RESEARCH PAPER

Evaluation of Nephro-Protective and Diuretic Activity of Chenopodium Album Leaves Extract on Wistar Rats

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ABSTRACT

Background: Kidney diseases and urinary disorders represent major global health burdens, often leading to severe complications such as acute kidney injury (AKI) and urolithiasis. Conventional synthetic diuretics and nephroprotective agents frequently cause adverse side effects, sparking an increasing interest in discovering safer, plant-based alternatives from traditional medicine. Chenopodium album Linn. (commonly known as Bathua or Lamb's quarters) is an annual weed widely utilized in folklore medicine for its diverse therapeutic properties, including treating urinary tract disorders. However, systematic scientific validation regarding its parallel nephroprotective and diuretic potential remains limited.

Materials and Methods: Forty-two Wistar rats were divided into seven groups. Nephrotoxicity was induced using gentamicin, administered intraperitoneally, for 14 days at a dose of 80 mg/kg. Test groups 1&2 received Chenopodium Album leaf extract (250 & 500 mg/kg), and Test groups 3 & 4 received combination (gentamicin + C. Album leaf extract). Treatments were continued for 14 days. BUN, Serum creatinine, Uric acid level, and kidney histopathology were evaluated. Statistical analysis was performed using one-way ANOVA.

Results: Treatment groups showed increase in urine volume with improvement in nephrotoxicity and renal biomarkers as compared with the disease control group. Histopathology also indicated reduced renal damage and improved kidney structure.

Conclusion: The study is expected to provide scientific evidence regarding the nephroprotective and diuretic potential of Chenopodium Album leaf extract and in the management of kidney related problems.

Keywords: Nephrotoxicity, Chenopodium Album, nephroprotective activity, gentamicin, renal biomarkers.

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1. INTRODUCTION

Herbal medicine has emerged as an efficacious therapeutic approach for a wide array of ailments, offering various health advantages that contribute to the enhancement of individual well-being. In contrast to synthetic pharmaceuticals, herbs play a nurturing and strengthening role on cells without eliciting adverse effects.[1] The utilization of Ayurvedic principles, herbal medicine, and Traditional Chinese Medicine has a longstanding history predating modern pharmaceuticals. The advantageous aspects of herbal medicine encompass safety, eco-friendliness, and ease of access. Generally, herbal remedies are perceived as superior alternatives to pharmaceuticals due to the potential negative impacts of the latter on both health and the environment. Across time, diverse herbal practices have evolved diagnostic techniques and treatment modalities with the aim of leveraging the body's innate capabilities to address physiological issues.[2] Herbal medicine offers a multitude of benefits over contemporary medications such as lack of adverse reactions, stimulation of natural healing processes, targeting root causes of conditions, enhancement of overall health, and cost-effectiveness. Frequently, herbal remedies involve a combination of various herbs in a formulation to bolster the body's inherent abilities.[3]

According to Global Burden of Disease estimates, there are about 670–700 million people suffering from chronic kidney disease (CKD), with more than 1.5 million related deaths annually, accounting for several percent of all deaths in the world. CKD entails complications such as anaemia, mineral metabolism disorders, metabolic acidosis, and especially, hypertension and cardiovascular disorders. It is predicted to become one of the main reasons of loss of life years.[4]

Chronic kidney disease is now considered one of the independent risk factors for the development of cardiovascular diseases. Moderate CKD is associated with 2-3 times higher mortality rate among cardiovascular disorders, and about three-quarters of patients having

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advanced stages of CKD suffer from cardiovascular disease, making it the leading cause of death among them.[5] About 5-15% of all hospitalizations involve acute kidney injuries (AKI) and 50-60% of intensive care units admittances. These conditions are associated with a high rate of mortality during hospital stays, prolonged hospital stays, and serious complications, which include recurrent AKI, progression of CKD, cardiovascular disorders, and higher mortality rates.[6]

The most prevalent kidney issue is Nephrotoxicity, which happens when the body is exposed to a toxin or medicine.[7] Nephrotoxicity is characterized by impaired renal function including reduced glomerular filtration rate, elevated serum blood urea nitrogen level, and morphological changes in kidney tissue. Additionally, it manifests as tubular dysfunction with proteinuria, glucosuria, and decreased ammonium excretion.[8] Reduced urine concentrating capacity, tubular proteinuria, lysosomal enzymatic, and mid-glucosuria, as well as decreased ammonium excretion, a decrease in glomerular filtration rate, creatinine clearance, an increase in serum blood urea nitrogen, and a change in the morphology of kidney tissue, are functional manifestations of nephrotoxicity.[9] Numerous medications, chemicals, and heavy metals can have a negative impact on the kidney, causing nephritic syndrome, chronic intestinal nephritis, and acute renal failure, all of which can end in irreversible renal damage.[10] However, poor renal function also has a direct impact on cardiovascular health. An aminoglycoside antibiotic called gentamicin is used to treat serious infections. Gentamicin's nephrotoxicity has historically been seen as a tubulopathy, where renal insufficiency is primarily caused by tubular destruction and malfunction. Proteinuria, enzymatic, and electrolytic changes are a few clinical observations that could be explained by this.[11,12]

1.1 CHENOPODIUM ALBUM

Chenopodium album, a botanical specimen belonging to the Chenopodiaceae family, boasts a global distribution and is classified within the extensive genus Chenopodium, which encompasses approximately 250 distinct species. Commonly referred to as "lamb's quarters" in the English language, this plant can exhibit annual, biennial, or perennial traits.[13] Noteworthy for its nutritional richness, C. album, also known as Bathua, holds significance as a prevalent leafy vegetable crop in Asia, Europe, and the United States of America.[14]

C. album is a pale green, erect and strong-scented polymorphous annual plant that has a height of 3.5 m and grows at a place of an altitude of 3600 m above sea level. Some of the characteristics of the plant include the following: Kingdom: Plantae Phylum: Spermatophyta Subphylum: Angiospermae Class: Dicotyledonae Order: Caryophyllales Family: Amaranthaceae.[15,16]

The specimen is conventionally utilized for its sedative, blood-purifying, and diuretic qualities, as well as for enhancing gastrointestinal well-being, serving as an antiscorbutic laxative, and countering intestinal parasites. Moreover, it demonstrates hepatoprotective properties, aids in the management of renal and urinary tract conditions, and manifests hypotensive, antinociceptive, and antipruritic effects.[17,18] Within the scope of reproductive health, it harbours substances associated with sperm immobilization. Furthermore, the utilization of cooked *C. album* leaves and/or herbal infusions derived from them in the management of nephrolithiasis and urological disorders is recognized as the preferred therapeutic approach in the traditional medicine practices of Rajasthan, Toba Tek Singh, and Azad Jammu and Kashmir. Additionally, individuals in the Shekhavati region of Rajasthan employ cooked *C. album* leaves to address colic and other urinary system maladies.[19-21]

2. MATERIALS AND METHODS

2.1 Procurement of drugs and chemicals

All the necessary chemicals and solvents were sourced from trusted suppliers like CDH, E, Merck India, FINAR, RenChem, and Sigma Aldrich, using lab-grade (LR) reagents to ensure research-quality standards. All chemicals were bought of analytical grade & acquired from standard, reputable suppliers.

2.2 Collection, Authentication and Preparation of the plant

The leaves of the selected plants *Chenopodium album* were collected from reliable and authenticated sources. The plant materials were thoroughly examined and identified by qualified botanists to confirm their authenticity. Dr Priyanka Ingle scientists a head of botanical survey identified the plant leaves (No. BSI/BGIR/1/TECH./2026/315). Once verified, the plants were processed and prepared for extraction using standard procedures.

2.3 Extraction of *Chenopodium album* leaves

The *Chenopodium album* leaves were washed, dried under shades and convert it into powder using blender. The 50 gm of dried powder was loosely packed in the thimble of Soxhlet apparatus and was extracted with following solvents. First Petroleum Ether was used to remove out the impurities for 24 hrs. then after ethanol (95%) was used for 48 hrs. (40°C) to obtain the better extract. From this extract only ethanol was selected for further study. The extract was then concentrated by evaporating the solvent using water-bath. The concentrated extract was air dried at room temperature, weighed and percentage yield was calculated. For future research, the dried extract was sealed in airtight bottles and kept at 4 ◦C. The semisolid form of the extract was insoluble in water; to make the extract soluble an inert solubilizer 1% CMC was used.[22]

2.4 Animal procurements

Animal (Wistar rats) weighing between 150-200 gm were

procured from National Institute of Biologics, Noida Sector-62, U.P, after the certification of Institutional Animal Ethics Committee (IAEC) and kept at the Animal House Facility, HIMT, Greater Noida. They were quarantine for 7 days before the experiment. The animals were housed in polypropylene cages under controlled environmental conditions: temperature was maintained at 25 ± 2°C, with relative humidity 50 - 60% and a 12- hour light/dark cycle to provide a consistent and stable setting. The rats had free access to standard pellet feed & water throughout the study. Prior to the initiation of the experiment, all animals were examined for any visible signs of illness or injury to ensure their health status.[23]

2.5 Dose regimen and protocol design

The rats were separated into seven groups and each groups have 6 animals. Nephrotoxicity was induced by a I.P. dose of gentamicin at 80mg/kg regularly for 14 days, and the test drug was given orally for 14 days to obtain the nephroprotective effect. For diuretic activity, single dose of test substance was given orally to obtain the diuretic action of the drug. The study was performed at a normal room temperature (25 ± 2°C). The animals were randomised into seven groups and treated as follows:[24,25]

- Group 1 (Normal control) was given 10 ml/kg of normal saline orally,
- Group 2 (Disease control) received 80mg/kg of gentamicin,
- Group 3 & 4 (Test control 1 & 2) were treated with *C. Album* at dose of 250mg/kg and 500mg/kg, respectively.
- Group 5 & 6 (Test control 3 & 4) treated with Gentamicin + *C. Album* at a dose of 250mg/kg and 500mg/kg, respectively.
- Group 7 (the reference group) was administered 50 mg/kg of spironolactone.

2.6 Assessment of Nephroprotective activity

Nephrotoxicity was induced using gentamicin, administered intraperitoneally, for 14 days at a dose of 80 mg/kg. Throughout the study, the test and standard drugs were administered for 14 days. 24 hr after the final dose, blood samples were collected via the cardiac puncture. The blood was taken to centrifuged at 3000 RPM for 15 minutes, and the serum was isolated & kept at -20°C for subsequent biochemical analysis. Additionally, kidney tissues were collected, rinsed with normal saline and stored in a formalin solution for further use.[26]

2.7 Test for Diuretic Activity

The procedure described by Lipschitz, Haddian and Kepscar was adopted for the assessment of diuretic activity of the ethanol extract of C. album leaf.

The experimental animals were grouped into 7 groups of six animals in each group. The rats were fasted over night with free access to water prior to the administration of the different substances. Prior to experimentation, the animals were screened for any visible signs of disease, and only the healthy animals were selected for the study. The study was performed at a normal room temperature (25 ± 2°C). Group I (the control group) was given 10 mL/kg of normal saline, Group 7 (the reference group) was given 50 mg/kg of spironolactone and the test groups (3,4,5,6) were administered different doses of *C. album*, respectively.[27,28]

Immediately after administration, the animals were placed in metabolic, specially designed to separate urine and feaces. The urine, collected in graduated vials, was measured at the end of 6 h and expressed as mL/100 g of body weight per 6 h. Urine samples, which are collected from metabolic cages, were analysed for Na+ and K+ concentration by flame photometric method.[29]

2.8 Blood collection and biochemical analysis

After experimentation the experimental animals' hearts were punctured to obtain blood samples for biochemical examination. To reduce pain and discomfort, the animals were fasted overnight and given an injection of thiopental sodium at a dose range of 40 mg/kg body weight. A sterile syringe and needle were used in aseptic condition to draw blood straight from the heart. Serum was prepared after when blood was collected in collecting tube. After being collected, the blood samples were put into dry, clean centrifuge tubes and left to coagulate at room temperature. After that, the samples were centrifuged for ten to fifteen minutes at 3000 rpm. to extract the serum. For biochemical analysis, including serum creatinine, urea, and other parameters, the produced clear serum was carefully collected and stored.

2.9 Histopathological examination

Kidneys were removed carefully after sacrificing the animals and washed with normal saline. To preserve kidney tissues, they are preserved in a 10% formalin solution. Alcohol was used to dry the tissues, and xylene was used for cleaning. Sample were fixed in paraffin wax and thin pieces of sample was cut using a microtome. Haematoxylin stains and Eosin dye were applied

to the tissue sections. The stained slides were examined under a microscope to observe histopathological evaluation in kidney tissue.

2.10 Statistical analysis

The experimental data for six animals in each group (n = 6) were expressed as Mean ± SEM (Standard Error of Mean). Statistical analysis was performed using one-way Analysis of Variance (ANOVA) followed by Tukey's multiple comparison test to evaluate the significance between different groups. A p-value less than 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

3.1 Phytochemical Screening

Preliminary phytochemical screening of ethanolic extracts

from *Chenopodium album* leaves revealed the presence of key bio active compounds linked to kidney protection. *Chenopodium album* showed a strong presence of phenolic compounds, alkaloids, flavonoids, saponins, fatty acids, terpenoids & essential oil constituents. These compounds possess distinct pharmacological activities; specifically, the presence of bioactive flavonoids and phenolics compounds that provide a strong physiological basis for evaluating the diuretic and nephroprotective effects, supporting the traditional use of plants in managing kidney-related conditions.

3.2 Effect of *C. Album* on body weights against gentamicin induced animal

Changes in the experimental animals' body weight was measured on initial Day (day1) before starting the doses and on 14 Days. Group I (Normal Control) animals showed normal growth and progressive increase in body weight. Group II (disease control) showed a notable decreased in body weight due to gentamicin induced nephrotoxicity and associated metabolic disturbances. Groups III and IV, administered varying doses of *Chenopodium Album* leaf extract, exhibited greater body weight gain compared to the disease control group. Group V and Group VI which received Gentamicin + different doses *C. Album* also showed moderate recovery in body weight. Group VII treated with standard drug showed significant restoration of body weight and produced results near to the normal control group.

Table 1: Effect of *C. Album* on body weights against gentamicin induced animal

Groups	Treatment/dose	Initial weight	Final weight
I- Normal Control	Saline solution (1ml/kg)	138.74 ± 0.94	204.19 ± 1.26
II- Disease control	Gentamicin (80mg/kg)	141.44 ± 1.95	183.33 ± 1.75
III- Test control-1	*C. Album* (250mg/kg)	138.91 ± 1.12	203.66 ± 1.81
IV- Test Control-2	*C. Album* (500mg/kg)	138.99 ± 1.37	200.55 ± 1.68
V- Test control-3	Gentamicin + *C. Album* (80mg/kg, 250mg/kg)	138.88 ± 1.62	203.26 ± 2.23
VI- Test control-4	Gentamicin + *C. Album* (80mg/kg, 500mg/kg)	141.13 ± 1.64	186.83 ± 1.91
VII- Standard control	Gentamicin + spironolactone (80mg/kg ,50mg/kg)	140.83 ± 1.72	189.16 ± 1.96

3.3 Effect of *C. Album* leaf extract on urine

Changes in the experimental animals' urinary parameters were evaluated over the treatment period to determine the diuretic potential of the extract. Group I (Normal Control) animals exhibited standard physiological baseline values, maintaining a steady urine volume of 3.55 ±

0.12 mL and a stable urinary pH of 7.1. Group II (Disease Control) animals showed a notable decrease in urine volume (4.17 ± 0.17 mL) alongside a distinct drop in urinary pH to 5.5, which is highly indicative of metabolic disturbances. Experimental groups treated with varying doses of *Chenopodium album* leaf extract demonstrated progressive, dose-dependent restoration and enhancement of renal excretion parameters. Group III (Test Control-1) and Group IV (Test Control-2) animals showed an increase in overall urine volume to 4.88 ± 0.15 mL and 5.28 ±

0.13 mL, respectively. This upward trend was consistently supported by Group V (Test Control-3) and Group VI (Test Control-4), which received alternative dosage regimens of *C. album* extract; these cohorts displayed significant increases in urine volume up to 5.15 ± 0.13 mL alongside stabilized urinary pH values ranging from 6.10 to 6.40, indicating moderate to substantial recovery of renal filtration mechanisms.

Table 2: Effect of *C. Album* Leaf Extract on Urine parameters

Groups	Volume of urine	pH	Diuretic action	Lipschitz values
I- Normal Control	3.55 ± 0.12	7.1	1	0.53
II- Disease control	4.17 ± 0.17	5.5	1.17	0.62
III- Test control-1	4.88 ± 0.15	6.88	1.37	0.72
IV- Test Control-2	5.28 ± 0.13	6.94	1.48	0.78
V- Test control-3	5 ± 0.08	6.10	1.40	0.74
VI- Test control-4	5.15 ± 0.13	6.4	1.45	0.76
VII- Standard control	6.75 ± 0.09	6.5	1.90	1.00

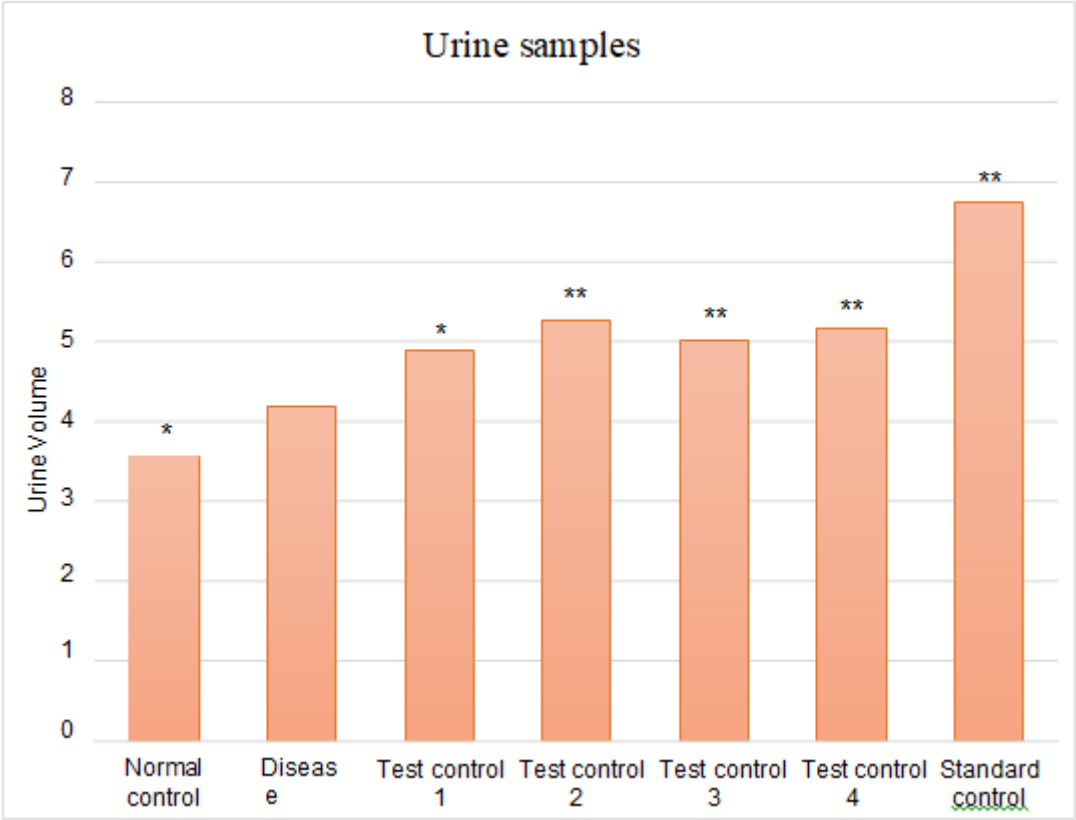


Fig. 1: Illustrate the Urine Volume of different groups

Group-2, the disease control group, exhibited significantly different results (*p < 0.01) compared to Group-1, the normal control group. Treatment with the test drugs in Group-3 and Group-4 showed when compared with the disease control group (*p < 0.01) and (**p < 0.001) respectively. Similarly, test control 3 group (Group-5) and test control 4 group (Group-6)

showed (**p < 0.001) and (**p < 0.001) respectively in comparison to the disease control group (Group-2), whereas the standard control group (Group-7) also showed (**p < 0.001) as compared with the disease control group.

3.4 Effect of *C. Album* leaf Extract on Kidney Function markers

Blood Urea Nitrogen (BUN) level, serum creatinine level, and uric acid level are important biochemical markers used for the assessment of kidney function and renal damage. For evaluating the nephroprotective effect of extract, persistent nephrotoxicity is induced to causes glomerular and tubular injury, leading to impaired renal filtration and increased uric acid level. Elevated BUN and serum creatinine levels indicate reduced kidney function.

Table 3: Effect of *C. Album* leaf Extract on Kidney Function markers

Groups	Urea (mg/dL)	Serum creatine (mg/dL)	Uric acid (mg/dL)
I- Normal control	20.75 ± 0.95	0.68 ± 0.02	2. 4 ± 0.12
II- Disease control	39.25 ± 1.20	2.0 ± 0.01	6.4 ± 0.87
III- test control-1	23.75 ± 1.35	0.85 ± 0.02	2.6 ± 0.14
IV- Test control-2	23.62 ± 0.2	0.82 ± 0.03	2.7 ± 0.24
V- Test control-3	33 ± 0.89	1.6 ± 0.04	4.9 ± 0.31
VI- Test control-4	30 ± 1.1	1.3 ± 0.03	4.4 ± 0.26
VII- Standard control	26 ± 0.50	1.1 ± 0.05	4.0 ± 0.14

Blood Urea Nitrogen (BUN): Group I (Normal Control) animals showed normal BUN levels indicating healthy renal function. Group II (Disease Control) showed a marked increase in BUN level due to renal impairment caused by gentamicin induced nephrotoxicity. Group III & IV treated with *C. Album* leaf extract showed normal BUN level. Group V & VI treated with combination of (gentamicin + *C. Album*) different doses of extract showed reduction in elevated BUN level as compared with the disease treated group, suggesting enhanced protective effect on kidney function. Group VII treated with standard drug showed significant normalization of BUN level and produced results close to the normal control group.

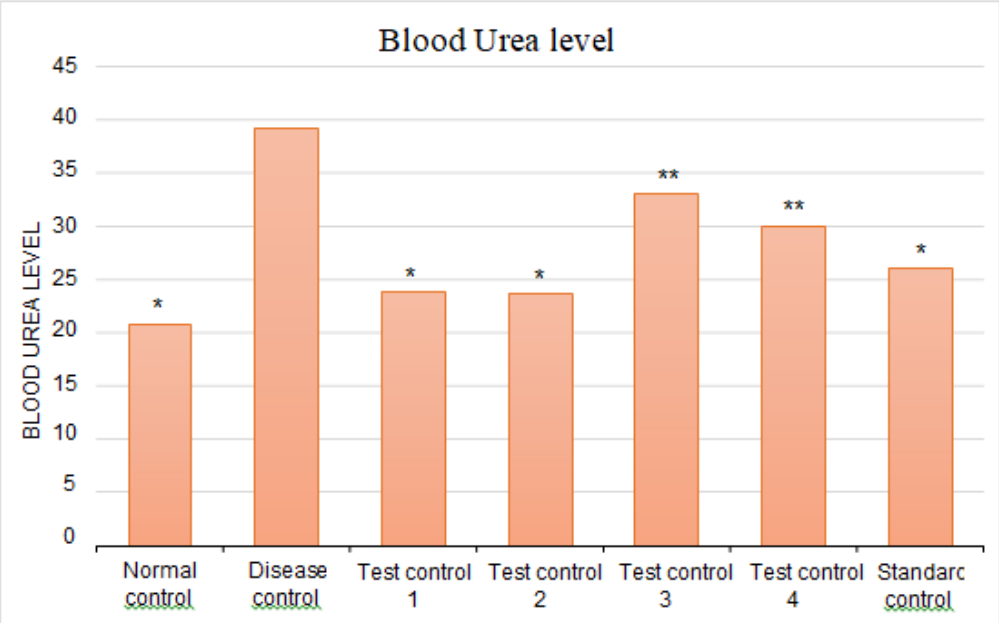


Fig. 2: Represent the Blood Urea level of different groups

Group-2, the disease control group, demonstrated a statistical significance (*p < 0.01) when compared to Group-1, the normal control group. Treatment with the test drugs in Group-3 and Group-4 showed when compared with the disease control group (*p < 0.01) and (*p < 0.05) respectively. Similarly, test control 3 group (Group-5) and test control 4 group (Group-6) showed (**p < 0.001) and (**p < 0.001) respectively in comparison to the disease control group (Group-2), whereas the standard control group (Group-7) also showed (**p < 0.01) as compared with the disease control group (Group-2).

Serum Creatinine: Group I (Normal Control) animals showed normal serum creatine levels indicating healthy renal function. Group II (Disease Control) showed a marked increase in creatine level due to renal impairment caused by gentamicin induced nephrotoxicity. Group III & IV treated with *C. Album* leaf extract showed normal creatine level. Group V & VI treated with combination of (gentamicin + *C. Album*) different doses of extract showed reduction in elevated serum creatine level as compared with the disease treated group, suggesting enhanced protective effect on kidney function. Group VII treated with standard drug showed significant normalization of serum creatine level and produced results close to the normal control group.

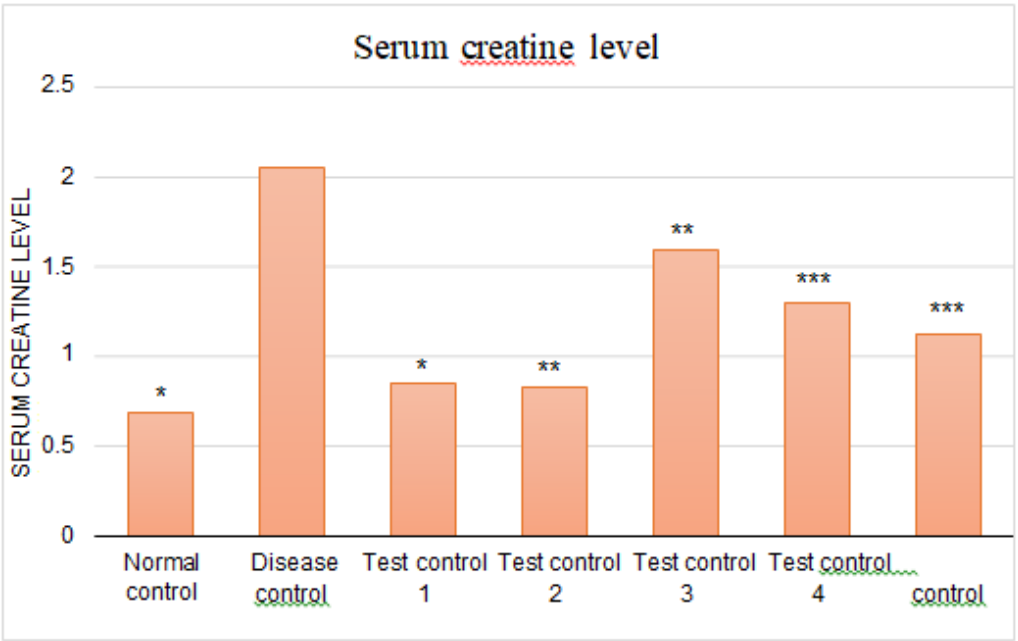


Fig. 3: Represent the Serum Creatine level of different groups

The disease control group (Group-2) showed (**p < 0.001) as compared with the normal control group (Group-1). Treatment with the test drugs in Group-3 and Group-4 showed when compared with the disease control group (*p < 0.05) and (**p < 0.01) respectively. Similarly, test control 3 group (Group-5) and test control 4 group (Group-6) showed (**p < 0.01) and (**p < 0.001) respectively in comparison to the disease control group (Group-2), whereas the standard control group (Group-7) also showed (**p < 0.001) as compared with the disease control group (Group-2).

Uric acid: Group I (Normal Control) animals showed normal uric acid levels indicating healthy renal function. Group II (Disease Control) showed a marked increase in uric acid due to renal impairment caused by gentamicin induced nephrotoxicity. Group III & IV treated with *C. Album* leaf extract showed normal uric acid level. Group V & VI treated with combination of (gentamicin + *C. Album*) different doses of extract showed reduction in elevated uric acid level as compared with the disease treated group, suggesting enhanced protective effect on kidney function. Group VII treated with standard drug showed significant normalization of uric acid level and produced results close to the normal control group.

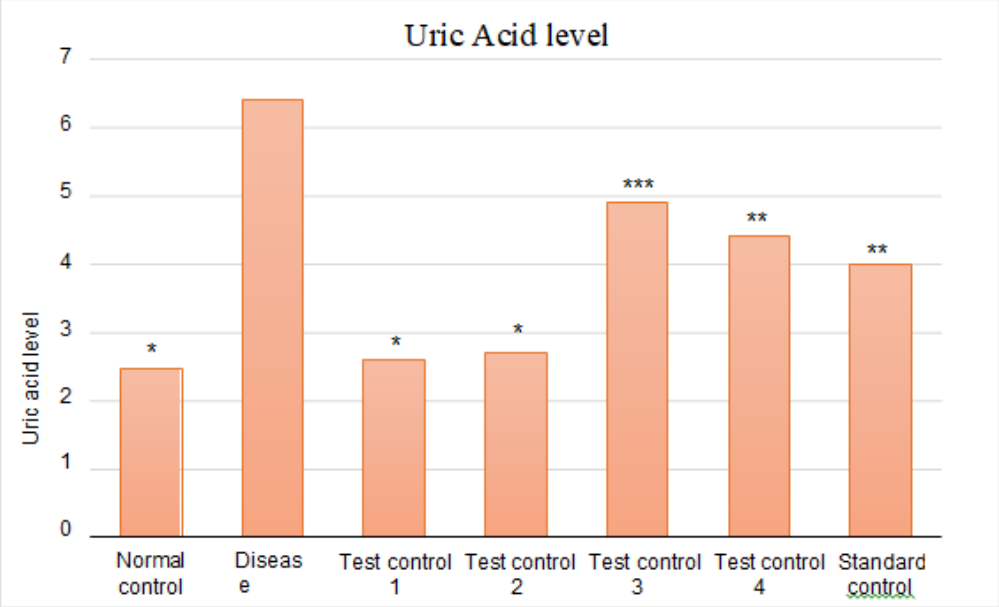


Fig. 4: Represent the Uric Acid level of different groups

The disease control group (Group-2) showed (*p < 0.05) as compared with the normal control group (Group-1). Treatment with the test drugs in Group-3 and Group-4 showed when compared with the disease control group (*p < 0.05) and (*p < 0.05) respectively. Similarly, test control 3 group (Group-5) and test control 4 group (Group-6) showed (**p < 0.001) and (**p < 0.001) respectively in comparison to the disease control group (Group-2), whereas the standard control group (Group-7) also showed (**p < 0.001) as compared with the disease control group (Group-2).

3.5 Effect of *C. Album* on Urinary Electrolytes

The excretion profiles of essential urinary electrolytes, specifically Na^+, K^+, and Cl^- ions were quantitatively evaluated across all experimental groups to determine the net natriuretic effect. Administration of *Chenopodium album* leaf extract produced a prominent, dose-dependent increase in electrolyte elimination without causing excessive potassium depletion, thereby confirming its therapeutic potential as an effective electrolyte-regulating agent.

Table 4: Effect of *C. Album* on Urinary Electrolytes

Groups	Urinary electrolytes conc. (mmol/L)			Natriuretic activity (Na^+/K^+)
	Na^+	K^+	Cl^-	
I- Normal control	130.80 ± 1.15	73.21 ± 0.81	104.80 ± 0.25	1.79
II- Disease control	125 ± 0.71	70.5 ± 0.14	103.20 ± 0.34	1.78
III- Test control-1	132.60 ± 0.67	76.62 ± 0.65	108.36 ± 0.56	1.73
IV- Test control-2	138.45 ± 0.34	82.05 ± 0.82	109.35 ± 0.47	1.68
V- Test control-3	126 ± 1.36	71.6 ± 0.43	104 ± 0.96	1.76
VI- Test control-4	131.61 ± 1.49	78.2 ± 0.24	106.11 ± 0.37	1.68
VII- Standard control	140.0 ± 1.1	58.19 ± 0.31	109.81 ± 0.68	2.41

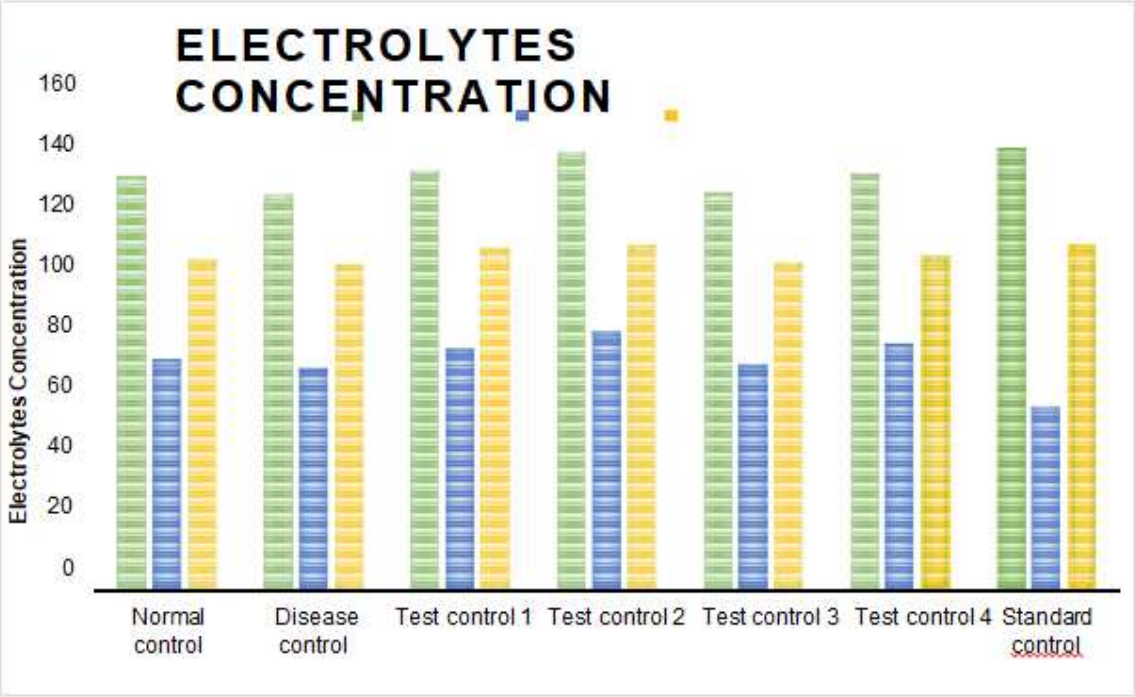


Fig. 5: Represent the Urinary Electrolyte Concentration of Different Groups

4. HISTOPATHOLOGICAL ANALYSIS

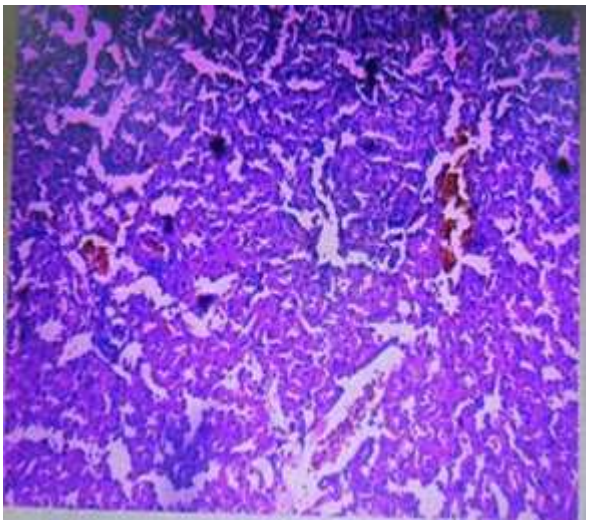


Fig. 6: Histopathological representation of Kidney tissue GROUP-1

Kidney section showing normal histopathology in group 1 slide, indicates proximal distal tubules are well preserved with intact epithelial lining, & blood vessels are normal, interstitial space with no inflammatory cells. Overall, all this is healthy architecture of kidney.

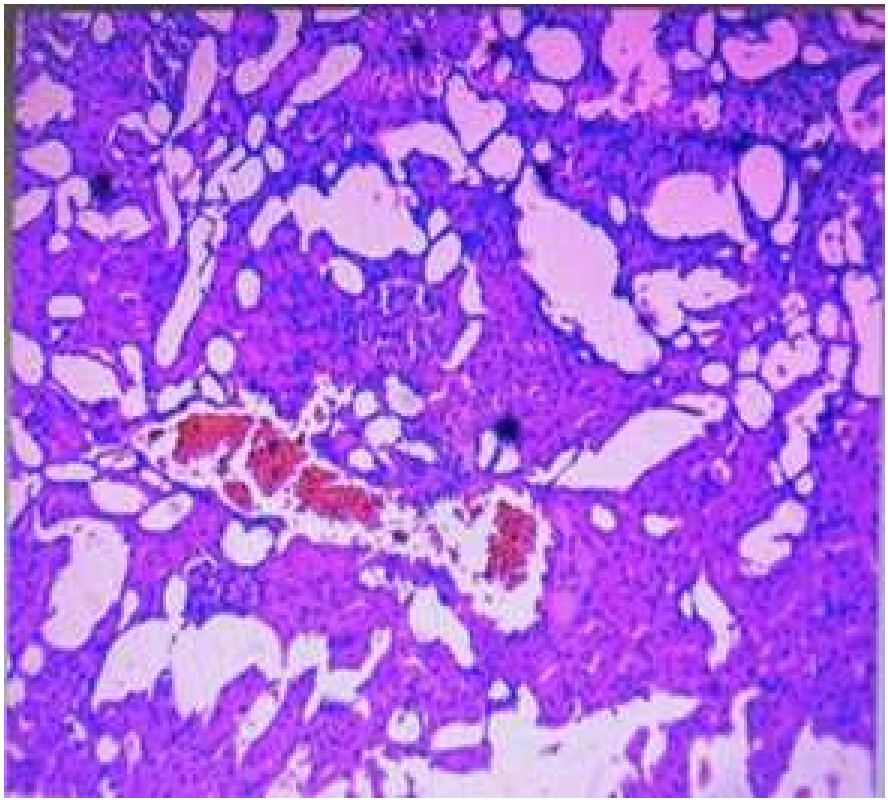


Fig. 7: Histopathological representation of Kidney tissue GROUP-2

Kidney section showing severe pathological alteration in group 2 slide, which indicates tubular degeneration, tubular necrosis and vacuolar degeneration. These finding confirms significant renal damage associated with nephrotoxicity.

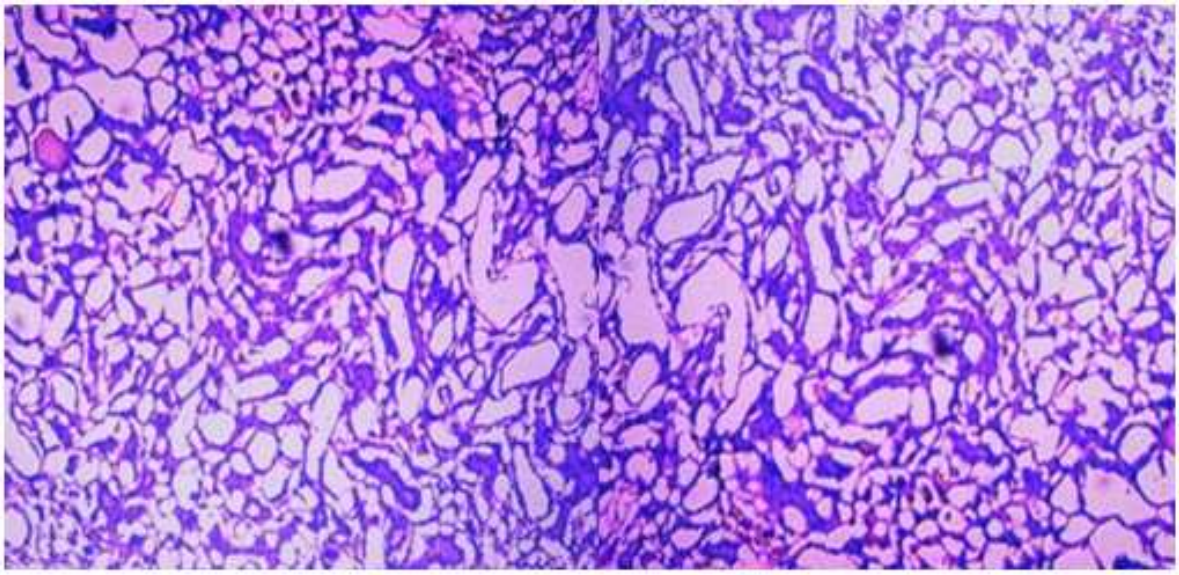


Fig. 8: Histopathological representation of Kidney tissue GROUP-3 & GROUP-4

Kidney section showing normal histopathology, which indicates well preserved distal tubules; normal blood vessels and intact proximal tubules with no inflammatory cell. Overall kidney section is normal and healthy.

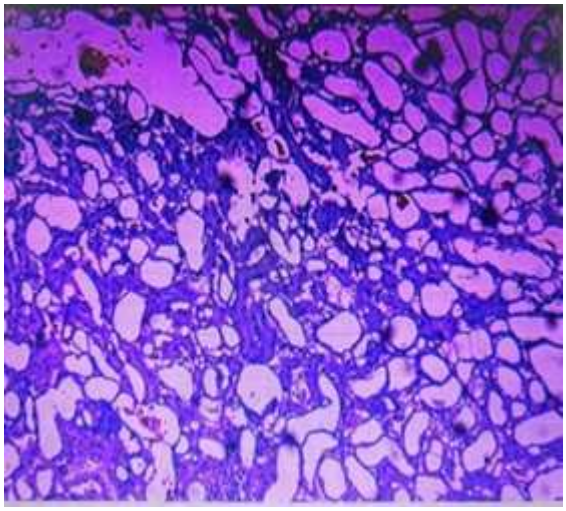


Fig. 9: Histopathological representation of Kidney tissue Group-5

Kidney section of drug treatment Group-5 showed marked improvement in renal histoarchitecture. Indicates intact Bowens capsule; proximal tubules are intact and indicates mild inflammatory cell. Overall, histological structure is significantly improved as compared to disease control.

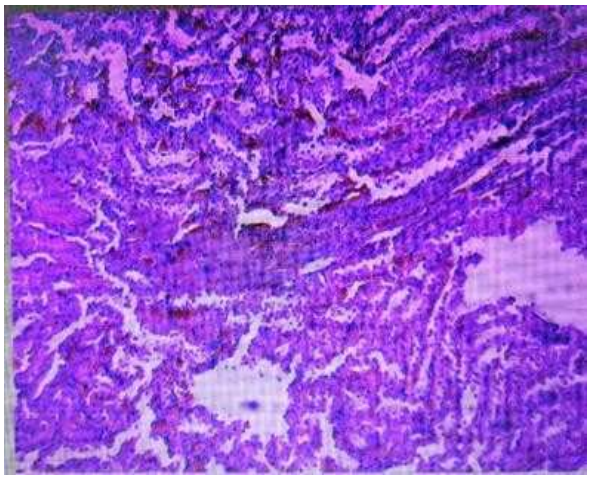


Fig. 10: Histopathological representation of Kidney tissue GROUP-6

Kidney section showing improvement in histopathology, as renal tubules is well preserved, intact proximal tubules and only mild inflammatory cell. Overall, there is significant improvement showing as compared to Group 2 and Group 5.

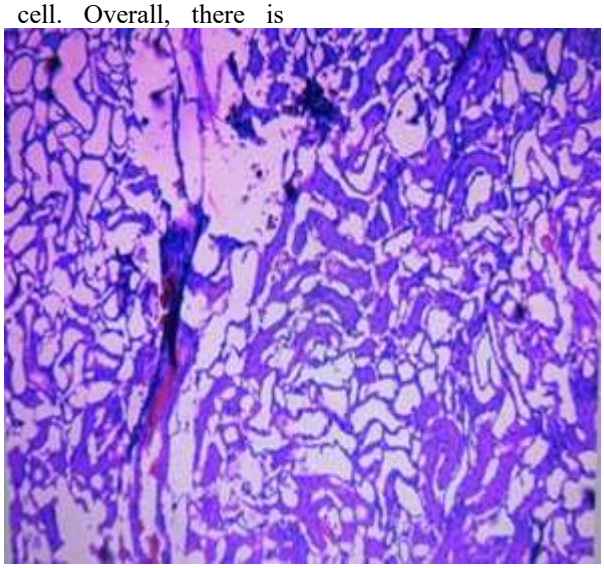


Fig. 11: Histopathological representation of Kidney tissue Group -7

Kidney section showing excellent improvement in histoarchitecture, indicates well preserved Distal tubules; blood vessels and interstitial space looks normal. Overall section shows marked improvement compared to Group 5 and Group 6.

5. CONCLUSION

The study concludes that the of *Chenopodium Album* Leaf extract, provides significant protection against gentamicin induced nephrotoxicity in Wistar rats. Gentamicin administration caused marked nephrotoxicity, slight reduction in body weight, and elevation of renal function indicators include BUN, serum creatinine, and uric acid, indicating renal damage and development of nephrotoxicity. Treatment with only *Chenopodium Album* leaf extract shows good diuretic activity indicating excretion of urine and electrolytes. Treatment with combination of gentamicin and *C. Album* leaf extract shows significantly increase body weight and changed kidney biochemical markers. Histopathological examination also confirmed improvement in renal architecture in treated groups. The combination treated groups showed better protective activity and results comparable to the standard drug treated group. The nephroprotective effect may be due to presence of flavonoids, tannins, and phenolic compounds, which have antioxidant and anti-inflammatory activities. The study suggests that *Chenopodium Album* leaf extract may beneficial in the diuretic purpose and in the treatment of nephroprotective and kidney related complications.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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