International Journal of Medical and Pharmaceutical Excellence
VOLUME-1 ISSUE-1 | INAGURAL EDITION | January-March 2026 | MPE003

Paper Received: **18/01/2026** Paper Reviwed: **08/02/2026** Paper Published: **10/02/2026**

NEPHRO PROTECTIVE EFFECT OF AQUEOUS PSIDIUM GUAJAVA IN GENTAMICIN NEPHROTOXICITY

Mr. Imran Hussain,*Assistant Professor
Integral University, Lucknow, Uttar Pradesh, India.

ABSTRACT: Gentamicin-induced nephrotoxicity prevention is assessed using the aqueous extract of Psidium guajava leaves. Serious bacterial infections are treated with gentamicin. Its medical applications are restricted by tubule degeneration and oxidative stress-induced kidney injury. The nephrotoxicity of gentamicin was investigated in animal models. Aqueous extract of Psidium guajava was also evaluated for its protective properties. Serum creatinine, BUN, urea, and renal tissue histology were used to evaluate kidney function. Renal function was impaired and kidney tissues were damaged by gentamicin. The metabolic changes were reduced by aqueous Psidium guajava extract, which restored kidney structure. Psidium guajava, an antioxidant and free radical scavenger, may provide kidney protection. This investigation determined that gentamicin-induced kidney toxicity may be mitigated by aqueous Psidium guajava extract.

Keywords: *Nephroprotective activity; Psidium guajava; Gentamicin-induced nephrotoxicity; Oxidative stress; Renal function; Antioxidant activity*

1. INTRODUCTION

Acute kidney injury (AKI) is a prevalent and hazardous medical condition that involves an abrupt cessation of renal function. This results in acid-base imbalances, metabolic waste, electrolyte imbalances, and fluid imbalances. AKI is caused by acute tubular necrosis as a result of ischemia or nephrotoxicity. AKI can be caused by ischemia-reperfusion injury, kidney-toxic medications, and sepsis.

On a global scale, kidney disease is on the rise. 850 million individuals worldwide are impacted by renal disease. This pertains to the prevention and treatment of kidney disease. Hospitalized patients who have experienced drug-induced nephrotoxicity develop acute renal failure.

Aminoglycoside-induced renal impairment is accurately modeled by gentamicin-induced acute kidney injury. In 1964, Micromonospora purpurea was utilized to produce gentamicin, the third clinical aminoglycoside antibiotic. Gentamicin is antibacterial and medicinal; however, its prolonged use may result in kidney injury.

In renal proximal tubular cells, aminoglycosides such as gentamicin generate reactive oxygen species (ROS) and are nephrotoxic. Renal tubules are destroyed by oxidative stress, which results in impaired kidney function. it induces mitochondrial dysfunction, inflammation, lipid peroxidation, and cell demise.

Diabetes, gastrointestinal, neurological, and kidney diseases are all treated for free by traditional medicine. Natural medicinal plants are utilized in traditional medicine and

fundamental healthcare due to their affordability, accessibility, and safety. Psidium guajava, a widely used medicinal herb, has a variety of applications.

Flavonoids, phenolic acids, tannins, terpenes, and alkaloids are present in guava leaf extract. The anti-inflammatory, anti-cancer, and antioxidant properties of these portions make them effective in the treatment of a variety of diseases. Mice are safeguarded from cyclosporine A-induced nephrotoxicity by aqueous Psidium guajava leaf extracts.

Milk thistle seed silymarin is a well-known nephroprotectant. The antioxidant and membrane-stabilizing properties of this substance have been demonstrated in numerous studies to protect rodents from drug-induced nephrotoxicity.

2. MATERIALS AND METHOD

The Experimental Approach of this Study was authorized by the Regional Institute of Medical Sciences (RIMS) Institutional Animal Ethics Committee (1596/GO/a/12 CPCSEA registration) in accordance with the Indian Government's Committee for the Control and Supervision of Experiments on Animals.

In Imphal, Manipur, pathology, biochemistry, and JNIMS Pharmacology collaborated.

Collection and Identification of Psidium guajava Leaves: In February 2023, Imphal West harvested fresh Psidium guajava foliage. The plant was discovered and verified by Mrs. Yumnam Sanatombi, a guest faculty member of Manipur University's Life Science department. The laboratory herbarium number was 001380MUMP.

Preparation of Plant Extract: For Psidium guajava leaves, we implemented the aqueous extraction method of Massoudi EL et al. 11. The leaves were allowed to dry in the shade for an extended period of time following their washing. Combination grinders were employed to pulverize dry leaves. Ten times more distilled water was used to soxhlet the powder. The water underwent a three-hour process of boiling and cooling. A substantial dark residue remained after the filter water dissipated. This was stored in a porcelain container at a temperature of 4°C. Continue until 20 grams of extract are obtained. The investigation employed aqueous extract of Psidium guajava.

The Experimental Animal Used in the Study: 25 albino rodents weighing 150–200 grams were provided by the JNIMS animal sanctuary in Porompat, Imphal. In order to acclimate to the laboratory, they were confined to departmental polypropylene enclosures for a period of ten days. Lab rodents were provided with an unlimited supply of water and consumed a standard meal. It was both bright and dark for twelve hours. In preparation for the testing, the animals were required to fast for 18 hours and were prohibited from consuming their own excrement.

Acute Oral Toxicity Studies: The acute oral toxicity of Psidium guajava leaf extract was evaluated in accordance with OECD/OCED guidelines 425. The extract's safety was demonstrated by the absence of documented fatalities at 2000 mg/kg body weight orally after 14 days.

Experimental Design: The examination persisted for fifteen days. Twenty-five albino rats of either species, weighing 150–200 grams, were employed. We incorporated silymarin and Psidium guajava leaf extracts into 2% gum acacia. Before being randomly divided into five groups of five, the animals were weighed, recorded, and numbered.

Group (Animals)	Treatment
Group I (Normal control)	2% gum acacia administered orally
Group II (Positive control)	Gentamicin (100 mg/kg, intraperitoneal) + 2% gum acacia (oral)
Group III (Standard drug)	Gentamicin (100 mg/kg, intraperitoneal) + Silymarin (200 mg/kg, oral)
Group IV (Treatment group)	Gentamicin (100 mg/kg, intraperitoneal) + AELPG (200 mg/kg body weight, oral)
Group V (Treatment group)	Gentamicin (100 mg/kg, intraperitoneal) + AELPG (300 mg/kg body weight, oral)

The rodents were grouped and sedated with ether the following day. S. urea, S. creatinine, S. sodium, S. potassium, and S. chloride were measured in blood tests. The cervical dislocation of rodents was necessary for the collection of blood for histology liver tissue.

3. RESULTS

In the tables, the numbers of many parameters were shown in the right units. Along with the Mean ± SEM (standard error of the mean), the data show five animals from each group. After a one-way ANOVA showed that there was statistical significance, we used the Tukey Kramer multiple comparisons test to compare the groups. The fact that both the F-ratio and the P value were less than 0.05 showed that the test was significant.

TABLE 1: Serum Level Of Urea, Creatinine, Sodium, Potassium And Chloride In All Groups (Mean±Sem)

Groups	Urea	Creatinine	Sodium	Potassium	Chloride
I	38.8 ± 1.83	0.38 ± 0.04	140.0 ± 0.55	3.92 ± 0.04	101.0 ± 0.32
II	100.4 ± 1.78#	1.12 ± 0.09#	145.0 ± 0.45#	5.06 ± 0.18#	105.6 ± 0.24#
III	44.8 ± 0.37*	0.48 ± 0.04*	141.0 ± 0.63*	4.18 ± 0.08*	102.2 ± 0.37*
IV	61.4 ± 0.81*@	0.70 ± 0.03*@	143.20 ± 0.37*@	4.56 ± 0.09*@	104.2 ± 0.37*@
V	46.6 ± 1.44*	0.54 ± 0.02*	141.80 ± 0.80*	4.40 ± 0.07*@	103.4 ± 0.40*@

One-way ANOVA

Parameter	F value	df	p value
Urea	331.38	4, 20	< 0.05
Creatinine	35.71	4, 20	< 0.05
Sodium	11.37	4, 20	< 0.05
Potassium	76.78	4, 20	< 0.05
Chloride	—	4, 20	< 0.05

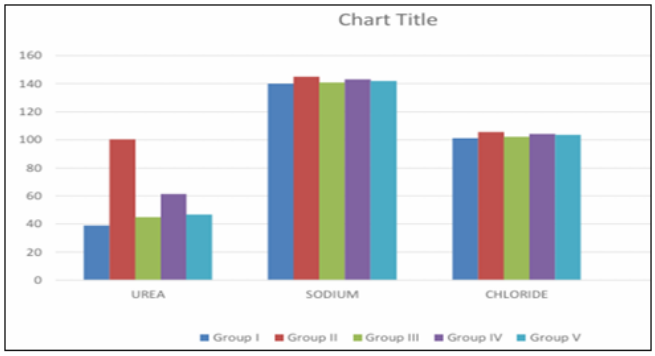

Fig. 1: Bar Diagram Showing Serum Levels Of Urea, Sodium And Chloride In All Groups. Each Value Is Expressed As Mean ± Sem

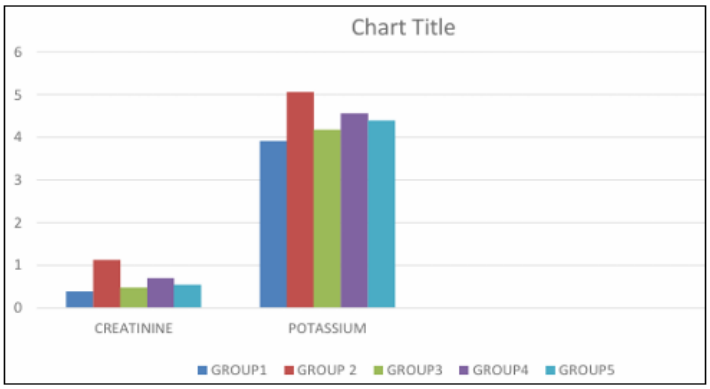

Fig. 2: Bar Diagram Showing Serum Levels Of Creatinine And Potassium In All Groups. Each Value Is Expressed As Mean ± Sem

The results show that the levels of urea (100.4±1.78), creatinine (1.12±0.09), sodium (145.0±0.45), potassium (5.06±0.18), and chloride (105.6±0.24) were significantly higher ($p<0.05$) in group II, which was given gentamicin to make the kidney damage worse. In group III, which received silymarin (200 mg/kg) along with gentamicin, blood levels of urea (44.8±0.37), creatinine (0.48±0.04), sodium (141.0±0.63), potassium (4.18±0.08), and chloride (102.2±0.37) were all significantly lower than those in group II ($p<0.05$). The levels of urea (61.4±0.81), creatinine (0.70±0.03), sodium (143.2±0.37), potassium (4.56±0.09), and chloride (104.2±0.37) were all much lower in group IV (200 mg/kg of AEPGL) than in groups II and III ($p<0.05$). When 300 mg/kg of AEPGL was given to group V, their levels of urea (46.6±1.44), creatinine (0.54±0.02), sodium (141.8±0.80), potassium (4.40±0.07), and chloride (103.4±0.40) were all significantly lower ($p<0.05$) than those in group II. The only important difference between groups V and III was the amount of potassium and salt present.

Serum urea, creatinine, sodium, potassium, and chloride levels were much lower in the groups that were given AEPGL compared to the positive control group II.

4. HISTOPATHOLOGICAL FINDINGS

Gross Features: None of the groups, not even the ones that were given silymarin, the poisonous control, the normal control, or the extract-treated groups at different doses, showed any major changes. The kidneys were the right size, form, color, surface, and contour.

FIG. 3: Gross Kidney Specimen Of Albino Rats

Microscopic Findings: In the control group (group I), the kidney histology showed that the tubules and glomeruli were normal (Fig). In the gentamicin-treated group (group II), acute tube necrosis, degeneration of proximal tubular epithelial cells, and sloughing of the lumen were seen.

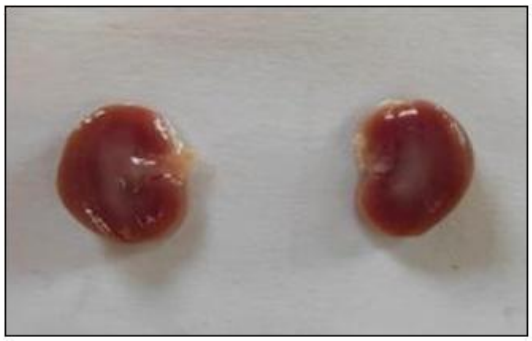

Fig. 4: Dissected Kidney of Albino Rats

The kidney interstitium became inflamed when gentamicin was used. When 200 mg/kg of silymarin was given to Group III, there was no damage to the interstitial spaces and only a few tubules with damaged epithelial cells. The number of inflamed cells went down in Group IV, and some damage was seen in the proximal tubular epithelial cells. On the other hand, people in Group V fully recovered from interstitial nephritis and acute tubular necrosis. The results of all of these studies show that the AEPGL protected the kidneys when preparations and gentamicin were given to rats.

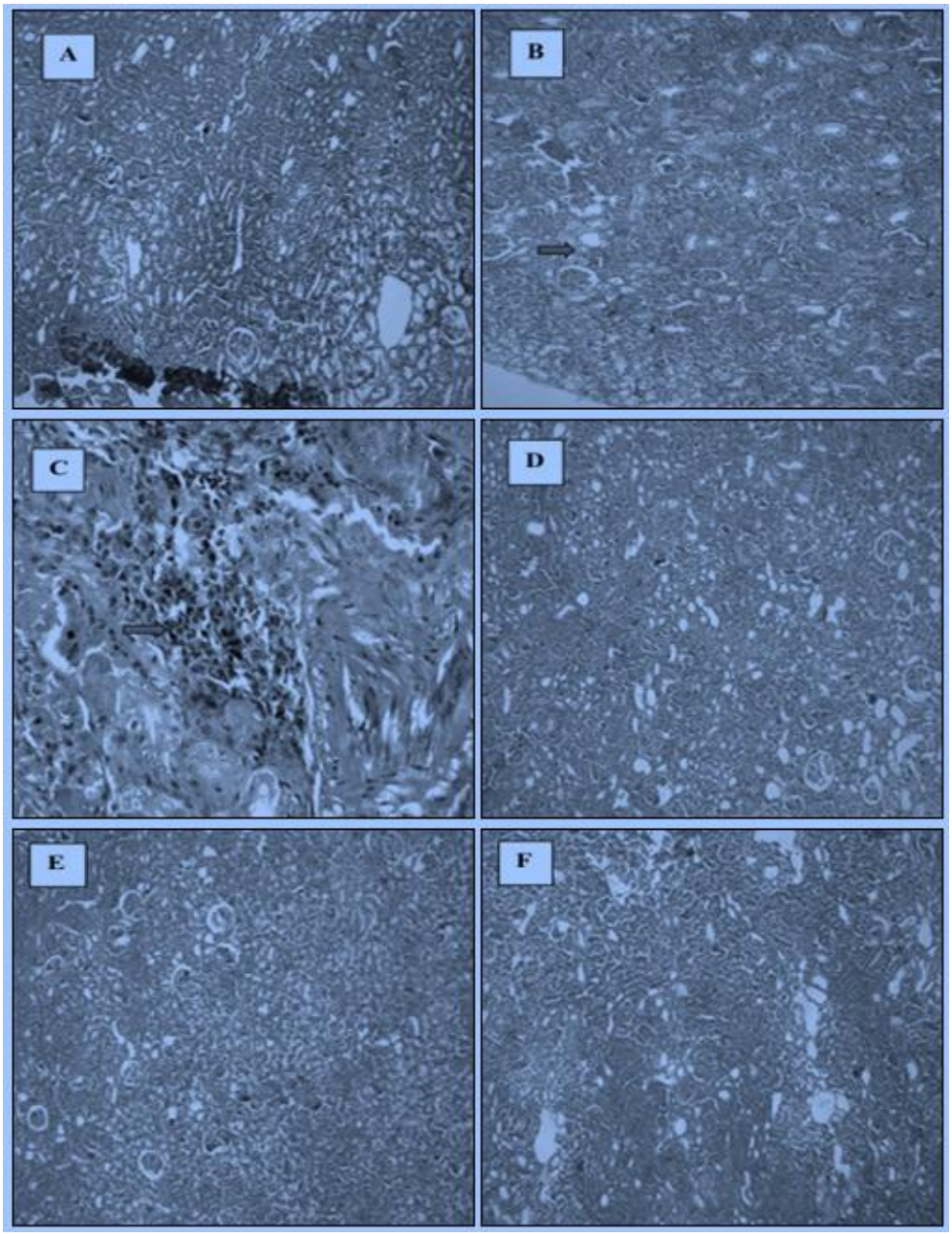

Fig. 5: Histopathology of rat kidney (H&E) showing tubular necrosis in gentamicin group and improvement with silymarin and AELPG treatment.

5. CONCLUSION

This research demonstrates that the aqueous extract of Psidium guajava leaves significantly safeguards the kidneys of albino rats against nephrotoxicity induced by gentamicin. Flavonoids, alkaloids, tannins, saponins, and phenolic compounds are bioactive chemicals in Psidium guajava that may be responsible for its nephroprotective properties. These substances enhance the activity of antioxidant enzymes, neutralize free radicals, and fortify renal tissue. These factors may elucidate the renal preservation attributes of Psidium guajava. The study indicates that the aqueous extract of Psidium guajava may serve as an effective nephroprotective agent. Further research with a purer form of the extract is necessary to elucidate its cellular and molecular mechanisms, assess the safety and efficacy of its active constituents, and evaluate its potential as a nephroprotective agent in the future.

REFERENCES:

1. Turgut F, Awad AS and Abdel-Rahman EM: Acute Kidney Injury: Medical causes and pathogenesis. J Clin Med 2023; 12: 375.
2. Xin Y, Liu Y, LiuL, Wang X, Wang D and Song Y: Dynamic changes in the real-time glomerular filtration rate and kidney injury markers in different acute kidney injury models. Journal of Translational Medicine 2024; 22: 856.
3. Liang J and Liu Y: Animal models of kidney disease: Challenges and perspectives. Kidney 360. 2023; 4: 14791493.
4. Tripathi KD: Essential of medical pharmacology.9th ed. New Delhi: Jaypee Brothers Medical Publishers (P). Aminoglyc and Antibiotics 2025; 53: 814-822.
5. Amir S, Abid M, Nadeem H, Tipu MK and Irshad N: The nephroprotective potential of selected synthetic compound against gentamicin induced nephrotoxicity. BMC
6. Pharmacology and Toxicology 2024; 25: 68. Jalali J and Rahbardar MG: Rosemary: A promising Therapeutic agent in alleviating nephrotoxicity. Journal of Food Biochemistry 2025; 5519628.
7. Orororo OC, Efekemo O, Odeghe OB, Clark PD, Awhin EP and Egbune EO: Phytochemical screening, in-vitro antioxidant capacity and nephroprotective effect of combined extract of Psidium guajava and Carica papaya Leaves in Rats Intoxicated with Cadmium. Asian Journal of Medicine and Health 2024; 22(8): 86-97.
8. Ugbogu EA, Emmanuel O, Uche ME, Dike DE, Okoro BC and Ibe C: The ethnobotanical, phytochemistry and pharmacological activities of Psidium guajava L. Arab J Chem 2022; 15(5): 103759.
9. Huynh HD, Nargotra P, Wang HMD, Shied CJ, Liu YC and Kuo CH: Bioactive Compounds from Guava Leaves (Psidium guajava): Characterization, Biological Activity, Synergistic Effects, and Technological Applications. Molecules 2025; 30: 1278.
10. Terzi F and Ciftci MK: Protective effect of silymarin on tacrolimus-induced kidney and liver toxicity. BMC Complementary Medicine and Therapies 2022; 22: 33.
11. Massoudi SEl, Zinedine A, Rocha JM, Benidir M, Najjaru I and Ghadraoui LEI: Phenolic composition and wound healing potential assessment of Moroccan henna. (Lawsonia inermis) Aqueous Extracts 2023; 10: 92.
12. Umeshgiri SGB, Nagraj A and Meghraj RH and Srinivas Amurthy AK: Evaluation of acute oral toxicity of a poly herbal ayurvedic formulation in wistar rats as per OECD423. IJAPR 2025; 13(5): 16-21.
13. Meka Kedir W, Dukassa Dubiwak A and Tofik Ahmed E: Nephroprotective Effect of Asparagus africanus Lam. Root Extract against Gentamicin-Induced Nephrotoxicity in Swiss Albino Mice. J Toxicol 2022; 2022: 8440019.
14. Akila AA, Gad RA, Ewees MGE-D, Abdul-Hamid M and Abdel-Raheim ES: Clopidogrel protects against gentamicin-induced nephrotoxicity through targeting oxidative stress, apoptosis and coagulation pathways. Naunyn-Schmiedeberg's Archives of Pharmacology 2025; 398: 2609-2625.
15. Akbas P, Kaya E, Makav M and Yildiz G: Investigation of antimicrobial and antioxidant activities of Chenopodium album extracts and their effects on gentamicin nephrotoxicity in rats. FSN 2023; 11: 8121-8130

16. Era N, Mukherjee S and Bordoloi SK: Nephroprotective effect of Bacopa monniera on gentamicin-induced nephrotoxicity in rodent models. Natl J Physiol Pharm Pharmacol 2021; 11(08): 850-855.
17. Salim J, Tabbsum M, Akram S, Sidhu MJJ, Nasrullah C and Jabbar S: Ameloriation of Gentamicin-induced nephrotoxicity by Allium cepa extract in male Wistar rats. Biomedica-Official Journal of Univeristy of Health Sciences 2024; 40(4): 164-169.
18. Akinaw MA, Nair SKP, Usure E, Leta B, Kedir A and Mamo SE: Nephroprotective effect of the leaf extract of Ajuga remota Benth against gentamicin-induced nephrotoxicity in swiss albino mice. J of Exp Pharmacol 2024; 16: 159-171.
19. Suliska N, Praviska M, Kurniati NF and Sukandar EY: Nephropotective effect of ethanolic extract of Sonchus arvensis L. leaves in gentamicin-piroxicam induced rat renal failure. J Res Phar 2021; 25(4): 441-449.
20. Bencheikh N, Bouhrim M, Kharchoufa L, AlKamaly OM, Mechchate H and Es-Safi I: The Nephroprotective Effect of Zizyphus lotus L.(Desf.) Fruitsina Gentamicin-Induced Acute Kidney Injury Modelin Rats: A Biochemical and Histopathological Investigation. Mol Basel Switz 2021; 26(16): 4806.
21. Kumar M, Tomar M, Amarowicz R, Saurabh V, Nair MS and Maheshwari C: Guava (Psidium guajava L) Leaves: Nutritional composition, phytochemical profile, and Health-promoting Bioactivities. Foods 2021; 10: 752.