increase became significant at 5.0ml/KgBW for 14 days of administration. This trend was present at all doses for 28 days of administration. Histology done showed normal kidney tissue architecture for short term use and at the lowest dose of 1.5ml/KgBW for long term use. Both 3.5ml/KgBW and 5.0ml/KgBW doses in the long term group showed abnormalities of destroyed renal tubules, absent glomeruli and occluded bowmans capsular spaces.

**Conclusion:** This study demonstrates that prolonged use of this leaf extract increases the risk of kidney malfunctioning.

**KEYWORDS:** Kidney toxicity; *Caladium hortulanum* leaf

## Introduction

The COVID-19 pandemic led to severe health and economic consequences, especially on citizens of low- and middle-income countries. Beyond the severe burden placed on health systems that already had poor infrastructure, it also regressed several decades of improvement in health and economies of these countries, with Nigeria as a poster child (1,2).

The pandemic ushered in a meteoric rise in the cost of health consumables, drugs and health services in the country (3). This can be ascribed to shortages, general increases in the prices of goods and services worldwide but most importantly, the impact of the fall of the Nigerian naira. This led citizens in the lower middle class and below to patronize herbalists and traditional medicine practitioners in the country (4).

*Caladium hortulanum* is a plant of immense ornamental value worldwide as a result of its beautiful leaves (5,6). Nigerian herbalists and traditional medicine practitioners use it heavily in their treatment of suspected infections amongst their patients (7,8,9).

The kidney is an important organ of excretion and metabolism of ingested substances. The impact of some of these medicinal plants on normal functioning organ systems has not been researched deeply in Nigeria (10,11). This led the researchers to carry out this study on the effect of the leaf extract of caladium plant on the functions and histoarchitecture of the kidney of wistar albino rat.

## MATERIALS AND METHODS

**Plant collection and identification:** *Caladium hortulanum* leaves were purchased from a traditional medicine practitioner at Okujagu town in Port Harcourt Local Government Area of Rivers State.

The plant specimen was confirmed by a Botanist and fellow researcher.

**Sample preparation:** The leaves were weighed, thoroughly washed with distilled water and crushed with a blender. The sample gotten was diluted with distilled water to the concentrations required.

**Specimen (animal) used for the experiment:** Twenty-four (24) albino rats were purchased from animal house of the Department of Biochemistry, University of Port Harcourt, Choba Park. The animals were fed with rat pellets, water and libitum.

**Experimental procedure:** A total twenty-four (24) albino rats of weight range (140-194g/BW) were randomly divided into four groups labelled A, B, C and D where group A served as control and rats (n=3rats/dose) were treated with distilled water. Rats in groups B, C and D (n = 3 rats/dose) were orally treated with 3 different doses of the leaf extract 1.5ml/kgBW, 3.5ml/kgBW and 5.0ml/kgBW for 14 and 28 days respectively. Animals were sacrificed twenty-four (24) hours after last treatment.

**Collection of blood and preparation of serum:** The rats were withdrawn from the cages in each of the group twenty-four (24) hours after the last administration of the drugs for 14 and 28 days and placed in a desiccator containing cotton wool soaked in chloroform to anaesthetize the rats. The blood samples were obtained by cutting the jugular vein of the rat on the neck by means of surgical blade and put in anticoagulant sample bottles smeared with lithium-heparin. The blood samples were spun at 5000rpm

using MSE Centrifuge to obtain plasma. The animal was dissected and only the kidney was collected for pathological studies.

**Estimation of Urea and Creatinine:** The urea level was estimated using diacetyl monoxime technique with protein precipitation, while the creatinine level was estimated by the Jaffe creatinine method as described in (12,13).

**Histological procedures and analysis:** The kidney was cut into slabs about 0.5cm thick and fixed in 10% normal saline for a day after which they were transferred to 70% alcohol for dehydration. The tissues were passed through 90% alcohol and chloroform for different durations before they were transferred into two changes of molten paraffin wax for 20 mins each in an oven at 57%.

Several sections of the 5µm thick were obtained from a solid block of tissue and were stained with hematoxylin and eosin staining after which they were passed through a mixture of equal concentration of xylene and alcohol, following clearance of xylene, the tissues were oven dried.

Photomicrographs were taken with a JVC colour video digital camera (JVC China) mounted on an Olympus light microscope (Olympus UK Ltd Essex, UK) to demonstrate cytoarchitecture of the kidney.

**Table 1:** Urea and Creatinine (mmol/l) results on 14 days of exposure

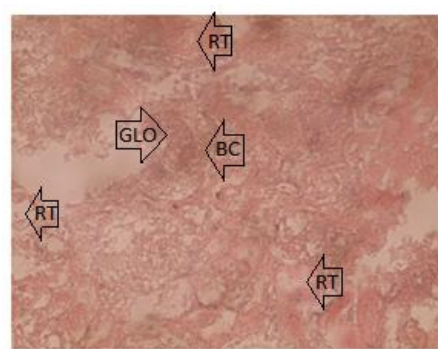
Extract volume (ml/kgBW)	Urea (mmol/l)	Creatinine (mmol/l)
Control (distilled water)	3.0±2.5	0.031±0.03
1.5	4.9	0.051
3.5	6.1	0.053
5.0	10.5	0.068

**Table 2:** Urea and Creatinine results on 28 days of exposure

Extract volume (ml/kgBW)	Urea (mmol/l)	Creatinine (mmol/l)
Control (distilled water)	3.0±2.5	0.031±0.03
1.5	11.3	0.065
3.5	11.5	0.074
5.0	14.5	0.123

## Histology

**Figure 1:** Control



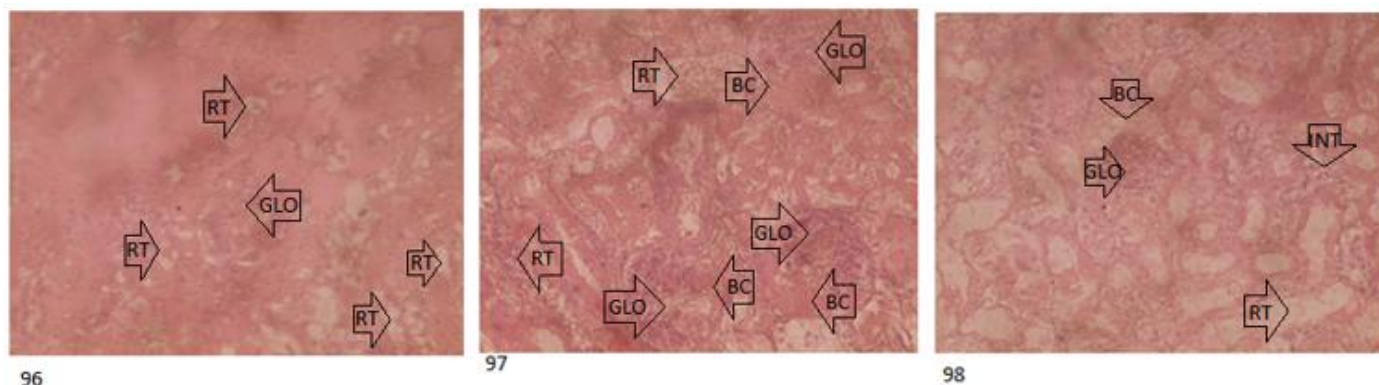
94

Slide 94: photomicrograph of kidney tissue treated with distilled

water showed normal tissue having glomeruli with tufts made up of glomerular cells, mesangial matrix and glomerular capillaries.

Glomeruli are surrounded by bowman's capsular spaces. Renal tubules are lined by simple epithelial cells. (control)

**Fig 2:** Result for 14 days of administration

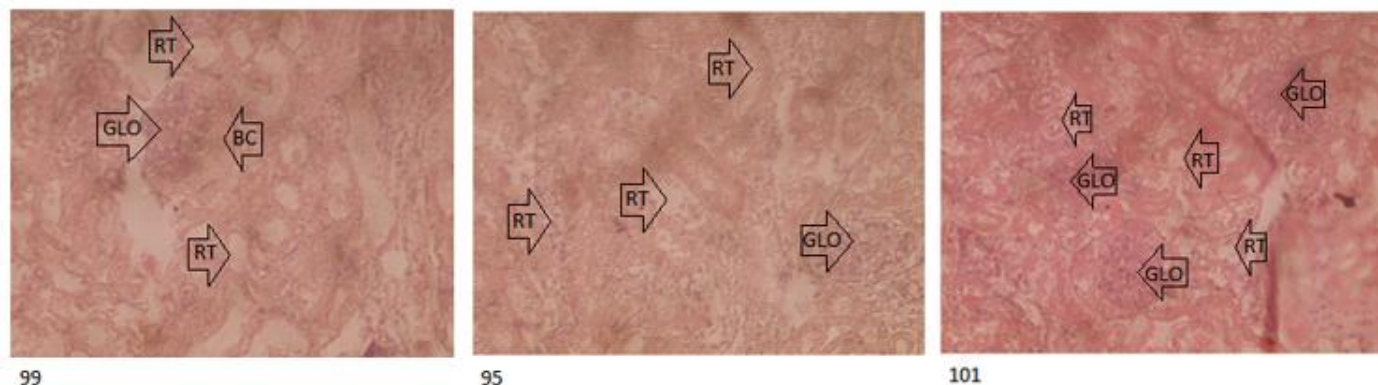


Slide 96: photomicrograph of kidney tissue treated with 1.5ml/kg showed histologically normal kidney tissue with normal glomeruli, renal tubules and patent bowman's capsular spaces

Slide 97: photomicrograph of kidney tissue treated with 3.0ml/kg showed histologically normal kidney tissue with normal glomeruli, renal tubules and patent bowman's capsular spaces

Slide 98: photomicrograph of kidney tissue treated with 5.0ml/kg showed histologically normal kidney tissue with normal glomeruli, renal tubules and patent bowman's capsular spaces

**Fig 3:** result for 28 days of administration



Slide 99: photomicrograph of kidney tissue treated with 1.5ml/kg showed histologically normal kidney tissue with normal glomeruli, renal tubules and patent bowman's capsular spaces

Slide 95: photomicrograph of kidney tissue treated with 3.0ml/kg showed histologically distorted kidney tissue with renal tubule destruction. Normal glomeruli, patent bowman's capsular spaces

Slide 101: photomicrograph of kidney tissue treated with 5.0ml/kg showed histologically distorted kidney tissue with absent glomeruli, renal tubules and occluded bowman's capsular spaces.

## RESULT AND DISCUSSION

Table 1 showed increasing concentrations of both urea and creatinine at all dosages of 14 days of administration. The increase became significant at 5.0mls/kgBW for urea having 10.5 mmol/l as compared to a control of  $3.0 \pm 2.5$  mmol/l. Similar trend was also noticed in creatinine having 0.68 mmol/l as compared to a control of  $0.031 \pm 0.03$  mmol/l.

Table 2 showed that at all dosages of administering the leaf extract for 28 days, there was a significant increase in both urea and creatinine concentrations when compared to control.

Figure 2 shows normal kidney histology at all dosages of the leaf extract when given for 14 days. Figure 3 shows normal kidney histology at a dosage of 1.5ml/kgBW. At 3.5ml/kgBW and 5.0ml/KgBW, the histology became distorted. This ranged from destroyed renal tubules, absent glomeruli and occluded bowman's capsular spaces.

The result showed that increasing dosages and duration of use of *Caladium hortulanum* leaf extract increased the risk and intensity of damage to the kidney. This was evidenced both by histology and biochemical studies. This was similar to the results from the studies conducted by (14,17) which showed necrosis, inflammation and changes to the kidney interstitium. Other research done showed significant antimicrobial activity (18, 7, 8), deleterious effects on the gastrointestinal tract (15) and the liver (16). On the other hand, (19) showed hepatoprotective of the corms impact on liver cells exposed to  $\text{CCl}_4$ . These damages can initially be borne by the kidney but as more components get destroyed, those left behind will be progressively destroyed by the increased workload. Holistic care is being promoted in current clinical practice (20). Patients in Nigeria have confidence in traditional medicine practitioners (21,22). With the increasing trend of patients abandoning conventional medicine for supposed cheaper, natural



and better understood traditional care, medical doctors have to work hand in hand with these practitioners to promote background and consistent routine monitoring of organ functioning while still using these traditional prescriptions.

## CONCLUSION

This study has shown that prolonged use of caladium leaf extract is nephropathic in rats. Pharmaceutical companies should perform further research on assessing a safe dose that can be used by traditional medicine practitioners.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## FINANCIAL DISCLOSURE

The authors declare no financial disclosure as no public funding was received.

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