

Research Article

Effects of *Dacryodes edulis* Leaf Extract on Kidney Function and Antioxidant Activity in Male Wistar Rats

^{1*}Ezomoh, Olusoga Olubunmi ²Chukwuma, Samuel Anakwe ³Onisuru Favour Ufuomanefev ⁴Prohp, The Prophet.

^{1,2,3,4}Department of Biochemistry, Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Article History:

Received: 04 Sept 2026 | **Accepted:** 12 Sept 2026 | **Published:** 19 Sept 2026

DOI: <https://doi.org/10.5281/zenodo.22840699>

*** Related declarations are provided in the final section of this article.*

Abstract

This study evaluated the effects of aqueous *Dacryodes edulis* leaf extract on kidney function and oxidative stress parameters in male Wistar rats. Eighteen rats were randomly divided into three groups of six animals each. Group I served as the normal control, while Groups II and III received 200 and 400 mg/kg body weight of *D. edulis* leaf extract, respectively, for 28 days. Serum urea, creatinine, sodium, potassium, chloride and bicarbonate concentrations were determined using Randox diagnostic kits. Kidney tissue superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) activities and malondialdehyde (MDA) concentration were also assessed. Data were analysed using one-way analysis of variance followed by Tukey's post-hoc test, with significance accepted at $p < 0.05$. Administration of the extract produced no significant differences ($p > 0.05$) in serum urea, creatinine, sodium, potassium, chloride or bicarbonate concentrations compared with the normal control throughout the treatment period. Similarly, SOD, CAT and GPx activities and MDA concentration did not differ significantly ($p > 0.05$) among the groups. The findings indicate that aqueous *D. edulis* leaf extract at 200 and 400 mg/kg did not markedly alter the measured renal biochemical, electrolyte and oxidative stress parameters in male Wistar rats during the 28-day treatment period. Further studies are required to evaluate its effects following prolonged administration and in experimental models of renal injury.

Keywords: Dacryodes edulis; Kidney function; Oxidative stress; electrolytes; Antioxidant enzymes; Wistar rats.

Introduction

The kidneys are vital organs that play a key role in regulating the internal environment of the body. They perform several main functions such as filtration of blood, elimination of metabolic waste products, control of fluid and electrolyte balance, maintenance of acid–base balance and synthesis of hormones involved in blood pressure regulation and red blood cell production (Venkatakrishna et al., 2023). Changes in kidney structure and function can disrupt these processes and may eventually lead to renal dysfunction (Dybiec et al., 2022). Biochemical markers like serum urea and creatinine, along with electrolytes like sodium, potassium, chloride and bicarbonate (John & Pasha, 2024), are used to assess kidney function. Any alterations in these parameters will help provide useful information about renal filtration, electrolyte regulation and acid–base balance (Nwaji et al., 2022).

Kidney diseases remain a significant global health problem. In particular, chronic kidney disease (CKD) is linked to a gradual decrease in kidney function and is a significant burden both for individuals and healthcare systems (Chesnaye et al, 2024). Multiple biological mechanisms occur in the course of kidney dysfunction, such as inflammation, metabolic changes, and oxidative stress (Wang & Zhang, 2024). Oxidative stress arises when the production of reactive oxygen species (ROS) is greater than their neutralization by the antioxidant mechanisms of cells. Excessive ROS can interact with cellular lipids, proteins and nucleic acids, resulting in cellular damage (Zhao et al., 2023). Oxidative stress could be especially harmful to the kidneys, due to their elevated metabolic rate and constant contact with filtered materials from the bloodstream (Piko et al., 2023).

The body possesses enzymatic and non-enzymatic antioxidant systems that regulate ROS levels and maintain cellular redox balance. Superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) are important enzymatic antioxidants. Through catalysing the conversion of superoxide radicals to hydrogen peroxide, SOD reduces the damage to the cell caused by the superoxide radicals (Zheng et al., 2023). Catalase plays a role in antioxidant defence by ensuring the breakdown of hydrogen peroxide to water and oxygen, which prevents accumulation in cells (Anwar et al., 2024). In addition to the above, GPx is involved in the detoxification of lipid hydroperoxides and H₂O₂ in reactions with glutathione (Vašková et al., 2023). Malondialdehyde (MDA) is a product of lipid peroxidation and is commonly

used as an indicator of lipid peroxidation in cells (Azeez et al., 2023). Assessment of these parameters in kidney tissue can therefore provide useful information about renal antioxidant status and oxidative stress.

Medicinal plants and plant-derived compounds have been the focus of much interest due to their biological activities. Flavonoids, phenolic compounds, tannins, and other phytochemicals are among the secondary metabolites found in many plants that can have antioxidant and anti-inflammatory effects (Elshafie et al., 2023). Studies are underway on the effect of flavonoids on oxidative stress and inflammatory processes in the kidneys (Alsawaf et al., 2022). Plant-derived antioxidants may exert their effects through several mechanisms, including direct scavenging of free radicals, inhibition of lipid peroxidation and enhancement of endogenous antioxidant defence mechanisms (Michalak, 2022). The biological activities of plant extracts, however, can be variable with respect to plant species, part of the plant, extraction method, dosage and duration of use. Thus, it is important to assess their potential biological effects and safety experimentally.

Dacryodes edulis, also referred to as African pear, safou or bush pear, is a tropical tree, common in the tropics and used for food in various parts of Africa. It is a member of Burseraceae family and is especially significant in West and Central Africa (Uhunmwangho & Omoregie, 2022). Different parts of the plant, including the fruits, leaves, bark and seeds, have been used for nutritional and traditional medicinal purposes. The fruit is highly consumed and other parts of the plant are used traditionally in managing various health conditions (Swana et al., 2023). All these medicinal properties have attracted growing scientific interest in the phytochemical composition and biological activities of *D. edulis*.

The biological properties of *D. edulis* have been assessed in several studies, which have revealed the presence of several bioactive constituents. The plant has been reported as being rich in phytochemicals with antioxidant and anti-inflammatory activities (Swana et al., 2023). It is especially important for its antioxidant activity as oxidative stress is a central factor in the mechanism of cellular damage and the onset of many chronic diseases (Edom et al., 2025). Antioxidant activity of *D. edulis* has also been previously investigated under various experimental conditions. For instance, Sanni et al., 2020, reported a protective effect of *D. edulis* against diabetes pathology due to its antioxidant properties. But data collected under one pathological situation cannot be directly transferred to normal renal function or other experimental conditions.

D. edulis leaf extract is also used to treat various ailments in traditional medicine and its phytochemical compounds could be responsible for the various reported biological effects (Dongmo et al., 2023). The fruit of *D. edulis* has been extensively studied due to its nutritional significance but the leaf extract's impact on biochemical and antioxidant parameters in the kidneys has yet to be thoroughly investigated (Inyang et al., 2025). This is significant because plant extracts that are thought to be beneficial can have different biological effects with varying doses and exposure time. Therefore, the effects of repeated administration of *D. edulis* leaf extract on the normal kidney function, electrolyte balance, and renal antioxidant status will need to be experimentally evaluated.

The biochemical parameters such as serum urea, serum creatinine, Na, K, Cl and HCO₃ are useful as indicators of changes associated with renal filtration and electrolyte and acid–base regulation (Kumahor, 2023; Ugwuene et al., 2026). Besides these serum parameters, estimation of SOD, CAT, GPx and MDA in kidney tissue will give data regarding antioxidant defence and lipid peroxidation. Considering these parameters together may thus offer a more comprehensive view on the renal effect of *D. edulis* leaf extract than using a single biochemical parameter.

Although several biological activities of *D. edulis* have been reported, information on the effects of repeated administration of its aqueous leaf extract on kidney function and renal antioxidant parameters in apparently healthy animals remains limited. Establishing these effects is important because, in the absence of experimentally induced renal injury, the response of the normal kidney to the extract can be assessed. This could help to determine the safety of the plant for the kidneys and its biological effects before being explored for therapeutic use.

Hence, this study assessed the effects of aqueous *Dacryodes edulis* leaf extract administered at 200 and 400 mg/kg body weight for 28 days on kidney function and antioxidant parameters in male Wistar rats. Serum urea, creatinine, sodium, potassium, chloride and bicarbonate were measured and SOD, CAT, GPx and MDA were measured in kidney tissue. The structure of the renal tissues was also examined after the administration of the extract to evaluate the changes in renal tissue structure.

MATERIALS AND METHODS

Collection and Identification of Plant Material

Fresh leaves of *Dacryodes edulis* were collected from Aba, Osisioma Local Government Area, Abia State, Nigeria. The plant was identified by Professor Kola Ajibesin of the Department of Pharmacognosy, Faculty of Pharmacy, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Preparation of Plant Extract

Fresh *Dacryodes edulis* leaves were shade-dried at room temperature for two weeks and subsequently ground into a fine powder. Five hundred grams (500 g) of the powdered leaves were soaked in 2 L of distilled water for 72 hours with intermittent stirring. The mixture was filtered using cheesecloth and the filtrate was concentrated to dryness in a water bath at 50°C. The dried aqueous extract was reconstituted with distilled water to the required concentrations for administration.

Experimental Animals

Eighteen apparently healthy male Wistar rats weighing 150–200 g were obtained from the Animal House, Department of Pharmacology, Faculty of Basic Clinical Sciences, College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria. The animals were housed in standard cages at the Animal House, Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State. They were allowed to acclimatise for 14 days under standard laboratory conditions and had free access to commercial grower's mash (Delta Feeds) and clean drinking water ad libitum. A 12-hour light/12-hour dark cycle was maintained throughout the acclimatisation period.

Ethical Approval

Ethical approval for the study was obtained from the Ethics Committee of the Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria. All experimental procedures involving the animals were conducted in accordance with approved institutional guidelines for the care and use of laboratory animals.

Experimental Design

The eighteen male Wistar rats were randomly divided into three groups of six animals each ($n = 6$). The treatment lasted for 28 days.

Group I (Normal control): Rats received distilled water.

Group II (Low dose): Rats received aqueous leaf extract of *Dacryodes edulis* at 200 mg/kg body weight.

Group III (High dose): Rats received aqueous leaf extract of *Dacryodes edulis* at 400 mg/kg body weight.

The extract was reconstituted in distilled water before administration.

Blood Sample Collection

Blood samples were collected from the submandibular vein on Days 0, 1, 7, 14 and 21 for biochemical analyses. Samples were collected between 10:00 a.m. and 12:00 noon, approximately 24 hours after administration of the extract. On Day 28, the animals were anaesthetised and blood samples were collected by cardiac puncture for the final biochemical analyses.

Collection and Preparation of Kidney Samples

Following euthanasia on Day 28, the kidneys were carefully excised and rinsed in normal saline. Portions of the kidney tissues were collected for oxidative stress analysis and histological examination. Kidney tissues required for biochemical analysis were homogenised in an appropriate buffer and centrifuged, while the resulting supernatant was used for the determination of oxidative stress parameters.

Determination of Kidney Function Parameters

Serum urea, creatinine, sodium, potassium, chloride and bicarbonate concentrations were determined using Randox diagnostic reagent kits (Randox Laboratories Ltd., Crumlin, UK). All biochemical assays were carried out according to the procedures specified by the manufacturer.

Determination of Oxidative Stress Parameters

Oxidative stress and antioxidant parameters were determined in kidney tissue homogenates using established biochemical methods. Superoxide dismutase (SOD) activity was determined according to the method described by Misra and Fridovich (1972), while catalase (CAT) activity was determined according to Sinha (1972). Glutathione peroxidase (GPx) activity was determined using the method described by Paglia and Valentine (1967). Malondialdehyde (MDA), as an index of lipid peroxidation, was determined according to the method described by Armstrong and Al-Awadi (1991).

Histological Examination

Kidney tissues collected for histological examination were processed using standard histological procedures. The tissue sections were stained with haematoxylin and eosin (H&E) and examined microscopically for changes in renal architecture, including the glomeruli, proximal and distal convoluted tubules and renal blood vessels. Photomicrographs were examined at $\times 400$ magnification.

Statistical Analysis

Data were expressed as mean $\pm$ standard deviation (SD). Differences among the experimental groups were analysed using one-way analysis of variance (ANOVA), followed by Tukey's post-hoc test for multiple comparisons. Differences were considered statistically significant at $p < 0.05$.

Results

Table 1. Serum urea concentration (mg/dL) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	52.11 $\pm$ 3.87 ^a	51.86 $\pm$ 3.42 ^a	54.33 $\pm$ 2.49 ^a
Day 1	51.75 $\pm$ 4.22 ^a	52.44 $\pm$ 3.07 ^a	51.68 $\pm$ 4.16 ^a
Day 7	53.22 $\pm$ 3.53 ^a	52.74 $\pm$ 4.22 ^a	53.12 $\pm$ 3.44 ^a
Day 14	54.61 $\pm$ 4.32 ^a	53.02 $\pm$ 2.66 ^a	52.72 $\pm$ 4.40 ^a
Day 21	52.71 $\pm$ 2.78 ^a	51.95 $\pm$ 4.12 ^a	52.54 $\pm$ 3.90 ^a
Day 28	52.98 $\pm$ 4.01 ^a	52.63 $\pm$ 4.20 ^a	51.83 $\pm$ 4.06 ^a

Values are expressed as mean $\pm$ SD (n = 6). Values with the same superscript within the same row are not significantly different at $p > 0.05$.

There were no significant differences ($p > 0.05$) in serum urea concentration between the normal control and the 200 and 400 mg/kg treatment groups throughout the 28-day treatment period. Serum urea values showed only slight fluctuations across the sampling periods.

Table 2. Serum creatinine concentration (mg/dL) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days.

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	0.43 ± 0.05 ^a	0.48 ± 0.05 ^a	0.53 ± 0.05 ^a
Day 1	0.45 ± 0.03 ^a	0.50 ± 0.04 ^a	0.51 ± 0.04 ^a
Day 7	0.45 ± 0.03 ^a	0.51 ± 0.06 ^a	0.51 ± 0.03 ^a
Day 14	0.44 ± 0.04 ^a	0.50 ± 0.04 ^a	0.53 ± 0.07 ^a
Day 21	0.46 ± 0.03 ^a	0.50 ± 0.07 ^a	0.54 ± 0.04 ^a
Day 28	0.45 ± 0.05 ^a	0.51 ± 0.02 ^a	0.52 ± 0.01 ^a

Values are expressed as mean ± SD (n = 6). Values with the same superscript within the same row are not significantly different at $p > 0.05$.

Serum creatinine concentration did not differ significantly ($p > 0.05$) among the experimental groups throughout the study. Although the extract-treated groups showed slightly higher numerical values at some sampling periods, no significant change was observed compared with the normal control.

Table 3. Serum sodium concentration (mmol/L) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	67.98 ± 2.66 ^a	70.25 ± 4.30 ^a	68.44 ± 2.50 ^a
Day 1	67.83 ± 3.57 ^a	68.72 ± 5.26 ^a	71.22 ± 4.22 ^a
Day 7	69.12 ± 2.79 ^a	71.23 ± 3.88 ^a	69.72 ± 3.88 ^a
Day 14	68.84 ± 4.32 ^a	70.35 ± 4.22 ^a	68.89 ± 5.22 ^a
Day 21	70.11 ± 5.28 ^a	70.88 ± 2.94 ^a	70.55 ± 3.77 ^a
Day 28	69.44 ± 3.95 ^a	69.59 ± 5.20 ^a	70.34 ± 4.03 ^a

Values are expressed as mean $\pm$ SD (n = 6). Values with the same superscript within the same row are not significantly different at $p > 0.05$.

There were no significant differences ($p > 0.05$) in serum sodium concentrations among the groups throughout the 28-day treatment period.

Table 4. Serum potassium concentration (mmol/L) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	1.56 $\pm$ 0.38 ^a	1.61 $\pm$ 0.51 ^a	1.60 $\pm$ 0.26 ^a
Day 1	1.59 $\pm$ 0.48 ^a	1.63 $\pm$ 0.45 ^a	1.58 $\pm$ 0.24 ^a
Day 7	1.58 $\pm$ 0.33 ^a	1.60 $\pm$ 0.66 ^a	1.62 $\pm$ 0.36 ^a
Day 14	1.60 $\pm$ 0.62 ^a	1.58 $\pm$ 0.28 ^a	1.60 $\pm$ 0.41 ^a
Day 21	1.58 $\pm$ 0.52 ^a	1.61 $\pm$ 0.43 ^a	1.59 $\pm$ 0.54 ^a
Day 28	1.60 $\pm$ 0.49 ^a	1.60 $\pm$ 0.55 ^a	1.61 $\pm$ 0.39 ^a

Values are expressed as mean $\pm$ SD (n = 6). Values with the same superscript within the same row are not significantly different at $p > 0.05$.

Serum potassium concentration remained comparable among the normal control and extract-treated groups, with no significant differences ($p > 0.05$) throughout the treatment period.

Table 5. Serum chloride concentration (mmol/L) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	17.88 $\pm$ 1.85 ^a	18.97 $\pm$ 2.01 ^a	20.92 $\pm$ 1.53 ^a
Day 1	19.23 $\pm$ 2.76 ^a	20.56 $\pm$ 1.78 ^a	20.41 $\pm$ 0.93 ^a
Day 7	17.67 $\pm$ 1.14 ^a	18.95 $\pm$ 1.46 ^a	19.06 $\pm$ 2.02 ^a
Day 14	18.99 $\pm$ 0.76 ^a	19.78 $\pm$ 1.88 ^a	21.08 $\pm$ 1.52 ^a
Day 21	20.16 $\pm$ 0.68 ^a	20.66 $\pm$ 2.06 ^a	19.95 $\pm$ 1.90 ^a

Day 28	19.68 ± 3.32 ^a	19.97 ± 0.97 ^a	21.32 ± 1.32 ^a
--------	---------------------------	---------------------------	---------------------------

Values are expressed as mean ± SD (n = 6). Values with the same superscript within the same row are not significantly different at p > 0.05.

No significant differences (p > 0.05) in serum chloride concentration were observed among the experimental groups throughout the study period.

Table 6. Serum bicarbonate concentration (mmol/L) in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Treatment period	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
Day 0	37.86 ± 2.38 ^a	40.61 ± 4.02 ^a	38.99 ± 4.09 ^a
Day 1	39.18 ± 1.67 ^a	38.75 ± 2.88 ^a	39.79 ± 2.55 ^a
Day 7	36.98 ± 2.11 ^a	40.40 ± 3.80 ^a	39.18 ± 1.85 ^a
Day 14	37.88 ± 3.12 ^a	41.21 ± 2.27 ^a	40.05 ± 1.95 ^a
Day 21	39.24 ± 2.21 ^a	40.76 ± 2.45 ^a	38.74 ± 2.18 ^a
Day 28	37.90 ± 2.34 ^a	39.98 ± 2.88 ^a	39.64 ± 2.86 ^a

Values are expressed as mean ± SD (n = 6). Values with the same superscript within the same row are not significantly different at p > 0.05.

Serum bicarbonate concentration did not differ significantly (p > 0.05) among the normal control, 200 mg/kg and 400 mg/kg treatment groups throughout the 28-day study period.

Table 7. Kidney tissue oxidative stress parameters in male Wistar rats administered aqueous *Dacryodes edulis* leaf extract for 28 days

Parameter	Normal control	<i>D. edulis</i> 200 mg/kg	<i>D. edulis</i> 400 mg/kg
SOD (U/mg protein)	9.78 ± 1.54 ^a	9.17 ± 1.44 ^a	9.26 ± 1.89 ^a
CAT (U/mg protein)	7.94 ± 1.11 ^a	7.98 ± 1.55 ^a	7.92 ± 1.78 ^a
GPx (U/mg protein)	8.82 ± 1.48 ^a	8.71 ± 1.60 ^a	8.51 ± 2.14 ^a
MDA (nmol/mg protein)	1.93 ± 0.31 ^a	1.88 ± 0.01 ^a	1.97 ± 0.03 ^a

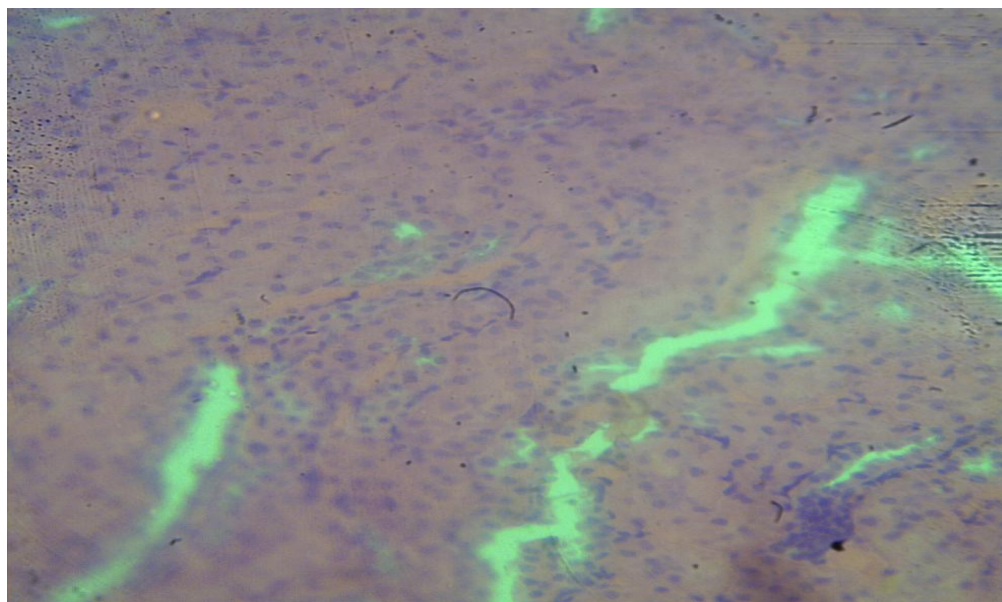
Values are expressed as mean ± SD (n = 6). Values with the same superscript within the same row are not significantly different at p > 0.05.

SOD activity did not differ significantly (p > 0.05) among the normal control, 200 mg/kg and 400 mg/kg groups. Similarly, CAT and GPx activities showed no significant differences among the groups. MDA concentration also remained statistically comparable between the control and extract-treated groups. Therefore, none of the measured kidney oxidative stress

parameters showed a significant change following 28 days of *D. edulis* leaf extract administration.

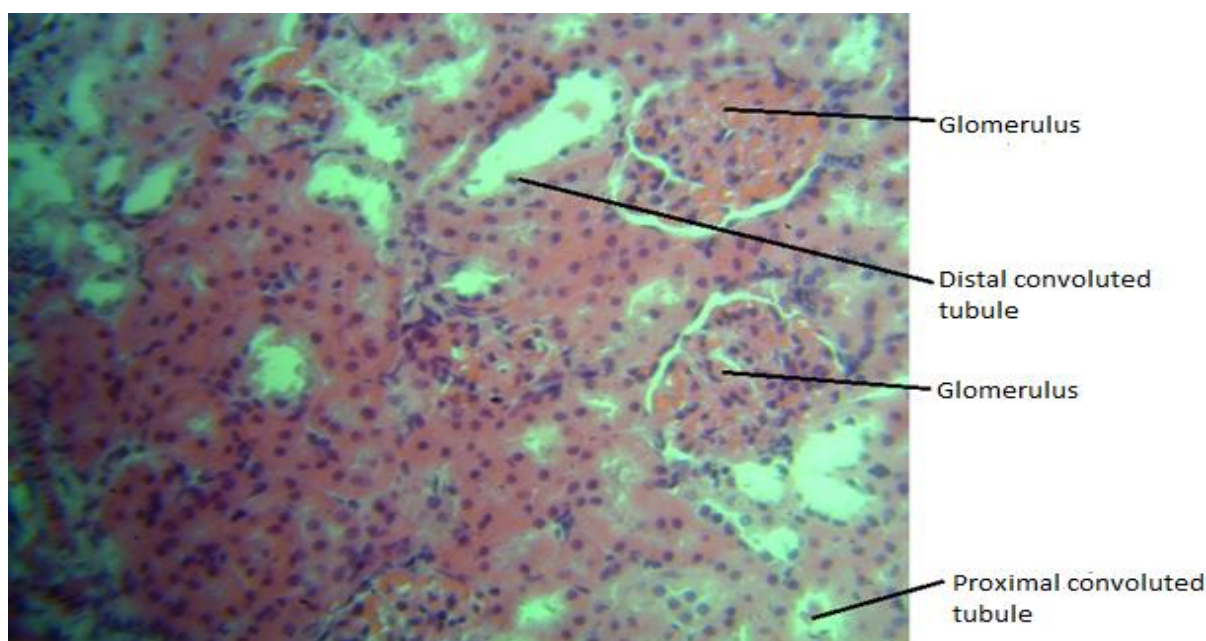
Histological Findings

Plate 1. Photomicrograph of kidney tissue from the normal control group (H&E, $\times 400$).



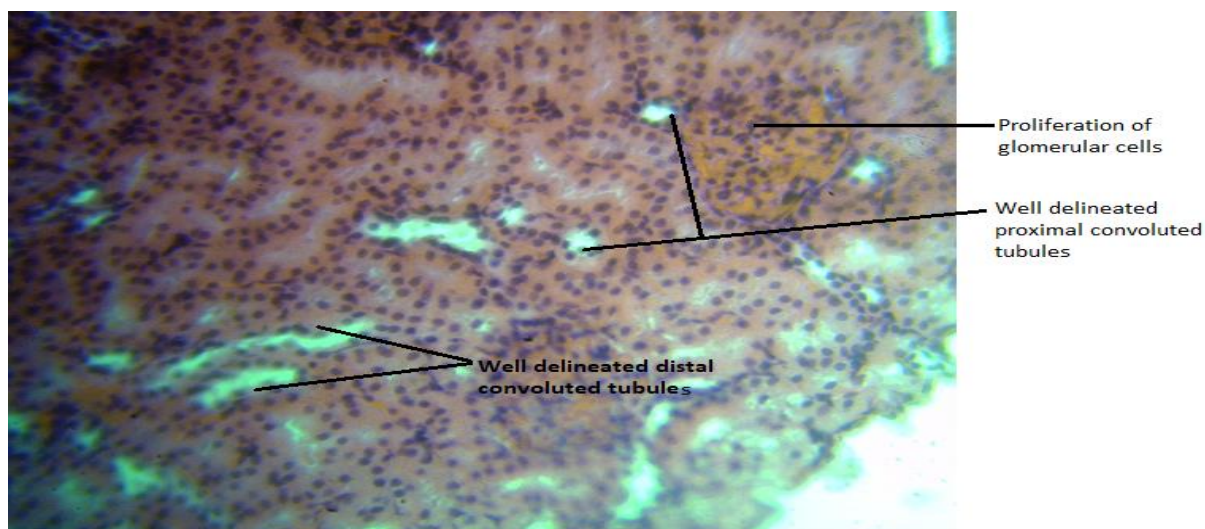
The kidney tissue of the normal control group showed preserved renal architecture, with well-delineated glomeruli and distinct proximal and distal convoluted tubules. The renal tissue microstructure appeared normal, with no obvious histological abnormalities

Plate 2. Photomicrograph of kidney tissue from rats administered 200 mg/kg aqueous *Dacryodes edulis* leaf extract (H&E, $\times 400$).



The kidney tissue showed preserved renal architecture, with distinct proximal and distal convoluted tubules and well-delineated glomeruli. No obvious alteration in the renal tissue microstructure was observed.

Plate 3. Photomicrograph of kidney tissue from rats administered 400 mg/kg aqueous *Dacryodes edulis* leaf extract (H&E, $\times 400$).



The kidney tissue showed generally preserved renal architecture, with well-delineated proximal and distal convoluted tubules. Proliferation of glomerular cells was observed, while the surrounding renal tissue remained generally preserved.

Discussion

In the present study, the effects of aqueous *Dacryodes edulis* leaf extract were evaluated on renal biochemical parameters and kidney antioxidant status after 28 days of treatment in male Wistar rats. The results indicated that there was no significant difference between the serum urea, creatinine, sodium, potassium, chloride, and bicarbonate concentrations of animals fed the extract at 200 and 400 mg/kg body weight and the normal control. Likewise, there was no significant difference between the experimental groups in terms of kidney SOD, CAT, GPx and MDA.

Biochemical assessment of renal function is often performed by measuring serum urea and creatinine, which can alter when renal filtration is affected (Kumahor, 2023). During the 28-day period there was no significant difference in serum urea between the two extract treated groups and the normal control in the present study. The creatinine was similar, but slightly higher values were noted in the treatment groups at certain sampling times. These differences were not statistically significant. There was no significant increase in urea or creatinine,

indicating no marked alteration of these biochemical markers of renal filtration by repeated doses of the *D. edulis* leaf extract at the doses tested.

The electrolyte levels in the serum were also not significantly different between the groups. Serum sodium and potassium concentrations did not differ significantly between the control and extract-treated groups during the experiment. The kidneys are a major organ of Sodium and potassium regulation by filtration, reabsorption and excretion, reabsorbing or eliminating sodium and potassium (Kim, 2024). Thus, there was no significant change in these electrolytes with the administration of the extract for the treatment period indicating that such regulation was not significantly altered.

Likewise, there was no significant difference between the experimental groups for serum chloride and bicarbonate. Chloride contributes to extracellular fluid and electrolyte balance, while bicarbonate plays an important role in maintaining acid–base homeostasis (Madhavan Unny et al., 2023). It is the kidneys that help control bicarbonate levels by reabsorbing bicarbonate and excreting acids (Gantsova et al., 2024). Therefore, The relatively stable chloride and bicarbonate concentrations therefore suggest that the extract did not produce a detectable disturbance in electrolyte or acid–base regulation.

The antioxidant parameters of the kidney were comparable. There were no significant differences in SOD, CAT or GPx activities between the control and treatment groups after 28 days of extract administration. SOD is one of the crucial antioxidant enzymes that catalyse the transformation of superoxide radicals into hydrogen peroxide, which reduces the damage caused by superoxide radicals to cells (Zheng et al., 2023). Another function of catalase is to neutralize hydrogen peroxide to produce water and molecular oxygen (Anwar et al., 2024). In addition, GPx is involved in the elimination of lipid hydroperoxides (Pei et al., 2023) and hydrogen peroxide. These enzymes showed slight variation in their numerical values, but in the present study there was no statistical difference, suggesting that the leaf extract of *D. edulis* did not significantly increase or decrease the renal antioxidant enzyme activities.

Malondialdehyde is commonly used as an indicator of lipid peroxidation and oxidative damage to cellular membranes (Mohideen et al., 2023). There were no significant differences among the groups in the concentration of MDA with the values for the control, 200 mg/kg and 400 mg/kg groups being 1.93 ± 0.31 , 1.88 ± 0.01 and 1.97 ± 0.03 U/mg protein, respectively. This shows that the extract failed to significantly affect the lipid peroxidation in kidney during the 28-days treatment period. The non-significant changes in MDA, together with the stable

antioxidant enzyme activities, suggest that the extract did not cause significant oxidative stress or significant antioxidant response in the kidneys in the normal experimental conditions.

The antioxidant effect and other biological activities of *D. edulis* have been reported previously and attributed to phytochemicals found in various parts of the plant (Swana et al., 2023). Antioxidant activity of *D. edulis* was also reported by Sanni et al. (2020) in an experimental setting related to diabetes. In the present study, however, significant antioxidant changes were not seen, which may be related to the fact that the rats apparently were not subjected to an experimentally induced oxidative or renal injury. In this setting, the endogenous antioxidant system can likewise be sufficient to keep redox balanced and hence reduce the size of any additional effects the extract might have.

Histological examination of the kidney tissues generally supported the biochemical findings. The normal control group showed preserved renal architecture with well-delineated glomeruli and distinct proximal and distal convoluted tubules. Similarly, the 200 mg/kg group showed preserved renal tissue architecture, while the 400 mg/kg group showed generally preserved tubular structures with proliferation of glomerular cells. These findings suggest that administration of the extract did not produce marked structural alterations in the kidney at the doses tested, although the glomerular cell proliferation observed at 400 mg/kg should be interpreted cautiously.

The biochemical results suggest that aqueous *D. edulis* leaf extract at 200 and 400 mg/kg body weight had no significant effect on the various renal function, electrolyte and oxidative stress parameters examined in male Wistar rats. The results, however, cannot be interpreted as evidence of a nephroprotective effect because an experimental model of renal injury was not included in the study.

Conclusion

The findings of this study showed that aqueous *Dacryodes edulis* leaf extract administered at 200 and 400 mg/kg body weight for 28 days did not significantly alter serum urea, creatinine, sodium, potassium, chloride or bicarbonate concentrations in male Wistar rats. Similarly, no significant changes were observed in renal SOD, CAT, GPx and MDA. These findings suggest that the extract did not markedly alter the measured renal biochemical and oxidative stress parameters at the doses studied. Further studies are required to evaluate its effects following prolonged administration and in experimental models of renal injury.

Limitations of the Study

This study was limited by the use of only two doses of *D. edulis* leaf extract and a treatment duration of 28 days. The study was also conducted in non-injured male Wistar rats, which do not have clinical renal diseases; hence the results could not be used to establish nephroprotective activity. Histological findings, especially as observed in the normal control group, need to be confirmed. Future studies should include a wider range of doses, longer treatment periods and appropriate models of experimentally induced renal injury to evaluate potential nephroprotective activity.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the conduct and publication of this study.

Article Publication Details

This article is published in the **International Journal of Multidisciplinary Department**, ISSN 3108-2718 (Online). In Volume 2 (2026), Issue 4 July-Aug)

The journal is published and managed by **IJRGP**.

Acknowledgements

We sincerely thank the editors and the reviewers for their valuable suggestions on this paper.

References

1. Alsawaf, S., Alnuaimi, F., Afzal, S., Thomas, R. M., Chelakkot, A. L., Ramadan, W. S., ... & Vazhappilly, C. G. (2022). Plant flavonoids on oxidative stress-mediated kidney inflammation. *Biology*, 11(12), 1717.
2. Anwar, S., Alrumaihi, F., Sarwar, T., Babiker, A. Y., Khan, A. A., Prabhu, S. V., & Rahmani, A. H. (2024). Exploring therapeutic potential of catalase: Strategies in disease prevention and management. *Biomolecules*, 14(6), 697.
3. Armstrong, D., & Al-Awadi, F. (1991). Lipid peroxidation and retinopathy in streptozotocin-induced diabetes. *Free Radical Biology and Medicine*, 11(4), 433–436.
4. Azeez, R. M., Al-Hashemi, W. K., Al-Auqbi, T. F., & Jebali, J. (2023). Relation of MDA as oxidative stress marker with lipid profile in a diabetic patient. *Al-Nahrain Journal of Science*, 26(3), 12-17.

5. Chesnaye, N. C., Ortiz, A., Zoccali, C., Stel, V. S., & Jager, K. J. (2024). The impact of population ageing on the burden of chronic kidney disease. *Nature Reviews Nephrology*, 20(9), 569-585.
6. Dongmo, K. J. J., Tali, M. B. T., Fongang, Y. S. F., Taguimjeu, P. L. K. T., Kagho, D. U. K., Bitchagno, G. T., ... & Ngouela, S. A. (2023). In vitro antiplasmodial activity and toxicological profile of extracts, fractions and chemical constituents of leaves and stem bark from *Dacryodes edulis* (Burseraceae). *BMC Complementary Medicine and Therapies*, 23(1), 211.
7. Dybiec, J., Szlagor, M., Młynarska, E., Rysz, J., & Franczyk, B. (2022). Structural and functional changes in aging kidneys. *International Journal of Molecular Sciences*, 23(23), 15435.
8. Edom, C. V., Okereke, C. S., Nosiri, C. I., Aaron, F. C., Chukwudoruo, C. S., Haruna, M. A., ... & Obinna, I. B. (2025). Nutritional and Phytochemical Characterization of *Dacryodes edulis* (African Pear) Ethanol Leaf Extract. *Asian Journal of Medical Principles and Clinical Practice*, 8(2), 788-804.
9. Elshafie, H. S., Camele, I., & Mohamed, A. A. (2023). A comprehensive review on the biological, agricultural and pharmaceutical properties of secondary metabolites based-plant origin. *International journal of molecular sciences*, 24(4), 3266.
10. Gantsova, E., Serova, O., Vishnyakova, P., Deyev, I., Elchaninov, A., & Fatkhudinov, T. (2024). Mechanisms and physiological relevance of acid-base exchange in functional units of the kidney. *PeerJ*, 12, e17316.
11. Inyang, A. N., Agiang, M. A., Mgbang, J. E., Etim, U. G., Henshaw, A. S., Ottoho, E. O., ... & Akpan, S. G. (2025). Evaluation of the processing methods of *Dacryodes edulis* var. *edulis* pulp: insights from biochemical changes in Wistar rats. *Tropical Journal of Phytochemistry and Pharmaceutical Sciences*, 4(8), 373-377.
12. John, A., & Pasha, T. (2024). Laboratory tests of renal function. *Anaesthesia & Intensive Care Medicine*, 25(5), 303-307.
13. Kim, G. H. (2024). Primary role of the kidney in pathogenesis of hypertension. *Life*, 14(1), 119.
14. Kumahor, E. K. (2023). 11 The Biochemical Basis of Renal Diseases. *Current trends in the diagnosis and management of metabolic disorders*, 185.

15. Madhavan Unny, N., Zarina, A., & Beena, V. (2023). Fluid and electrolyte balance. In P. K. Das, V. Sejian, J. Mukherjee, & D. Banerjee (Eds.), *Textbook of veterinary physiology* (pp. 193–211). Singapore: Springer Nature Singapore.
16. Michalak, M. (2022). Plant-derived antioxidants: Significance in skin health and the ageing process. *International journal of molecular sciences*, 23(2), 585.
17. Misra, H. P., & Fridovich, I. (1972). The role of superoxide anion in the autoxidation of epinephrine and a simple assay for superoxide dismutase. *Journal of Biological Chemistry*, 247(10), 3170–3175.
18. Mohideen, K., Chandrasekar, K., Ramsridhar, S., Rajkumar, C., Ghosh, S., & Dhungel, S. (2023). Assessment of oxidative stress by the estimation of lipid peroxidation marker malondialdehyde (MDA) in patients with chronic periodontitis: a systematic review and meta-analysis. *International journal of dentistry*, 2023(1), 6014706.
19. Nwaji, A. R., Inwang, U., Nwoke, F. A., & Ante, I. (2022). Changes in serum electrolytes, urea and creatinine in nicotiana tabacum-treated rats. *Nigerian Journal of Physiological Sciences*, 37(1), 153-156.
20. Paglia, D. E., & Valentine, W. N. (1967). Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidase. *Journal of Laboratory and Clinical Medicine*, 70(1), 158–169
21. Pei, J., Pan, X., Wei, G., & Hua, Y. (2023). Research progress of glutathione peroxidase family (GPX) in redoxitation. *Frontiers in pharmacology*, 14, 1147414.
22. Piko, N., Bevc, S., Hojs, R., & Ekart, R. (2023). The role of oxidative stress in kidney injury. *Antioxidants*, 12(9), 1772.
23. Sanni, O., Erukainure, O. L., & Islam, M. S. (2020). *Dacryodes edulis*: Protective antioxidant effects on diabetes pathology. In *Pathology* (pp. 205–212). Academic Press.
24. Sinha, A. K. (1972). Colorimetric assay of catalase. *Analytical Biochemistry*, 47(2), 389–394
25. Swana, L., Tsakem, B., Tembu, J. V., Teponno, R. B., Folahan, J. T., Kalinski, J. C., ... & Siwe-Noundou, X. (2023). The genus *Dacryodes* Vahl.: Ethnobotany, phytochemistry and biological activities. *Pharmaceuticals*, 16(5), 775.

26. Ugwuene, F. O., Ofodile, E. I., ORHONIGBE, I. O., Orji, O. C., Ogara, A. L., Agwu, L. O., ... & Joshua, P. E. (2026). Comparison of Electrolyte, Urea, Creatinine and Lipid Profile Status in Hypertensive and Renal Disease Patients in Enugu State University of Science and Technology (ESUT) Teaching Hospital. *Bio-Research*, 23(3), 217.
27. Uhunmwangho, E. S., & Omoregie, E. S. (2022). Changes in lipid class and fatty acid composition during the development of African pear (*Dacryodes edulis*) fruit pulp. *African Journal of Biochemistry Research*, 16(1), 24-31.
28. Vašková, J., Kočan, L., Vaško, L., & Perjési, P. (2023). Glutathione-related enzymes and proteins: a review. *Molecules*, 28(3), 1447.
29. Venkatakrishna, S. S. B., Onyango, L. C., Serai, S. D., & Viteri, B. (2023). Kidney anatomy and physiology. In *Advanced Clinical MRI of the Kidney: Methods and Protocols* (pp. 3–12). Springer International Publishing.
30. Wang, N., & Zhang, C. (2024). Oxidative stress: A culprit in the progression of diabetic kidney disease. *Antioxidants*, 13(4), 455.
31. Zhao, Y., Ye, X., Xiong, Z., Ihsan, A., Ares, I., Martínez, M., ... & Martínez, M. A. (2023). Cancer metabolism: the role of ROS in DNA damage and induction of apoptosis in cancer cells. *Metabolites*, 13(7), 796.
32. Zheng, M., Liu, Y., Zhang, G., Yang, Z., Xu, W., & Chen, Q. (2023). The applications and mechanisms of superoxide dismutase in medicine, food and cosmetics. *Antioxidants*, 12(9), 1675.