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Review Article

REVIEW ON AERVA LANATA FOR ANTIUROLITHIATIC ACTIVITY

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ABSTRACT

Aerva lanata (L) A. L. Juss. ex Schultes. (Amaranthaceae) locally known as 'bui' is an erect or prostrate undershrub with a long tap-root and many wolly-tomentose branches, found in the wild, throughout India. In traditional medicine the plant is used in cough, strangury, headache and urolithiasis. The phytochemical constituent present in the plant include alkaloid, flavonoid, methyl grevillate, lupeol, lupeol acetate benzoic acid, β-sitosteryl acetate and tannic acid. Pharmacological studies reported diuretic, anti-inflammatory, hypoglycemic, anti-diabetic, antiparasitic, antimicrobial, hepatoprotective, anti-urolithiasis, antiasthmatic, antifertility and hypolipidemic properties of Aerva lanata. This review article includes the detailed exploration of pharmacological aspects of Aerva lanata in an attempt to provide a direction for further studies.

KEYWORDS: *Aerva lanata, Pharmacology, Antiurolithiatic.*

INTRODUCTION

Aerva lanata (L) also known as Pashanabheda, belongs to the family Amaranthaceae, used for various medicinal uses including both antiurolithiatic and diuretic. The plant is diuretic, used in lithiasis. The root is demulcent, diuretic and useful in strangury. The roots are used in the treatment of headache. The plant is regarded as demulcent on the Malabar Coast [1, 2]. It is valued for cough in Ceylon; also known as vermifuge for children. The Meena tribals of the Sawaimadhopur district of Rajasthan give orally the juice of the roots to patients of liver congestion, jaundice, biliousness and dyspepsia. They also give decoction of the plant to cure pneumonia, typhoid and other prolonged fever [3].

Urolithiasis is the third most common disorder of the urinary tract. The worldwide incidence of urolithiasis is quite high and in north India more than 80% of urinary calculi are calcium oxalate stones alone or calcium oxalate mixed with calcium phosphate [4].

Hyperoxaluria is the main initiating factor of human idiopathic calcium oxalate (CaOx) stone disease. Oxalate is a powerful crystallization-driving factor present in the urine. Retention of which enhances cell injury and causes early stages of lithogenesis [5].

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Anti-urolithiatic agents are used to reduce / dissolve the kidney stone precipitates, caused by chemical, crystalline and amorphous substances. The deposits may originate from the blood cells or from the renal tract casts or accumulation of foreign substances in urinary tract, which are involved in formation of kidney and urinary bladder stones. The term calculus is synonymous with uroliths, stones, or crystals, which are painful urinary disorders that start as salt/chemical crystals that precipitate from urine. Under normal circumstances, the urine contains certain substances that prevent crystallization. When urine fails to dissolve deposits effectively in urinary tract, such deposits assume higher proportions which may affect the passage of urine and known as urolithiasis [6].

Anti-Urolithiatic Activity from Plant drug:

Research evidences:

Antiurolithiatic effect of Aerva lanata Linn extract on ethylene glycol: The aqueous extract of Aerva lanata (L) was evaluated for antiurolithiatic activity in male albino Wistar rats. Ethylene glycol (0.75%) in drinking water was fed to all the groups (Groups II-V) except normal control (Group I) for 28 days to induce urolithiasis. Groups II, served as positive control (hyperurolithiatic), Groups III and IV served as curative regimen and received Extract (500 and 1000mg/kg body weight) from 15th day till 28th day once daily by oral route and Group V standard (cystone 750 mg/kg), respectively. Oxalate, calcium and phosphate were monitored in the urine and kidney. Serum BUN, creatinine, and uric acid were also recorded. The aqueous extract of Aerva lanata (L) were safe orally and exhibited no gross behavioral changes in the rats. In hypercalculi animals, the oxalate, calcium, and phosphate excretion grossly increased. However, the increased deposition of stone forming constituents in the kidneys of calculogenic rats were significantly ($P < 0.001$) lowered by treatment with extract. These results confirm that Aerva lanata (L) possess potent

antiurolithiatic activity. The results obtained suggested that the Aerva lanata (L) extract has a potent antiurolithiatic agent [7].

In silico Antiurolithiatic Screening of Aerva lanata (L) Isolated constituents: The isolated compounds from two fractions n-butanol and ethyl acetate of Aerva lanata (L) plant extract using column chromatography were characterized by modern analytical techniques such as IR, HPTLC, NMR and LCMS as Quercetin and Betulin. These two compounds were also studied by In silico technique downloading a protein 2 ETE of Oxalate oxidase from PDB and docked with it. This has generated good docking scores which predicts good inhibitory activity on the enzyme which reportedly responsible for kidney stone formation and good candidates for better Antiurolithiatic activity [8].

Chemical analysis and in vitro evaluation of antiurolithiatic activity of Aerva lanata (Linn.) Juss. Ex Schult.roots: The aqueous extract of Aerva lanata (L) root part was evaluated for antiurolithiatic activity. 1 % aq. extract of *Aerva lanata* was effective in controlling calcium phosphate mineralization where as 5% aq. extract was found to inhibit calcium oxalate and calcium phosphate mineralization. 1% aq. extract was effective in controlling calcium phosphate mineralization to an extent of 68.22% in comparison with calcium oxalate mineralization restricting it to only 36.44%.

On the contrary 5% aq. extract was effective in controlling both types of crystal mineralization; however it had an upper hand in controlling calcium oxalate than calcium phosphate. 5%aq. extract of A. lanata showed maximum activity in inhibiting calcium oxalate and calcium phosphate mineralization to percentage of 68.53% and 58.05% respectively [9].

In-vitro Anti-Urolithiatic Activity of Aerial parts of Aerva lanata (L.) Juss: Various plant species of Aerva lanata (L.) have been reported to possess antiurolithiatic property. In this study aqueous, chloroform, benzene extracts of Aerva lanata (L.) and standard for dissolving kidney stones- calcium oxalate by an in-vitro model. To check their potential to dissolve experimentally prepared kidney stones- calcium oxalate by an in-vitro model for Aerva lanata (L.) and cystone as a standard compound collected from market. Phenolic compound isolated from the benzene and aqueous, flavonoids and steroids from aqueous fraction of the leaf. Aqueous fractions showed highest dissolution of stones as compare to others. Aqueous fraction was more effective in dissolving calcium oxalate (54.5±0.022%). Phenolic and flavonoids fractions of Aerva lanata (L.) were found to be more effective when compared to reference standard-formulation Cystone [10].

Antiurolithiatic activity of natural constituents isolated from Aerva lanata: Ethylene glycol (0.75% v/v) induced urolithiasis model was used to study the antiurolithiatic activity in male Wistar albino rats. The animals were divided into five groups containing six each. Based on the LD_{50} of the plant extract (2000 mg/kg b.w) equivalent dose was calculated from their yield. Two isolated compounds (quercetin and betulin) of A. lanata were screened for antiurolithiatic potentials in calculi induced (ethylene glycol 0.75% v/v) male Wistar albino rats by administering 2 mg/kg b.w/day orally as test dose for 28 days.

The urine volume was found to be significantly increased from 12.76 ± 0.10 ml to 21.35 ± 0.20 ml in the rats treated by quercetin and 21.50 ± 0.21 ml in rats treated by betulin. Urine microscopy revealed significant reduction ($p < 0.001$) in the size of calculi and significantly enhanced ($p < 0.001$) excretion of calcium, oxalate, phosphate, whereas the level of magnesium was increased. SEM of kidney sections has revealed reduction in the calculi in treated animals. Serum analysis has revealed significant reduction in the level of BUN and creatinine in treated rats.

The isolated quercetin and betulin from A. lanata have shown mild diuretic effect as well as antiurolithiatic effect by significantly reducing the size of calculi in the kidneys and enhancing the excretion of calcium, phosphate, oxalate while maintaining the level of magnesium, which is reported to be one of the calculi [11].

In vitro Inhibition of Calcium Oxalate Nucleation by Extract-based Fractions of Aerial Parts and Roots of Aerva lanata: The antiurolithic assay was performed by nucleation method. The analysis revealed the phenolic and flavonoid containing fraction from aerial parts to be the most active (71.01±1.13 %) amongst the different extract-derived fractions compared to the one obtained from roots (54.61±2.30 %). Besides, fluorescence analysis and physicochemical evaluation were carried out according to the official guidelines and supported the quality control of the plant material. Preliminary phytochemical screening of the fractions was also performed and confirmed the presence of various metabolites. Additionally, the content of tannins, total phenolics and flavonoids were also determined spectrophotometrically and found to be comparatively higher in aerial parts (tannin content of 4.34±0.63 mg tannic acid equivalent/g extract, total phenolic content of 127.84±1.50 gallic acid equivalent/g extract and total flavonoid content of 77.61±3.78 rutin equivalent/g extract) than roots (tannin content of 3.03±0.63 mg tannic acid equivalent/g extract, total phenolic content of 98.09±1.10 gallic acid equivalent/g extract and total flavonoid content of 62.81±5.69 rutin equivalent/g extract). Hence, the study aids in screening out the best active extract derived fraction exerting litholytic efficacy, which provides a route to further isolation of lead bioactive compounds contributing to significant antiurolithic potency of this traditionally employed herb of immense pharmacological spectrum [12].

CONCLUSION

Aerva lanata has been ethnomedicinally used as therapeutic agent for a variety of diseases. Moreover, numerous research works have proven its uses beyond the ethnomedical ones in experimental animal [13]. Alkaloid and flavonoids which were isolated from this plant may be responsible for pharmacological activities. Therefore cultivation, collection and further pharmacological exploration of Aerva lanata are essential for further improvement on the treatment towards kidney stone b .By keeping all these evidences we can promote and encourage aerva lanata for further formulation and development.

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