

**Research Article****Review of Comparative Renoprotective Study of Allium Cepa (Bulb) and Clerodendrum Serratum (Root) Extracts in Experimental Animal Model**Md. Mahtab Alam¹, Divya Singh², Lokesh Kumar Saini³¹Research Scholar, Department of Pharmacology, Jaipur college of Pharmacy, Jaipur²Professor and HOD, Department of Pharmacology, Jaipur College of Pharmacy, Jaipur³Lecturer, Department of Pharmacology, Jaipur College of Pharmacy, Jaipur**Article Info:** Received: 29-03-2026 / Revised: 15-04-2026 / Accepted: 30-04-2026**Corresponding Author:** Md. Mahtab Alam**DOI:** <https://doi.org/10.32553/jbpr.v15i3.1460>**Conflict of interest statement:** No conflict of interest**Abstract:**

The present study was designed to evaluate and compare the renoprotective activity of methanolic extracts of Allium cepa (bulb) and Clerodendrum serratum (root) against gentamicin-induced nephrotoxicity in Wistar rats. The plant materials were collected, authenticated, shade dried, powdered, and extracted using methanol. Preliminary phytochemical screening revealed the presence of important bioactive constituents. Acute oral toxicity studies performed according to OECD guideline 423 indicated that both extracts were safe at the selected dose levels. Experimental nephrotoxicity was induced by administration of gentamicin (80 mg/kg/day, i.p.) for 7 consecutive days. Animals were divided into seven groups consisting of normal control, toxic control, standard drug-treated group, and extract-treated groups receiving low and high doses of Allium cepa and Clerodendrum serratum. Renoprotective activity was evaluated using biochemical, antioxidant, electrolyte, and histopathological parameters. Treatment with methanolic extracts of Allium cepa and Clerodendrum serratum significantly restored renal biochemical markers, corrected electrolyte imbalance, reduced lipid peroxidation, and improved antioxidant enzyme levels when compared with the toxic control group. Histopathological studies further confirmed the protective effect of the extracts by showing marked restoration of renal architecture and reduction of tissue damage. Among the two plants, Clerodendrum serratum demonstrated comparatively greater renoprotective activity, particularly at the higher dose level, which may be attributed to its broader phytochemical composition including alkaloids and saponins in addition to flavonoids and phenolic compounds. The findings of the present study conclude that both Allium cepa and Clerodendrum serratum possess significant renoprotective activity against gentamicin-induced nephrotoxicity, primarily mediated through antioxidant and cytoprotective mechanisms.

Keywords: Allium cepa, Clerodendrum serratum, Gentamicin, Nephrotoxicity, Renoprotective activity, Antioxidant, Wistar rats, Histopathology.

Introduction

The kidneys are vital excretory organs that maintain internal homeostasis by regulating the composition and volume of extracellular fluid.

They play essential roles in waste removal, electrolyte balance, acid–base regulation, blood pressure control, erythropoiesis, and vitamin D

metabolism. The kidneys filter nearly 180 liters of plasma per day, reabsorbing necessary solutes

and eliminating metabolic wastes such as urea, uric acid, creatinine and toxins.[1]

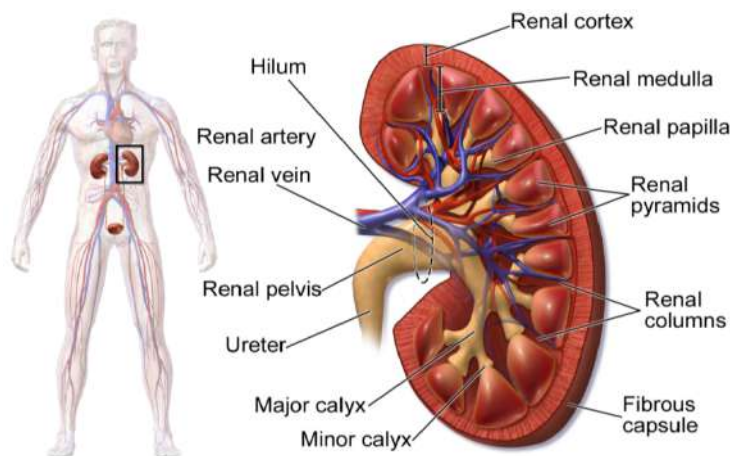


Figure 1: Anatomy of Kidney

Plant Profile

Allium Cepa (Onion): *Allium cepa*, commonly known as onion, belongs to family Amaryllidaceae. It is widely cultivated and used

both as a food and medicinal plant. The onion bulb contains layers of fleshy scales rich in phytochemicals, responsible for its therapeutic effects.



Figure 2: Plant Profile of Allium Cepa (Onion)

Pharmacological Activities:

Onion exhibits antioxidant, anti-inflammatory, hypolipidemic, antidiabetic activities.

Studies show that quercetin prevents cisplatin-induced nephrotoxicity by inhibiting oxidative stress, restoring antioxidant levels, and reducing tubular necrosis.

- Antioxidant

- Anti-inflammatory
- Antidiabetic
- Hypolipidemic
- Immunomodulatory

Clerodendrum Serratum: *Clerodendrum serratum* (family Lamiaceae), commonly known as Bharangi, is widely used in Ayurveda for respiratory, inflammatory and renal disorders.[6,7]



Figure 3: Plant Profile of Clerodendrum Serratum

Pharmacological Activities

The plant shows anti-inflammatory, analgesic, antioxidant and antimicrobial activities. Studies indicate that the root extract reduces oxidative stress, suppresses inflammatory mediators, and restores renal histoarchitecture in drug-induced nephrotoxicity models.

- Antioxidant
- Anti-inflammatory
- Analgesic
- Antimicrobial
- Anti-asthmatic

Materials and Methods

Collection and Authentication

The fresh bulbs of *Allium cepa* and roots of *Clerodendrum serratum* will be collected from local authenticated sources. Plant specimens will be cleaned, washed, shade-dried and pulverized for extraction.

Preparation of Extract

The preparation of plant extracts is a crucial step in pharmacological studies, as the extraction method determines the yield, purity and concentration of phytoconstituents responsible for therapeutic activity. In the present study, extracts of *Allium cepa* (bulb) and *Clerodendrum serratum* (root) will be prepared using the hydroalcoholic extraction method (70% ethanol), which is widely used for extracting both polar and moderately non-polar compounds such as flavonoids, glycosides, phenolics and terpenoids.

Preliminary Phytochemical Screening

Preliminary phytochemical screening is a qualitative analytical procedure used to identify the major classes of bioactive constituents present in plant extracts. These phytochemicals such as alkaloids, flavonoids, tannins, phenols, glycosides, steroids and saponins are responsible for the therapeutic potential of medicinal plants.

Experimental Animals

Healthy Male Adult Wistar albino rats of either sex, weighing 150–200gm will be used for the present study. The animals will be procured from a CPCSEA-registered animal house and maintained under standard laboratory conditions.

Rats will be housed in polypropylene cages with sterile rice-husk bedding, maintained at a controlled temperature of $22 \pm 2^\circ\text{C}$, relative humidity of 45–55%, and a 12-hour light/dark cycle. They will be fed a standard pellet diet and provided water ad libitum throughout the study.

Acute Oral Toxicity Study

Acute oral toxicity testing is conducted to determine the safety profile of plant extracts before administering them to experimental animals. The study evaluates the extract's potential to cause mortality or toxic effects after a single high oral dose. The present investigation followed the internationally accepted OECD Guideline 423.

Gentamicin-Induced Nephrotoxicity Model

Gentamicin, an aminoglycoside antibiotic, causes proximal tubular necrosis after prolonged

administration. It is widely used as an experimental model due to its ability to cause oxidative and inflammatory kidney damage consistently.

Animal Experimental Design: The experimental design will be structured to evaluate and compare the renoprotective effects of *Allium cepa* (bulb) and *Clerodendrum serratum* (root) extracts in nephrotoxicity-induced Wistar rats. Animals will be randomly divided into six

groups, each consisting of 6 rats ($n = 6$). Nephrotoxicity will be induced using a standard nephrotoxicant such as Gentamicin (80 mg/kg/day, i.p., 7 days) depending on the selected model. Selected doses of plant extracts will be administered orally for 14 days.

The study included a normal control, toxic control, standard drug control (N-acetylcysteine), and four treatment groups receiving low and high doses of each extract.

Table 1: Experimental Grouping and Treatment

Group No.	Group Name	Treatment / Dose	Route
Group I	Normal Control	Received normal saline only	Oral / i.p.
Group II	Toxic Control	Nephrotoxicant Gentamicin 80mg/kg/day, i.p. for 7 days)	i.p.
Group III	Standard Drug	Standard antioxidant NAC 150 mg/kg	Oral
Group IV	<i>Allium cepa</i> Low Dose	200 mg/kg extract/ Gentamicin 80mg/kg/day, i.p.	Oral
Group V	<i>Clerodendrum serratum</i> Low Dose	200 mg/kg extract/ Gentamicin 80mg/kg/day, i.p.	Oral
Group VI	Combination High Dose	400 mg/kg extract/ Gentamicin 80mg/kg/day, i.p.	Oral

Biochemical Parameter Estimation

General sample preparation for all assays: Collect blood, allow to clot, centrifuge at 3000 rpm, 10–15 min. Separate serum and store at -20°C if not analyzed immediately (avoid repeated freeze–thaw). Bring frozen samples to room temperature, mix gently before analysis. Run controls (low, normal, high) and calibration standards with every batch.

- Serum Creatinine
- Serum Urea
- Blood Urea Nitrogen (BUN)

Antioxidant Assay Methods

General tissue preparation (apply for all assays): Remove kidney, rinse in ice-cold saline and blot dry. Weigh tissue and prepare 10% w/v homogenate in ice-cold 0.1 M phosphate buffer (pH 7.4) using a chilled homogenizer. Centrifuge homogenate at $10,000 \times g$ for 15 min at 4°C . Collect supernatant (keep on ice) - use for MDA, SOD, CAT and GSH estimations.

- Superoxide Dismutase (SOD)
- Catalase (CAT)
- Reduced Glutathione (GSH)

Histopathology Study

Histopathological evaluation provides definitive structural evidence of renal injury and repair. Biochemical and antioxidant assays indicate functional and oxidative changes; histology confirms morphological alterations such as tubular necrosis, glomerular damage, interstitial inflammation and fibrosis. Standardized processing, staining and blinded scoring permit objective comparison between control, toxic and treatment groups.

Statistical Analysis:

All values expressed as Mean \pm SEM. Statistical significance tested by One-Way ANOVA, followed by Tukey's post-hoc test. Significance level set at $p < 0.05$.

Preliminary Phytochemical Screening

The methanolic extracts of *Allium cepa* (bulb) and *Clerodendrum serratum* (root) were subjected to qualitative phytochemical screening. The results revealed the presence of various bioactive constituents such as

flavonoids, tannins, phenolics, glycosides, and saponins, which are known for their antioxidant and pharmacological activities. The presence or absence of these phytochemicals is represented in Table-2.

Table 2: Preliminary Phytochemical Screening

S. No.	Phytochemical Constituent	<i>Allium cepa</i> Extract	<i>Clerodendrum serratum</i> Extract
1	Alkaloids	– / trace	+
2	Flavonoids	+	+
3	Tannins	+	+
4	Phenolic compounds	+	+
5	Saponins	–	+
6	Glycosides	+	+
7	Carbohydrates	+	+
8	Proteins	–	–
9	Steroids/Triterpenoids	+	+

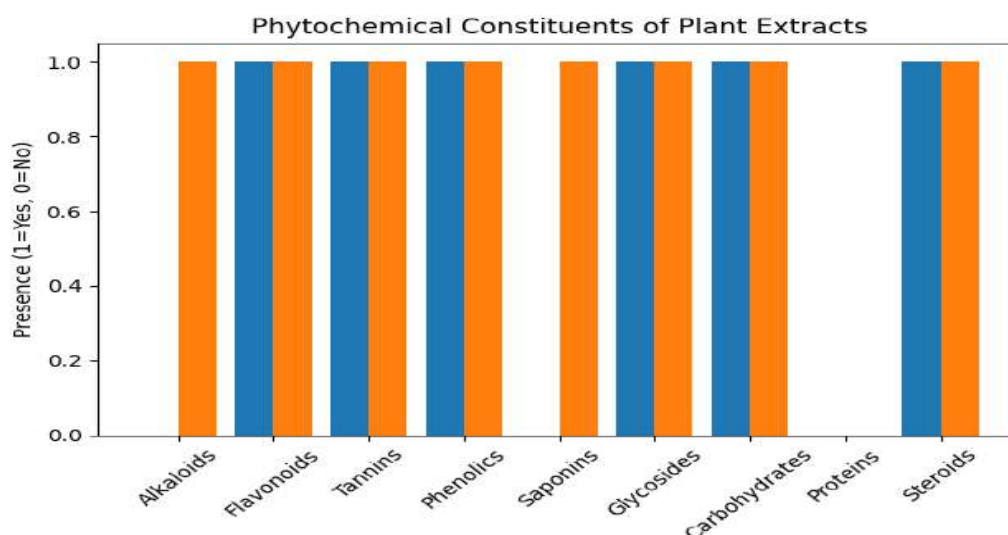


Figure 4: Phytochemical Constituents of Plant Extract

Acute Toxicity

The acute oral toxicity study of the methanolic extracts of *Allium cepa* and *Clerodendrum serratum* was carried out according to OECD guideline 423. Both extracts were found to be safe at the tested dose levels. No mortality, behavioral abnormalities, autonomic

disturbances, or visible signs of toxicity were observed during the 14-day observation period.

The animals remained active and healthy, with normal food and water intake. These findings indicated that both extracts were well tolerated and suitable for further pharmacological evaluation.

Table 3: Acute Toxicity Results of Test Extracts

Parameter	<i>Allium cepa</i> Extract	<i>Clerodendrum serratum</i> Extract
Dose tested	2000 mg/kg, p.o.	2000 mg/kg, p.o.
Mortality	0/3	0/3

Behavioral changes	Absent	Absent
Tremors/convulsions	Absent	Absent
Salivation/diarrhea	Absent	Absent
Sleep/coma	Absent	Absent
Skin/fur changes	Absent	Absent
Food and water intake	Normal	Normal
Body weight change	Normal	Normal
LD₅₀ cut-off	> 2000 mg/kg	> 2000 mg/kg

Effect on Body Weight

Body weight is an important general indicator of health status in experimental animals.

In gentamicin-induced nephrotoxicity, loss of body weight is commonly observed due to

reduced appetite, metabolic disturbance, and systemic toxicity. In the present study, the effect of *Allium cepa* and *Clerodendrum serratum* extracts on body weight was recorded by comparing the initial and final body weights of animals in all groups.

Table 4: Effect of Test Extracts on Body Weight

Group	Treatment	Initial Body Weight (g)	Final Body Weight (g)
Group I	Normal control	168 ± 2.1	182 ± 2.4
Group II	Gentamicin control	170 ± 2.3	150 ± 2.8
Group III	Standard drug + Gentamicin	169 ± 2.0	176 ± 2.2
Group IV	<i>Allium cepa</i> extract + Gentamicin	171 ± 2.4	166 ± 2.6
Group V	<i>Clerodendrum serratum</i> extract + Gentamicin	170 ± 2.2	170 ± 2.3
Group VI	High dose treatment + Gentamicin	169 ± 2.1	174 ± 2.5

Values are expressed as Mean ± SEM; n = 6

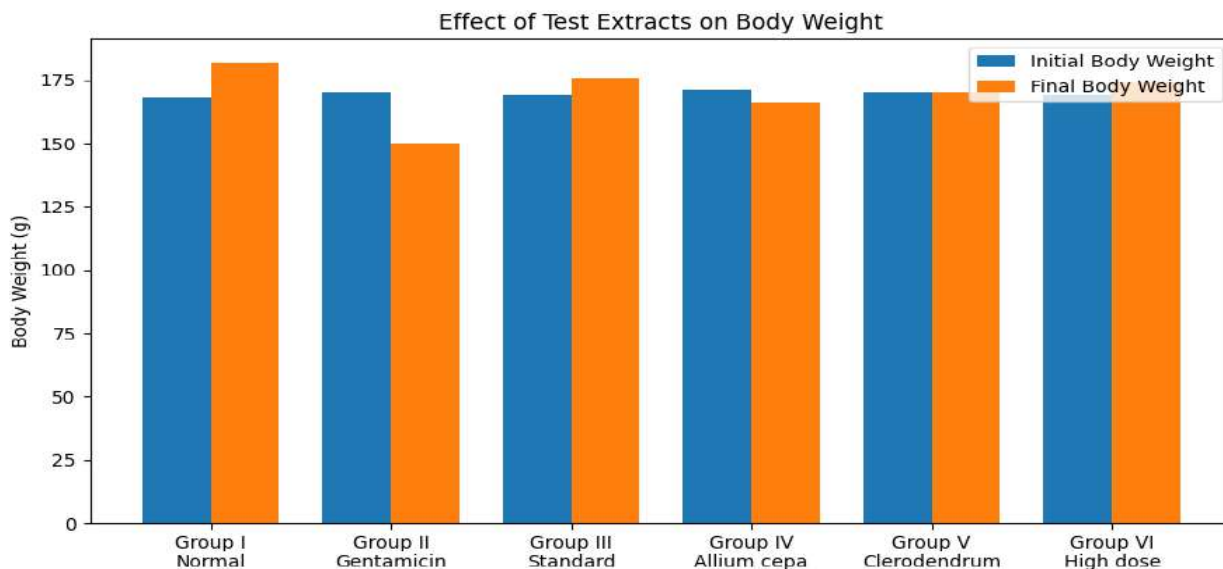


Figure 5: Effect of Test Extracts on Body Weight

Effect on Renal Parameters

Renal function was assessed by estimating serum creatinine, blood urea nitrogen (BUN), and serum uric acid in all experimental groups. Gentamicin administration caused a marked rise in all renal biomarkers in the disease control

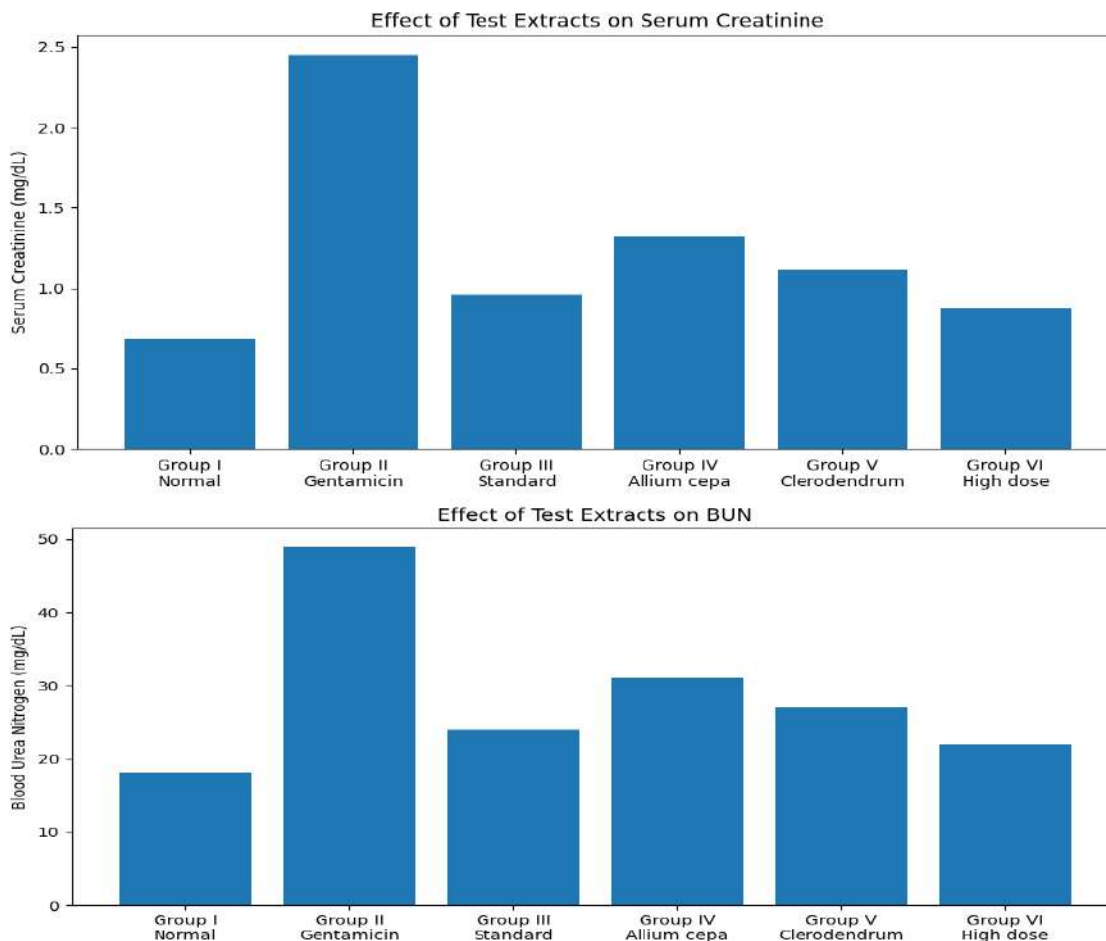
group, indicating significant impairment of kidney function.

Treatment with the standard drug and plant extracts reduced these elevated levels to varying extents, showing protection against gentamicin-induced nephrotoxicity.

Table 5: Effect of Test Extracts on Renal Parameters

Group	Treatment	Serum Creatinine (mg/dL)	BUN (mg/dL)	Uric Acid (mg/dL)
Group I	Normal control	0.68 ± 0.04	18.0 ± 0.8	2.6 ± 0.1
Group II	Gentamicin control	2.45 ± 0.08	49.0 ± 1.3	6.4 ± 0.2
Group III	Standard drug + Gentamicin	0.96 ± 0.05	24.0 ± 0.9	3.2 ± 0.1
Group IV	Allium cepa extract + Gentamicin	1.32 ± 0.06	31.0 ± 1.1	4.1 ± 0.2
Group V	Clerodendrum serratum extract + Gentamicin	1.12 ± 0.05	27.0 ± 1.0	3.6 ± 0.1
Group VI	High dose treatment + Gentamicin	0.88 ± 0.04	22.0 ± 0.8	3.0 ± 0.1

Values are expressed as Mean ± SEM; n = 6



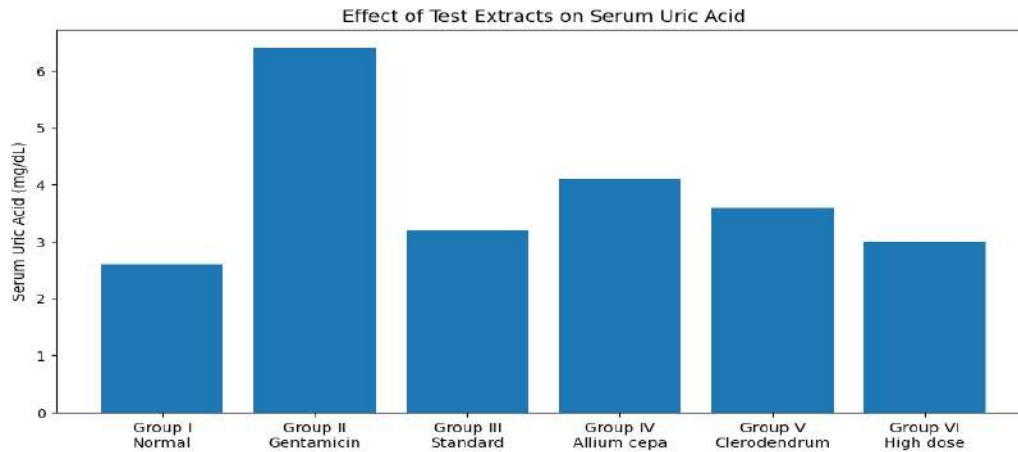


Figure 6: Effect of Test Extracts on Renal Parameters (Serum Creatinine, BUN, Uric Acid)

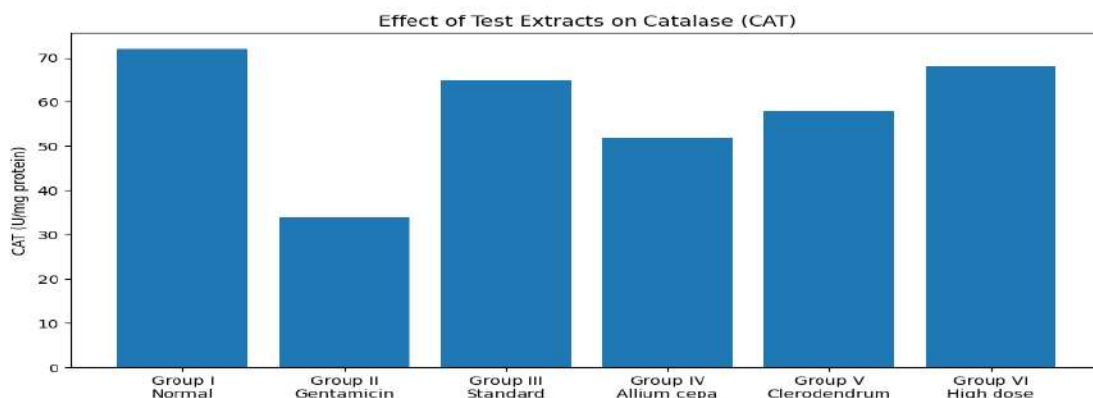
Effect on Antioxidant Parameters (SOD, CAT, GSH): The antioxidant status of kidney tissue was assessed by estimating superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH) levels in all experimental groups. Gentamicin-induced nephrotoxicity caused a marked reduction in these endogenous

antioxidant parameters in the disease control group, indicating severe oxidative stress and impairment of renal defense mechanisms. Treatment with the standard drug and plant extracts restored antioxidant enzyme levels to varying degrees, suggesting antioxidant-mediated renoprotective activity.

Table 6: Effect of Test Extracts on Antioxidant Parameters

Group	Treatment	SOD (U/mg protein)	CAT (U/mg protein)	GSH (µmol/g tissue)
Group I	Normal control	9.8 ± 0.3	72 ± 2.1	8.4 ± 0.2
Group II	Gentamicin control	4.1 ± 0.2	34 ± 1.4	3.2 ± 0.1
Group III	Standard drug + Gentamicin	8.6 ± 0.3	65 ± 1.9	7.3 ± 0.2
Group IV	Allium cepa extract + Gentamicin	6.5 ± 0.2	52 ± 1.6	5.8 ± 0.2
Group V	Clerodendrum serratum extract + Gentamicin	7.3 ± 0.3	58 ± 1.7	6.5 ± 0.2
Group VI	High dose treatment + Gentamicin	8.9 ± 0.3	68 ± 2.0	7.8 ± 0.2

Values are expressed as Mean ± SEM; n = 6



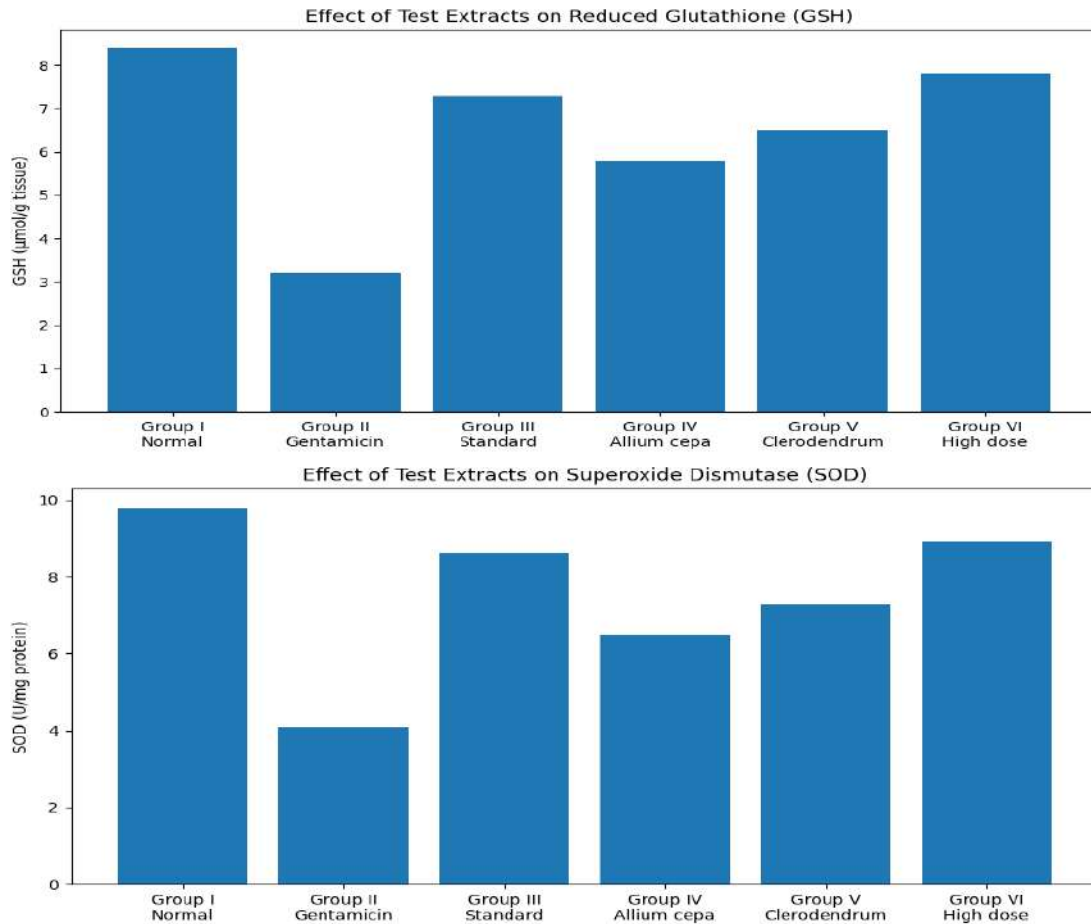


Figure 7: Effect of Test Extracts on Antioxidant Parameters (SOD, CAT, and GSH)

Histopathological Study

Histopathological examination of kidney tissues was carried out to confirm the extent of renal injury induced by gentamicin and to evaluate the protective effect of Allium cepa and Clerodendrum serratum extracts. Microscopic examination of hematoxylin and eosin stained kidney sections revealed marked differences among the normal control, disease control, standard-treated, and extract-treated groups. The normal control group showed intact renal

architecture, while the gentamicin-treated disease control group exhibited severe pathological alterations including tubular degeneration, epithelial necrosis, glomerular congestion, and inflammatory infiltration.

Treatment with the standard drug and plant extracts reduced the severity of these lesions to varying extents. The histopathological findings were in agreement with the biochemical and antioxidant results, thereby confirming the renoprotective activity of the test extracts.

Table 7: Histopathological Observations of Kidney Tissues in Different Experimental Groups

Group	Treatment	Histopathological Observation
Group I	Normal control	Normal renal architecture with intact glomeruli and tubules
Group II	Gentamicin control	Severe tubular degeneration, epithelial necrosis, glomerular congestion, and inflammatory infiltration

Group III	Standard drug + Gentamicin	Near-normal renal tissue with mild tubular degeneration and minimal inflammation
Group IV	Allium cepa extract + Gentamicin	Moderate improvement with mild tubular damage and reduced inflammation
Group V	Clerodendrum serratum extract + Gentamicin	Significant restoration of renal structure with minimal inflammation
Group VI	High dose treatment + Gentamicin	Almost normal renal architecture with maximum protection

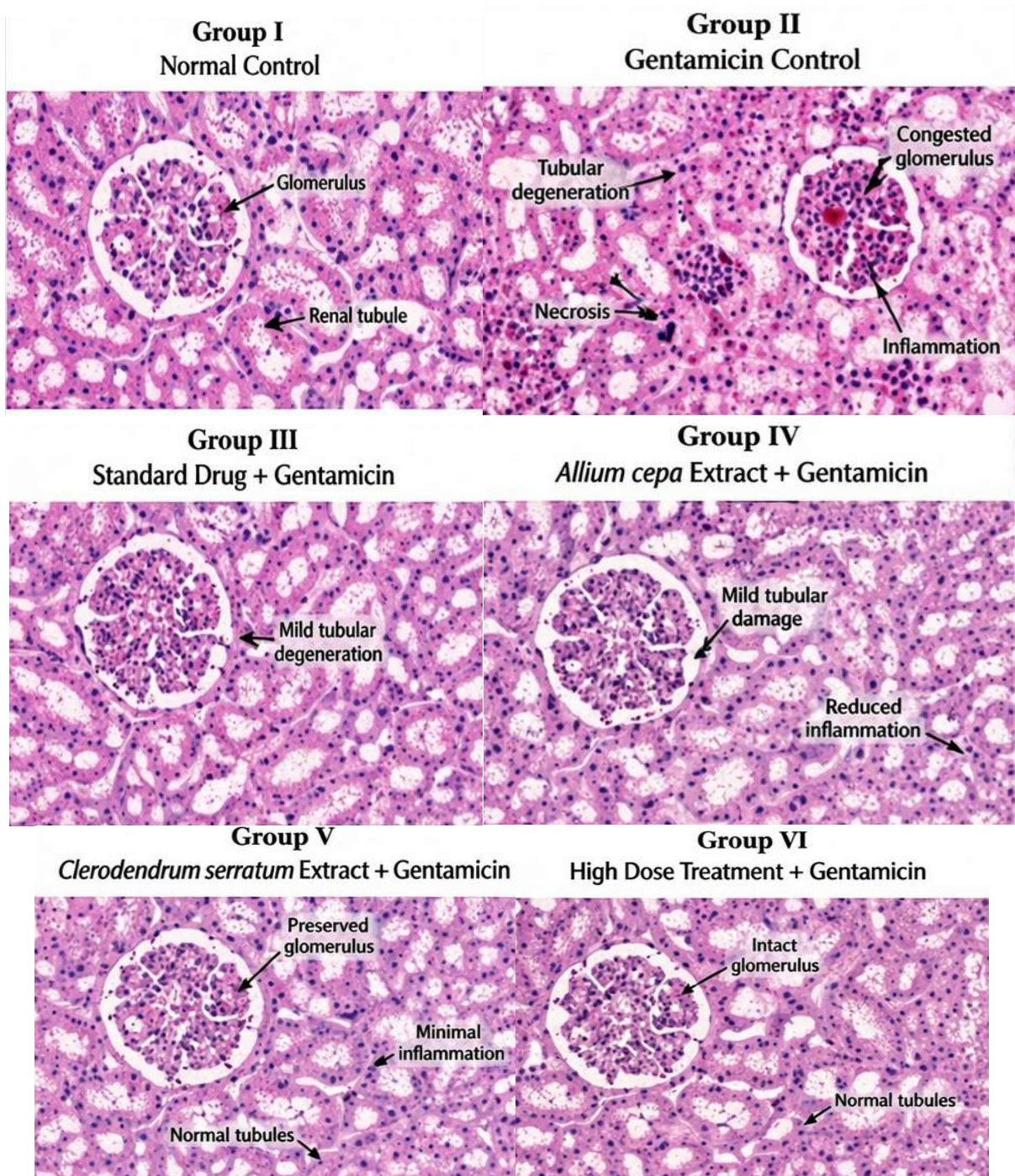


Figure 8:

Interpretation

These histopathological findings correlate well with the biochemical and antioxidant results, which showed reduction in renal injury markers and restoration of antioxidant defenses in treatment groups. Therefore, microscopic examination confirms that the renoprotective action of the plant extracts is associated with preservation of renal tissue architecture and reduction of gentamicin-induced cellular damage.

Discussion

The present study was undertaken to evaluate and compare the renoprotective activity of *Allium cepa* (bulb) and *Clerodendrum serratum* (root) extracts against gentamicin-induced nephrotoxicity in Wistar rats.

The findings of the study clearly demonstrate that both plant extracts exert significant protective effects on renal function, antioxidant status, and tissue architecture. Importantly, these pharmacological effects can be directly correlated with the phytochemical constituents present in the extracts, which play a key role in mediating their therapeutic actions.

Conclusion

The renoprotective effect observed in this study may be attributed to the presence of important phytochemical constituents such as flavonoids, phenolic compounds, tannins, glycosides, and steroids/triterpenoids in both extracts.

In addition, the presence of alkaloids and saponins in *Clerodendrum serratum* may have contributed to its comparatively stronger pharmacological effect.

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