

IN VIVO ANTI-UROLITHIATIC ACTIVITY OF LEAVES EXTRACT OF *PELTOPHORUM PTEROCARPAM* IN ETHYLENE GLYCOL INDUCED UROLITHIASIS IN RATS

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ABSTRACT

Background: Urolithiasis (kidney stone disease) is a common urological disorder worldwide, and its management is frequently limited by recurrence, adverse effect and cost, prompting interest in plant-based alternatives. *Peltophorum pterocarpum* (Fabaceae) is traditionally used for fever, skin disorders, diabetes, hypertension and inflammation, and its leave are reported to contain flavonoids, tannis, phenolics, terpenoids and glycosides.

Objectives: To evaluate the anti-urolithiatic potential of the alcoholic extract of *P. pterocarpum* leaves (ALEPP) in an ethylene glycol (EG)-induced urolithiasis model in rats. **Methods:** ALEPP was obtained by Soxhlet extraction (95% ethanol) of shade-dried, authenticated leaf powder and screened for phytoconstituents. Acute oral toxicity was assessed as per OECD guidelines. Urolithiasis was induced in Wistar rats by 0.5% EG in drinking water for 42 days. Five groups (n=6) received distilled water (normal control), EG (Toxicant group), EG + Cystone (750mg/kg), EG+ALEPP (100mg/kg), EG+ALEPP (400mg/kg) with treatment from day 22 to 42 day. Serum creatinine, calcium and uric acid were estimated at the end of the study. **Results:** EG administration markedly raised serum creatinine, calcium and uric acid relative to normal controls, confirming induction of urolithiasis. ALEPP lowered all three parameters in a dose-dependent manner; at 400mg/kg the reduction approached that produced by the standard drug cystone, while 100mg/kg produced a smaller effect. **Conclusion:** The alcoholic leaf extract of *P. pterocarpum* shows dose-dependent anti-urolithiatic activity in the ethylene glycol-induced rat model, supporting further isolation and mechanistic evaluation of its active constituents.

KEYWORDS: *Peltophorum pterocarpum*; urolithiasis; ethylene glycol; nephroprotective; Cystone; rat.

1. INTRODUCTION

Urolithiasis, or kidney stone disease, is one of the most common disorders of the urinary tract and imposes a substantial and recurring burden on healthcare systems worldwide.^[1,2] Calcium oxalate is the major constituent of most urinary calculi, which form through a sequence of urinary supersaturation, nucleation, crystals aggregation and retention within the renal tubule.^[3,4] Conventional management, ranging from pharmacotherapy to extracorporeal lithotripsy and surgery, is frequently limited by high recurrence rates, adverse effects and cost^[2,5] which has prevention and management of urolithiasis.

Peltophorum pterocarpum (sonn) Benth (Fabaceae), commonly known as copper pod or yellow-flame tree, is a large evergreen tree found widely across India and other topical regions. Various parts of the plants are traditionally used to treat fever, skin disorders, diabetes, hypertension, inflammation and parasitic infectious, and phytochemical studies report the presence of flavonoids, tannins, phenolic compounds, triterpenoids and glycosides. Constituents of this type are widely associated with antioxidant and nephroprotective activity, and underlie the anti-urolithiatic effects reported for several other medicinal plants in the ethylene glycol-induced rat model.^[6-10] However, the in-vitro anti-urolithiatic activity has been reported but lacks the sufficient data for translating into medicinal uses. Therefore, this study has been undertaken to evaluate the effect of *P. pterocarpum* leaves on experimentally induced urolithiasis in rats.

The present study was therefore designed to evaluate the anti-urolithiatic activity of the alcoholic extract of *P. pterocarpum* leaves (ALEPP) against ethylene glycol-induced urolithiasis in rats, using serum creatinine, calcium and uric acid as markers of renal function and stone-forming risk.

2. MATERIALS AND METHODS

2.1 Plant material

Leaves of *P. pterocarpum* were collected in June 2026 from the campus of V.L college of Pharmacy, Raichur, Karnataka, India and authenticated by Dr. Pramod Kumar, Professor & Head, Department of Pharmacognosy, V.L college of pharmacy Raichur, Karnataka. The leaves were shade-dried at room temperature and reduced to a fine powder using a mechanical grinder.

2.2 Preparation of the extract

The leaf powder was defatted with petroleum ether (1:4) and then extracted with 95% ethanol in a Soxhlet apparatus for 18hr, until the solvent siphoning over the thimble ran colourless. The extract was concentrated on a water bath maintained below 50 °C, air-dried to remove residual solvent, and stored in an air-tight container below 4 °C. The alcoholic extract of the leaves of *P. pterocarpum* (ALEPP) was obtained as a dark-brown, sticky mass (yield: 5.0g)

2.3 Preliminary phytochemical screening

ALEPP was screened qualitatively for major phytoconstituent- alkaloids, carbohydrates, steroids and triterpenoids, flavonoids, saponins, tannins, glycosides, and proteins and amino acids using standard chemical tests.

2.4 Acute oral toxicity study

Acute oral toxicity of ALEPP was assessed in mice as per OECD guidelines; no mortality or abnormal behavioural changes were observed up to a dose of 2000 mg/kg, p. o. On this basis, doses of 100 mg/kg (1/20th) and 400 mg/kg (1/5th) of the maximum tested dose were selected as the low and high doses, respectively, for the urolithiasis study.

2.5 Experimental animals and ethical statement

Wister albino rats of either sex (140-200g) were procured from animal house facility of V.L. College of Pharmacy, Raichur and acclimatized for 7 days under standard animal husbandry conditions ($26 \pm 2^\circ\text{C}$, 45-55% relative humidity, 12hr light/dark cycle) with a standard pellet diet and water *ad libitum*. All procedures were approved by the Institutional Animal Ethics Committee, V.L. College of Pharmacy, Raichur (Registration No. 557/PO/Re/S/02/CCSEA). (Approval No. VLCP/Phcology/02604) were conducted in accordance with CPCSEA guidelines.

2.6 Ethylene glycol-induced urolithiasis

Urolithiasis was induced by administering 0.5% ethylene glycol (EG) in drinking water for 42 days [6]. Rats were randomly divided into five groups of six animals each:

Group I – Normal control (distilled water only)

Group II – EG (Toxicant group 0.5%, days 22-42)

Group III – EG + standard Cystone (750mg/kg, p.o., days 22 – 42)

Group IV – EG + ALEPP (100mg/kg, p.o., days 22–42)

Group V – EG + ALEPP (400mg/kg, p.o., days 22–42)

In Groups III–V, treatment was co-administered with continued EG exposure from day 22 to day 42. At the end of the 42-day study period, blood was collected from all animals for biochemical estimation.

2.7 Biochemical estimation: Serum creatine (Jaffe's method), uric acid (uricase-peroxidase method) and calcium (Arsenazo III method) were estimated using commercial diagnostic kits (Erba Diagnostics, Mannheim, Germany) on a semi-automated clinical chemistry analyser.

2.8 Statistical analysis

Data are expressed as Mean $\pm$ SEM (n = 6 per group) and were analysed by one-way ANOVA followed by Dunnett's multiple comparison test, with $p < 0.05$ considered statistically significant.

3. RESULTS

3.1 Phytochemical screening

Preliminary phytoconstituents screening of ALEPP indicated the presence of alkaloids, carbohydrates, steroids and triterpenoids, flavonoids, saponins, tannins, glycosides, and proteins and amino acids.

3.2 Effect on serum biochemical parameters

Administration of 0.5% ethylene glycol for 42 days produced a marked rise in serum creatinine, calcium and uric acid compared with the normal control group (Table 1, Figure 1), consistent with successful induction of urolithiasis. Treatment with the standard drug cystone (750mg/kg) substantially reduced all three parameters toward normal values. ALEPP produced a dose-dependent protective effect: at 100mg/kg, serum creatinine, calcium and uric acid remained only partially reduced, whereas at 400mg/kg the values moved closer to those of the Cystone-treated group, indicating a stronger anti-urolithiatic effect at the higher dose.

Table 1: Effect of Cystone and ALEPP on serum biochemical parameters in ethylene glycol-induced urolithiasis in rats.

Parameter	Normal control	EG (toxicant)	EG + Cystone (750 mg/kg)	EG + ALEPP (100 mg/kg)	EG + ALEPP (400 mg/kg)
Serum creatinine (mg/dL)	0.60 ± 0.02***	2.02 ± 0.11	0.62 ± 0.015***	0.80 ± 0.015***	0.71 ± 0.024***
Serum calcium oxalate (mg/dL)	5.56 ± 0.16***	13.21 ± 0.28	6.34 ± 0.084***	10.79 ± 0.36**	7.31 ± 0.10***
Serum uric acid (mg/dL)	6.47 ± 0.12***	17.70 ± 0.723	7.52 ± 0.253***	14.87 ± 0.26 ns	10.82 ± 0.174***

Values are mean ± SEM (n = 6 rats/group). One-way ANOVA followed by Dunnett's multiple comparison test; each treated group compared with the EG (toxicant) control. *P<0.05, **P<0.01, ***P<0.001, ns = not significant.

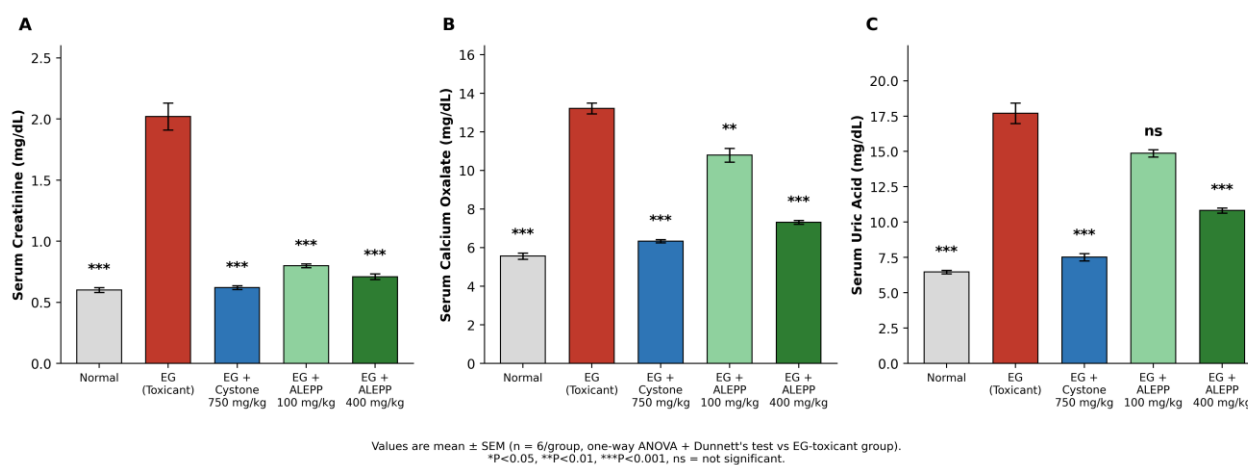


Figure 1: Effect of the alcoholic leaf extract of *Peltophorum pterocarpum* (ALEPP) on ethylene glycol (EG)-induced changes in (A) serum creatinine, (B) serum calcium oxalate and (C) serum uric acid in rats. Values are mean ± SEM (n = 6/group); one-way ANOVA + Dunnett's test vs the EG (toxicant) group. *P<0.05, **P<0.01, *P<0.001, ns = not significant.**

4. DISCUSSION

Chronic exposure to ethylene glycol is a well-established means of inducing calcium oxalate urolithiasis in rats: EG is metabolised to oxalate, which is excreted in the urine and combines with calcium to form crystals that deposit within the renal tubules, producing tubular injury and impairing renal function.^[6] This is reflected in the present study by the marked elevation of serum creatinine and uric acid – indicators of reduced glomerular filtration and renal damage – and of serum calcium, in the EG-only group relative to normal controls.

Treatment with ALEPP attenuated these changes in a dose-dependent manner, with the 400mg/kg dose producing a response comparable to that of the standard drug Cystone, a polyherbal formulation used clinically for urolithiasis. A comparable dose-dependent protective effect against EG-induced urolithiasis has been reported for several other plant extracts rich in flavonoids, tannins and other phenolic constituents, including *Hordeum vulgare* seeds,^[7] *Vernonia cinerea*,^[8] *Chenopodium album* leaves^[9] and the polyherbal formulation.^[10] The phytoconstituents identified in ALEPP in the present study – flavonoids, tannins, saponins and alkaloids – are consistent with the antioxidant, diuretic and crystallisation-inhibitory mechanisms proposed for these agents.^[11] The reduction in serum calcium with ALEPP treatment may similarly reflect reduced calcium oxalate crystal deposition and antioxidant-mediated protection of the

renal tubular epithelium, although the present study did not directly assess urinary oxalate excretion or renal histopathology; these endpoints should be examined in future work to confirm the mechanism suggested by the present biochemical findings.

Overall, these results support the traditional use of *P. pterocarpam* as a medicinal plant and are consistent with its phytochemical profile providing a plausible basis for anti-urolithiatic activity, while indicating that its potency at the doses tested remained below that of the standard drug.

5. CONCLUSION

The alcoholic extract of *P. pterocarpum* (ALEPP) leaves exhibited dose-dependent anti-urolithiatic activity in the ethylene glycol-induced rat model, reducing EG-induced elevations in serum creatinine, calcium and uric acid, with the 400mg/kg dose approaching the effect of the standard drug cystone. These findings support further work to isolate and characterise the responsible phytoconstituents, and to confirm the protective effect using biochemical and renal histopathological endpoints.

DECLARATIONS

Ethics approval and consent to participate

All animal procedures were approved by the Institutional Animal Ethics Committee, V.L College of Pharmacy, Raichur (CPCSEA registration no. 557/PO/Re/S/02/CPCSEA; approval no. VLCP/Phcology/02604), conducted in accordance with CPCSEA guidelines for the care and use of laboratory animals. Not applicable to human/clinical consent.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Anthropic's Claude AI for grammar correction and enhancing readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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REFERENCES

1. Alelign T, Petros B. Kidney stone disease: an update on current concepts. *Adv Urol*, 2018; 2018: 3068365.
2. Edwin Jarald E, Kushwah P, Edwin S, et al. Effect of Unex on ethylene glycol-induced urolithiasis in rats. *Indian J Pharmacol*, 2011; 43: 466-468
3. Hiremath RDB, Jalalpure SS. Effect of hydro-alcoholic extract of *Vernonia cinerea* Less. against ethylene glycol-induced urolithiasis in rats. *Indian J Pharmacol*, 2016; 48: 434-440.
4. Khan SR, Kok DJ. Modulators of urinary stone formation. *Front Biosci*, 2004; 9: 1450-1482.
5. Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran Pathologic Basis of Disease. 8th ed. Philadelphia: Saunders Elsevier; 2010. Chapter 20, The kidney and its collecting system.
6. Okada Y, Kawamura J, Nonomura M, Kuo YJ, Yoshida O. Experimental and clinical studies on calcium urolithiasis: (I) animal model for calcium oxalate urolithiasis using ethylene glycol and 1-alpha (OH)D3. *Hinyokika Kyo*, 1985; 31(4): 565-577.
7. Pearle MS, Calhoun EA, Curhan GC. Urologic diseases in America project: urolithiasis. *J Urol*, 2005; 173(3): 848-857.
8. Pyrah LN. Renal Calculi. London: Springer-Verlag; 1979.
9. Shah JG, Patel B, Patel S, Patel R. Antiurolithiatic and antioxidant activity of *Hordeum vulgare* seeds on ethylene glycol-induced urolithiasis in rats. *Indian J Pharmacol*, 2012; 44: 672-677.
10. Sikarwar I, Dey YN, Wanjari MM, et al. *Chenopodium album* Linn leaves prevent ethylene glycol-induced urolithiasis in rats. *J Ethnopharmacol*, 2017; 195: 275-282.
11. Patel PK, Patel MA, Vyas BA, Shah DR, Gandhi TR. Antiurolithiatic activity of saponin rich fraction from the fruits of *Solanum xanthocarpum* Schrad. & Wendl. (Solanaceae) against ethylene glycol induced urolithiasis in rats. *J Ethnopharmacol*, 2012; 144(1): 160-170.