



EXPLORING THE THERAPEUTIC POTENTIAL OF MEDICINAL PLANTS IN MANAGING NEPHROLITHIASIS

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Abstract: Renal calculi, commonly referred as kidney stones, is a common ailment that impacts more than 12% of the world's community. Kidney stones afflict more than 12% of the population in India annually. with certain regions having higher incidence rates. Urinary stones are well-managed by Ayurvedic medicine, which is known for its antiurolithiatic and diuretic effects. This is especially true when using plants from the Pashanabheda group. The incidence, kinds, and potential use of medicinal plants in the management and prevention of urolithiasis are all examined in this study. The article talks about a variety of therapeutic herbs, including *Melia azedarach*, *Aerva lanata*, *Nigella sativa*, *Zea mays*, parsley, roselle, and *Punica granatum*, known for their antiurolithiatic activities. These plants exhibit diverse mechanisms of action, such as increasing urine volume, pH regulation, anticalcifying activity, and antioxidant effects. Calcium oxalate stones, the most common type, can cause excruciating pain, and the mentioned plants show promise in preventing their formation and facilitating their natural passage. The selected plants possess diuretic qualities, inhibit calculi development, and demonstrate antiurolithiatic efficacy. For instance, As *Nigella sativa* contains thymoquinone, which inhibits inflammatory processes, and *Zea mays* acts a diuretic, helping stones to be expelled. Another two herbs that help to stop urinary calculi from coming back are parsley and roselle. this review emphasizes the potential of medicinal plants in managing nephrolithiasis by avoiding the development of stones and facilitating their elimination. Further research and clinical studies are recommended to establish the efficacy and safety of these plant-based remedies for broader use in antinephrolithiatic medications.

IndexTerms - Nephrolithiasis, Medicinal Plants, Ayurvedic Medicine.

I. INTRODUCTION

When hard masses—also referred to as kidney stones—are found in the kidneys, the ailment known as nephrolithiasis are present either in renal calculi or urolithiasis. According to concerned Ayurvedic medicine within India. The Pashanabheda herb cluster proves beneficial in addressing renal calculi. Pashanabheda, derived from Sanskrit, signifies a group of botanicals characterized by their antiurolithiatic and diuretic attributes (Pashana referring to stone, and Bheda meaning break) (Alok et al., 2011).

It has been documented that Ayurveda extensively employs numerous herbal plants for the treatment of urolithiasis. The diverse range of activities exhibited by these herbal plants encompasses litholytic properties, anticalcifying, antibacterial, antioxidant, diuretic, analgesic, and antispasmodic qualities, with none having any negative side effects. In India about 12% of people get kidney stones annually, state Gujarat, Rajasthan, Maharashtra, Punjab, Delhi, and Haryana having the more incidence rates (Patel & Acharya, 2020). It has third most common urinary system condition. Within industrialised nations, 10-12% of people have urinary stones (Thenmozhi et al., 2016).

The designation Pashanbheda has been employed to denote a range of diuretic and related plants, such as *Alternanthera sessalis* and *Aerva* spp. in South India, and *Rotula aquatica* in Mysore, *Ammaunia baceifera* in Kerala, *Bauhinia racemosa*, *Coleus* spp. *Bryophyllum* spp, *Didymocarpus pedicellata*, *Ocimum basilicum* in Bengal, and many others (Chitme et al., 2010). Determining the precise mechanism of action of these medicinal plants is crucial to the creation of safe and efficient antinephrolithiatic medications. The current articles objective is to give a critical evaluation of the role that medicinal plants play in nephrolithiasis management and prevention (Al et al., 2019).

II. PREVALANCE

Urolithiasis affects over 12% of the worlds population, with incidence rates of 15% in Asia, 59% in Europe, and 13% in North America. In India, it is estimated that 12% of the population has urolithiasis, while 15% of people in North India suffer from kidney stones. According to epidemiological research, males exhibit a greater tendency than women to have this ailment. 12% of men and 6% of women within their 20s as well 40s, both are affected by the illness. Men had a recurrent frequency of 70-81 percent, whereas the rate for women is 47-60 percent.

III. HERBAL TREAT CONTAINS A WIDE RANGE OF PHYTOCONSTITUENTS AND UTILISE THE SEVERAL THERAPEUTIC MODALITIES TO HANDLE UROLITHIASIS INCLUDING :

- increases urine volume, pH, and anticalcifying activity (diuretic activity), which aids in the calculus natural passage.
- Maintain equilibrium between the urine inhibitor and promoter of crystallisation, which influences the formation, aggregation, and development of crystals (the action known as crystallisation inhibition).
- reduces the mucin that binds to calculi.
- enhanced renal performance
- reduces the risk of urinary calculi recurring by regulating the imbalance of crystalloid colloid and enhancing renal function.
- Enhance the antioxidant status of the renal tissue, preserve the cell's integrity membranes, and stop recurrence (antioxidant activity)
- Inhibition of ACE and Phospholipase A2
- shows a discernible improvement within the burning micturition, discomfort, and haematuria associated with urinary calculi (analgesic and anti-inflammatory action) (Alok et al., 2011).

IV. CLASIFICATION AND TREATMENT OF NEPHROLITHIASIS

Nephrolithiasis is the name for the ailment that develops when urine becomes very concentrated and its minerals combine with calcium to form crystals (stone). Calculi are broadly categorised into four types:

- 1) **OXALATE OF CALCIUM:** The predominant form of renal calculi is represented by kidney stones composed of calcium oxalate that in fact radioopaque, tiny, dense, and strongly demarcated on radiographs. Their diameters range from 1 to 2 cm.
 - 2) **URIC ACID STONE:** A heavy diet in animal protein can cause uric acid stones, which in fact is problematic along with gouty and non-gouty arthritis because they produce more the urine's uric acid content. Stones creation in this kidney as a result of this concentrated uric acid-containing pee. The utilization of allopurinols leads to a diminished synthesis of uric acid.
 - 3) **STRUVITE STONES:** arise from the disintegration of magnesium ammonium phosphate crystals, often associated with infections in the kidneys and bladder, which raise a pH of pee. This kind of stones are probably generated in women compared to men.
 - 4) **CYSTEIN STONE:** This incredibly rare form of calculus is caused by a uncommon genetic condition called cystine leakage through the kidney and within the urine, resulting in crystals (stones) (Khajuria & Bisht, 2017)
- 70-80% of calcium stone, 40-60% of calcium oxalate monohydrate, 40-60% of calcium oxalate dehydrates Brushite, or calcium hydrogen phosphate, is present in 2-4% (<1%) calcium orthophosphate, Cystine stone (1%), Struvite (1%), Uric acid stone (5-10%), and Xanthine stone (1%), 50-60% Mixed Stones Calcium oxalatephosphate mixture (35-40%), Calcium oxalate and uric acid mixture (5%) (Thenmozhi et al., 2016).
- The most prevalent (80%) type of stones are calcium oxalate (CaOx) stones, which are eventually created by calcium, phosphate, and oxalate deposits and can cause excruciating agony (IDM'HAND, 2022).

V. PARTICULARLY MEDICINAL PLANTS USED TO TREAT UROLITHIASIS:

The chosen therapeutic herbs are those with the ability to both prevent the production of stones and effectively shatter those that have already formed. Plants with diuretic properties aid when eliminating kidney and the urinary tract debris deposits and remnants of stones. also inhibits the development of calculus. The aforementioned plants exhibit the aforementioned characteristics and have potent diuretic and antiurolithiatic activities (Thenmozhi et al., 2016)

1) *Melia Azedarac* (chinaberry tree)

kingdom: plantae
division : magnoliophyta
class : magnoliopsida
order : Sapindales

Melia pertains to the botanical family Meliaceae. Specifically classified as *Melia azedarach*, the taxonomic nomenclature designates her as such (Bscbo-, n.d.)

Getting Raw Drugs Collected

The department of botany at Maria Siddha Medical College and Hospital officially acknowledged the taxonomic identification of the *Melia azedarach* specimen. The foliage in question was sourced from the Tirunelveli District in Tamil Nadu during the month of April in the year 2019. The college received a herb voucher specimen for later use (Antony ArokyarajD, n.d.). *Melia azedarach* is a fantastic diuretic source. Antibiotics, helminth inhibitors, and urolithiatics. Every component of *Melia azedarach* possesses medicinal qualities.

While natural components are less hazardous than modern medications, they may nevertheless have some potential benefits. *Melia azedarach* is an inexpensive and widely accessible medicinal herb. Its antiurolithiatic action is abundant. To bring a medicine with a wide range of effects to the market in the future, more research on humans can be done (Antony ArokyarajD, n.d.)

2) Sirupeelai *Aerva lanata* (Linn.)

It is possible to eat the entire plant, particularly the leaves. You can eat the leaves as a vegetable or add them to soups. The herb is a diuretic in conventional medicine, antihelminthic, antidiabetic, to treat skin diseases, headaches, fractures, spermatorrhoea, coughing and nasal bleeding. Historically, the herb has been used to treat a wide range of ailments, including spermatorrhoea, headaches, skin diseases, burns, wound healing, prevention of bleeding during pregnancy, treatment of burns, breaking down gallstones and kidney stones, spermatorrhoea, coughing, or nasal bleeding. There have also been reports of antiinflammatory, antimalarial, analgesic, as well as calming properties associated with the plant extract (Thenmozhi et al., 2016)

Antiurolithiatic properties:- When Aerial portions of *A. lanata* (2 g/kg) were added to ethylene glycolinduced urolithic rats, the aqueous suspension significantly reduced the amount of enzymes involved in stone production as well as creates a cytoprotective mechanism.

In rats subjected to trial kidney calculi caused by ethylene glycol, the antiurolithiatic effectiveness of an aqueous extract derived from dried *A. lanata* flowers (at a dosage of 3.2 mg/kg) surpassed that of the standard cystone treatment (Thenmozhi et al., 2016)

3) *Nigella sativa* (black seed)

Nigella sativa, belonging to the Ranunculaceae family, harbors alkaloids, fixed oil, saponin proteins, and essential oil within its seeds. The primary constituents of the essential oil comprise thymol, dithymoquinone, thymohydroquinone, and thymoquinone. One of *N. sativa*'s primary ingredients, thymoquinone, is what gives the plant its pharmacological effects, particularly when it comes to treating nephrolithiasis. within a previous study, *N. sativa* decreased in size and quantity of CaOx stones that were placed within rat's kidneys, which was helpful. The cyclooxygenase and 5lipoxygenase pathways can be inhibited by thymoquinone. The ingestion of black seeds has the potential to halt inflammatory processes, indicating a presumed safety for consumption during pregnancy. However, exercising caution is advised against escalating medication intake in larger quantities, as it likely poses safety concerns. It can cause the uterus to contract less forcefully or not at all. There exists a potentiality for *Nigella sativa* to retard the process of blood coagulation, thereby increasing the propensity for bleeding occurrences Black seed also help some peoples having blood pressure and blood sugar levels (Rasool et al., 2022a)

4) Maize (*Zea mays*)

Another name for it is maize silk (*Stigma maydis*). It is included in Gramineae family. This plant is widely distributed throughout Malaysia, North America, China, and India. *Zea mays* hairs efficacy in treating a wide range of illnesses makes it a popular choice and traditional medicinal agent. *Zea mays* contains a broad variety of bioactive substances, such as flavonoids, phenols, tannins, terpenoids, and cardiac glycosides. *Zea mays*'s natural diuretic qualities are why it's utilised to treat renal calculi. This activity is brought about by the saponins and tannins found in the fibre. Urine volume increases due to kidney function reduce urine's salinity levels. Furthermore, the increased volume of urine facilitates the urethra and bladder's ability to expel small stones that may have recently grown in the urinary tract or that may have broken off from bigger calculi pieces. *Zea* may be helpful in the treatment of urinary tract infections. Large amounts of maize should be avoided since they may have negative effects on diabetics, pregnant women, people with hypokalemia, and people with unstable blood pressure (Rasool et al., 2022b)

5) Parsley (*Petroselinum crispum*)

Umbelliferae family includes parsley, It exhibits a broad distribution across Europe, the Mediterranean, and Asia. Parsley seeds function as an antiurolithiatic agent by either augmenting urinary citrate or diminishing serum calcium levels, thereby mitigating urine calcium and CaOx A pH of 4.5 to 5.5 is suitable for CaOx stone. is perfect. Strong anti-CaOx medication parsley can elevate urine's pH to roughly six. Additionally, because parsley is made up of many different substances, including flavonoids, organic acids, and saponins, it has a diuretic effect.

Flavonoids exhibit potential diuretic effects through their binding affinity to adenosine A1 receptors. This binding contributes to an increase in urine volume, consequently reducing nucleation and supersaturation. Individuals with kidney ailments, edema, hypoglycemia, or hypertension should exercise caution in consuming parsley. Moreover, moderate interactions with warfarin and diuretics have been observed in conjunction with parsley (Rasool et al., 2022b)

6) Roselle (*Hibiscus sabdariffa*)

Hibiscus sabdariffa, colloquially known as roselle, is indigenous to Africa and India, falling within the taxonomic classification of the Malvaceae family. The primary bioactive elements within roselle comprise hibiscus anthocyanins, l-ascorbic acid, polyphenols, quercetin, and protocatechuic acid. Integrated into the traditional medicinal practices of Thailand, *H. sabdariffa* demonstrates effectiveness in the therapeutic intervention and prophylaxis of urinary calculi. Clinical trials have elucidated its uricosuric impact, manifesting a noteworthy augmentation in uric acid clearance and/or excretion. Additionally, a concurrent escalation in urine excretion is coupled with a reduction in the renal retention time of oxalic acid.

Furthermore, the usage of the water-based extract from *H. sabdariffa* flowers impedes the crystallization of a substantial constituent of kidney stones, namely calcium oxalate monohydrate (COM). Notably, pregnant women and diabetic individuals likely enjoy a safe consumption of Roselle based on available evidence (Rasool et al., 2022b)

7) Punica granatum (Delima)

Punica granatum is a member of the Lythraceae family. It is also known by the common names Pomegranate, Danimma in Telugu, Dalimbe in Kannada, Anar in Hindi, and Madulai in Tamil. *Punica granatum* has been used traditionally to treat a variety of ailments, such as kidney stones, kidney bleeding, irritable bladder irritation, painful urination, burning feelings, and issues with urine discharge [8]. North Karnataka's districts of Bagalkot and Bijapur are where the *Punica granatum* (PG) fruits were gathered (Rathod et al., 2012). The *Punica granatum* fruits go through uniform grinding and were subjected to shade-drying prior to extraction, with the removal of fat content. Subsequently a hot, continuous solvent extraction process was employed within the temperature range of 40–60 °C, involving both methanol or chloroform as a take out agents. After eliminating all of the solvent with a rotary flash evaporator, the material was made dry in as an example, a Mini Lyotrap LET Scientific Ltd, UK). Calculated in terms of dry weight, the percentage of extract yield for the PG chloroform and methanol extracts was determined to be 3.23% and 5.31%, respectively (Rathod et al., 2012). By mitigating the presence of reactive oxygen species, it exerts a notable influence on averting oxidative damage to renal tubules. Pomegranates assume a central role in the modulation of urea, creatinine, and uric acid levels. Prudence is recommended when administering pomegranates to individuals exhibiting hypotensive conditions (Rasool et al., 2022a).

VI. Conclusion

In conclusion, this comprehensive review underscores the significant therapeutic potential of medicinal plants in managing nephrolithiasis. The examined herbs, including *Melia azedarach*, *Aerva lanata*, *Nigella sativa*, *Zea mays*, parsley, roselle, and *Punica granatum*, exhibit diverse antiurolithiatic mechanisms, such as diuretic effects, pH regulation, and antioxidant activity. These natural remedies show promise in preventing and facilitating the elimination of kidney stones. However, further research and clinical studies are warranted to establish their efficacy and safety for broader integration into antinephrolithiatic medications, providing a valuable foundation for future advancements in renal stone management.

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