



Ethnobotanical Insights into Nephrolithiasis Management

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Abstract

Nephrolithiasis, commonly known as kidney stones, is a prevalent urological disorder that affects millions of people worldwide. Conventional treatments include surgical procedures, lithotripsy, and pharmaceutical interventions; however, increasing attention has been given to the use of medicinal plants as alternative or complementary therapies. This review examines the role of phytotherapy in preventing and treating nephrolithiasis by focusing on plants traditionally used in ethnomedicine and those validated by scientific research. The active compounds present in these plants, such as flavonoids, alkaloids, saponins, and polyphenols, contribute to their efficacy. Additionally, some herbal combinations and formulations derived from these plants have shown promising results in clinical trials for reducing stone recurrence and promoting renal health. This review highlights the potential of integrating medicinal plants into nephrolithiasis management, especially in resource-limited settings where access to advanced medical treatments may be restricted. However, further research is needed to standardize dosages, evaluate long-term safety, and explore synergistic effects with conventional therapies.

Keywords: Nephrolithiasis; Kidney Stones; Phytotherapy; Medicinal Plants; Traditional Medicine

Introduction

Nephrolithiasis, commonly known as kidney stones, is a prevalent urological disorder characterized by the formation of hard mineral deposits in the kidneys. The condition can lead to severe pain, urinary tract obstruction, hematuria, and, in chronic cases, renal damage [1]. The formation of kidney stones is influenced by various factors, including genetic predisposition, dietary habits, dehydration, and metabolic imbalances. Traditional treatments for kidney stones include surgical interventions, lithotripsy, and medications. However, these treatments are often associated with side effects, high costs, and the risk of recurrence. In recent years, the use of medicinal plants for the prevention and management of nephrolithiasis has gained significant attention. Herbal remedies, derived from a variety of plant species, offer natural, cost-effective alternatives with fewer side effects compared to conventional therapies. Many plants have demonstrated diuretic, anti-inflam-

matory, antioxidant, and litholytic properties, making them effective in both preventing stone formation and aiding in the dissolution of existing stones [2].

This growing interest in plant-based therapies is rooted in traditional medical systems such as Ayurveda, Traditional Chinese Medicine, and folk medicine, where medicinal plants have been used for centuries to treat kidney stones. Scientific research is increasingly validating the efficacy of these plants, highlighting their potential role in complementing modern treatments and reducing the recurrence of nephrolithiasis.

In this context, understanding the medicinal plants commonly used in the prevention and management of kidney stones is crucial for developing holistic, integrative approaches to treating this condition. This review explores the properties, mechanisms of action,

and clinical benefits of various medicinal plants used in the treatment of nephrolithiasis [3].

Causes of kidney stone

Kidney stones form when certain substances in the urine become concentrated and crystallize. Various factors can contribute to their formation. Here are the primary causes of kidney stones.

Dehydration

Low fluid intake or excessive fluid loss (through sweating, diarrhoea, or frequent urination) can lead to concentrated urine, promoting crystal and stone formation.

Dietary factors

- **High oxalate intake:** Consuming foods rich in oxalates (e.g., spinach, nuts, chocolate) can increase the risk of calcium oxalate stones.
- **Excess sodium (salt):** High sodium intake increases calcium in the urine, contributing to stone formation.
- **High animal protein:** Diets high in animal proteins (e.g., red meat, poultry, seafood) can increase levels of uric acid and lower citrate, promoting both uric acid and calcium oxalate stones.
- **High sugar intake:** Fructose and sucrose (table sugar) can increase the risk of kidney stones.

Genetic factors

- **Family history:** Having a family history of kidney stones increases the risk.
- **Inherited conditions:** Some genetic disorders, such as **cystinuria** (which causes high levels of cysteine in urine) or **primary hyperoxaluria** (excessive oxalate production), can lead to recurrent stones.

Metabolic disorders

- **Hypercalciuria:** Excess calcium in the urine can lead to calcium oxalate or calcium phosphate stones.
- **Hyperoxaluria:** Excess oxalate in the urine, either due to dietary factors or metabolic conditions, promotes stone formation.
- **Hyperuricosuria:** High levels of uric acid in the urine (often from diets rich in purines) can lead to uric acid stones.
- **Renal tubular acidosis:** A disorder affecting acid-base balance, leading to calcium phosphate stones.

- **Hyperparathyroidism:** Over activity of the parathyroid glands increases calcium levels in the blood and urine, promoting stone formation.

Medical conditions

- **Obesity and insulin resistance:** Both are associated with higher stone risk due to altered urine chemistry.
- **Gout:** This condition causes elevated uric acid levels, leading to uric acid stones.
- **Chronic diarrhoea:** Conditions like inflammatory bowel disease (IBD) or Crohn's disease cause dehydration and loss of bicarbonate, which increases the concentration of stone-forming substances in urine.
- **Urinary tract infections (UTIs):** Infections, especially with urease-producing bacteria, can lead to struvite stones.
- **Cystic kidney diseases:** These structural abnormalities increase the risk of stone formation.

Low citrate levels

Citrate helps prevent stone formation by binding with calcium in the urine. Low levels of citrate (hypocitraturia), which can be caused by metabolic disorders or diets low in fruits and vegetables, increase the risk of stone formation.

Other risk factors

- **Immobility or prolonged bed rest:** This can lead to calcium release from bones into the urine, increasing the risk of calcium-based stones.
- **Gastric bypass or weight loss surgery:** These surgeries can alter digestion and absorption of nutrients, leading to changes in urine chemistry that promote stone formation.

Symptoms of kidney stones

Kidney stones can cause a range of symptoms, depending on their size, location, and whether they are causing an obstruction. Common symptoms include.

Pathophysiology of kidney stones

Pathophysiology of kidney stones involves several factors that contribute to the formation of crystals or stones within the kidneys. These stones are primarily composed of substances like calcium, oxalate, uric acid, cystine, or struvite. Here's a breakdown of the process.

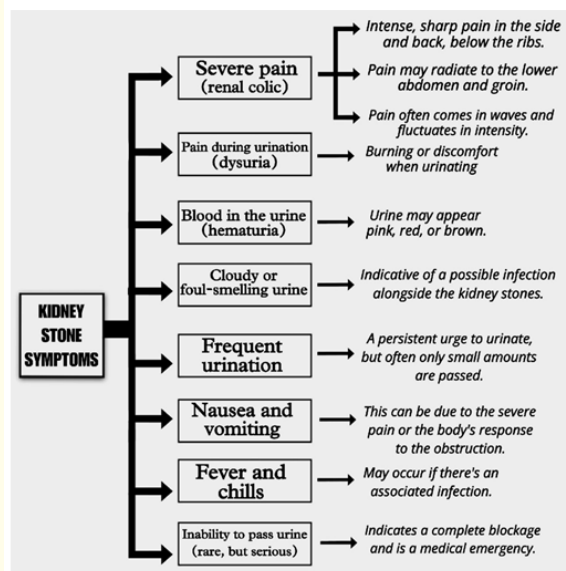


Figure 1: Symptoms of kidney stones.

Supersaturation of urine

- **Imbalance of solutes:** Kidney stones begin to form when there is an oversaturation of certain solutes (like calcium, oxalate, or uric acid) in the urine. Normally, these substances are dissolved and passed out in the urine.
- **Low urine volume or dehydration:** When there is insufficient water intake, the concentration of solutes in the urine increases, leading to supersaturation. This can cause these substances to precipitate out of solution and form crystals.

Crystal formation and aggregation

- **Nucleation:** Once urine is supersaturated with stone-forming solutes, small clusters of these ions form a nucleus, which initiates crystal formation. This can occur in the renal tubules.
- **Crystal growth:** The initial crystals serve as a core that attracts additional ions or molecules, leading to the enlargement of the stone. Factors like pH, inhibitors of crystal formation (like citrate), and promoters (like low levels of magnesium) influence the growth process.
- **Aggregation:** Crystals may also aggregate with other crystals or adhere to the renal epithelium (lining of the kidney), promoting the formation of larger stones.

Retention of crystals

- **Adherence to renal epithelium:** Some crystals get stuck to the renal papillae (the tips of the kidney tubules) or tubules, where they continue to grow. The retention of these crystals can be influenced by local conditions, including changes in the pH of urine, injury to the renal tubules, or inflammatory responses.
- **Matrix theory:** Some stones form around an organic matrix, which consists of proteins and other macromolecules. This matrix serves as a scaffold where minerals accumulate.

Stone growth and movement

- **Stone enlargement:** As the crystals aggregate and grow, they may form a solid mass (a kidney stone). The size and shape of the stone can vary depending on the mineral composition and how long it remains in the kidney.
- **Migration into the urinary tract:** Once the stone is large enough or dislodged, it may move through the urinary tract. If the stone enters the ureter (the tube that connects the kidney to the bladder), it can cause obstruction, pain (renal colic), and other symptoms.

Obstruction and pain

- **Ureteral obstruction:** As the stone moves, it may become lodged in the narrow passages of the urinary tract, such as the ureter. This causes an increase in pressure in the kidney (hydronephrosis) and results in intense pain (renal colic).
- **Inflammatory response:** The presence of the stone may lead to irritation and inflammation of the urinary tract lining, which further exacerbates symptoms like Haematuria (blood in urine).

Risk factors contributing to stone formation

- **Genetic factors:** Some individuals are genetically predisposed to stone formation, especially those with conditions like primary hyperoxaluria or cystinuria.
- **Metabolic abnormalities:** Disorders like hypercalciuria (high calcium in urine), hyperoxaluria (high oxalate in urine), and hyperuricosuria (high uric acid in urine) increase the risk of stone formation.
- **Dietary factors:** High intake of oxalate-rich foods, animal proteins, or excessive salt can promote stone formation.
- **Dehydration:** Lack of sufficient fluid intake concentrates solutes in the urine.
- **Infection:** Some kidney stones, such as struvite stones, are associated with urinary tract infections. Bacteria that produce urease can increase urine pH, facilitating the formation of these stones.

Types of kidney stones and their pathogenesis

- **Calcium oxalate stones:** The most common type, formed due to high calcium and oxalate levels in the urine. Dehydration and hypercalciuria are significant contributors.
- **Calcium phosphate stones:** Form in alkaline urine, often associated with renal tubular acidosis or hyperparathyroidism.
- **Uric acid stones:** Form in acidic urine, commonly seen in individuals with gout or those with high purine diets.
- **Struvite stones:** Associated with urinary tract infections caused by urease-producing bacteria, these stones form in alkaline urine.
- **Cystine stones:** Caused by a genetic disorder (cystinuria) leading to high levels of cystine in the urine.

Diagnosis of kidney stones

- **Medical History and Physical Exam:** Discussing symptoms and history of kidney stones or family history.

Imaging tests

- **CT scan** (non-contrast) is the most effective for detecting stones.
- **Ultrasound** is used in some cases, especially for pregnant women or children.
- **X-rays** (KUB) can detect some stones but are less accurate.
- **Urinalysis:** Detects blood, crystals, or infection in urine.
- **Blood Tests:** To check for levels of calcium, uric acid, or kidney function.
- **Stone Analysis:** If the stone passes, it can be analyzed to determine its composition for future prevention [10].

Complications

Nephrolithiasis, commonly known as kidney stones, can lead to various complications if not managed properly. Here are some potential complications associated with nephrolithiasis:

- **Urinary Tract Infections (UTIs):** Kidney stones can obstruct the flow of urine, creating a conducive environment for bacterial growth, which can lead to infections in the urinary tract.
- **Hydronephrosis:** This condition occurs when urine backs up into the kidney due to a blockage caused by a stone, leading to swelling and potentially damaging the kidney tissue.
- **Chronic Kidney Disease (CKD):** Repeated episodes of nephrolithiasis can contribute to long-term kidney damage, increasing the risk of chronic kidney disease.
- **Acute Kidney Injury (AKI):** Sudden obstruction of urine flow can result in acute kidney injury, characterized by a rapid decline in kidney function.
- **Pain and Discomfort:** The presence of kidney stones often leads to severe pain, known as renal colic, which can significantly impact a person's quality of life.
- **Stone Recurrence:** Individuals with a history of nephrolithiasis are at a higher risk for developing new stones, leading to a cycle of complications and treatment.
- **Sepsis:** In severe cases, particularly if a UTI is present, the infection can spread to the bloodstream, causing sepsis, a life-threatening condition.
- **Renal Failure:** Untreated or recurrent nephrolithiasis can ultimately lead to renal failure, requiring dialysis or kidney transplantation in severe cases.
- **Psychological Impact:** Chronic pain and recurrent episodes of nephrolithiasis can contribute to anxiety, depression, and other psychological issues.
- **Surgical Complications:** In cases where surgical intervention is necessary (e.g., lithotripsy, ureteroscopy, or nephrectomy), there are risks associated with surgery, including bleeding, infection, and injury to surrounding structures.

Prevention and management strategies

To mitigate these complications, it is essential to focus on prevention and management strategies, which may include:

- **Hydration:** Increasing fluid intake to help dilute urine and prevent stone formation.
- **Dietary Modifications:** Reducing intake of foods high in oxalate, sodium, and animal protein.
- **Medications:** Using medications that can help prevent stone formation, such as thiazide diuretics for calcium stones or potassium citrate for uric acid stones.
- **Regular Monitoring:** Keeping track of kidney stone episodes and kidney function through regular check-ups.
- **Education:** Informing patients about the risk factors and lifestyle changes necessary to prevent stone recurrence.

Integrating medicinal plants known for their diuretic and anti-inflammatory properties can also aid in the prevention and management of nephrolithiasis. However, consulting healthcare professionals before using any herbal remedies is crucial for safety and efficacy.

Dietary plants for the prevention of kidney stones

Citrus fruits (Lemons, Oranges, Limes, Grapefruits)

It Contains high levels of citrate, which binds with calcium in the urine and prevents calcium stone formation. Citrate inhibits the crystallization of calcium salts, reducing the risk of calcium oxalate stones. Traditionally it is Consumed in form of lemon water or citrus juice on regularly bases can help increase urinary citrate levels [39].

Cucumbers (*Cucumis sativus*)

Cucumbers contain high level of water and diuretic properties. It Promotes hydration and increased urine output, diluting the concentration of stone-forming substances in the urine. Generally, on regular consumption of cucumbers helps maintain optimal hydration levels, a key factor in kidney stone prevention [46].

Watermelon (*Citrullus lanatus*)

It Consist of High Water Content and rich in potassium, which helps regulate acid-base balance in the urine. Also acts as a natural diuretic, promoting urine flow and helping to flush out small stones and prevent their formation. it is reported that Including watermelon in the diet aids in hydration and supports kidney function [45].

Basil (*Ocimum basilicum*)

Contains acetic acid and is rich in antioxidants. The Acetic acid helps dissolve kidney stones, while antioxidants support kidney health and reduce oxidative damage. the Consumption of Basil juice or tea can help in maintaining urinary health and preventing stones [42].

Celery (*Apium graveolens*)

The celery seeds and stalks are diuretic and rich in beneficial nutrients like potassium and antioxidants. It Promotes increased urine production, which helps in flushing out toxins and small stones, preventing their growth. By adding raw celery to the diet or drinking celery juice is a natural way to support kidney health and prevent stone formation [36].

Dandelion Greens (*Taraxacum officinale*)

They are Rich in vitamins A, C, K, and known for their diuretic properties. it helps increase urine output and removes waste and stone-forming compounds from the body. The consumption of dandelion tea or greens regularly helps maintain kidney health and prevent the formation of stones [37].

Cabbage (*Brassica oleracea*)

They are Rich in fiber, water content, and antioxidants. It Promotes detoxification and supports kidney function by increasing hydration and reducing oxidative stress. Generally, they are including cabbage in the diet can be beneficial for kidney health [45].

Ginger (*Zingiber officinale*)

Ginger Contains anti-inflammatory compounds such as gingerol. It also Reduces inflammation and supports overall kidney function, potentially lowering the risk of stone formation. By drinking ginger tea or adding fresh ginger to meals may help in the prevention of kidney stones [38].

Kidney beans (*Phaseolus vulgaris*)

They contain high in magnesium, which helps prevent calcium oxalate stones. the magnesium in kidney beans helps reduce oxalate levels in the urine, lowering the risk of stone formation. It is Incorporating kidney beans into the diet can help maintain a healthy urinary tract and prevent stones [44].

Apple cider vinegar (ACV)

Apple Cider Vinegar Contains acetic acid. They also Helps dissolve kidney stones and reduces the risk of stone formation by altering urine chemistry. Consuming diluted apple cider vinegar daily may aid in stone prevention [48].

Some medicinal plants have traditionally been used for the prevention and treatment of kidney stones due to their diuretic, anti-inflammatory, and stone-dissolving properties. Here's a list of common medicinal plants that are believed to aid in the treatment of kidney stones.

Tridax procumbens

Effect leaf of *tridax procumben* extract on crystal development has decreased. The final impact of crystal accumulation emphasizes the fact that the plant extract of *tridex procumben* could promptly hold back crystal arrangement, which clearly shows the antilithiatic activity of the plant *Tridax Procumbens*. Stone formation could be a multiplex process containing the crystal nucleation, and the secondary nucleation, fixation within the kidney, and more accumulation and secondary nucleat [47].

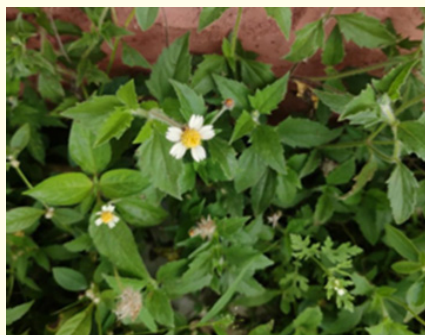


Figure 2: *Tridax procumbens*.

Bryophyllum pinnatum

In Ayurveda, the plant is additionally known as Pasanabheda which means “dissolver of stones”. The leaves of *Bryophyllum pinnatum* are widely utilized in traditional and ethnomedicinal practices for treatment of urinary insufficiency and stone disorders. *Bryophyllum pinnatum* is for the most part known as Pattharcaṭṭa in Indian traditional systems of medication which recommends its stone dissolving power. The current study found that hydro-alcoholic extracts of *Bryophyllum pinnatum* had a beneficial impact in reducing NaOx-induced changes in urine and serum biochemical parameters, oxidative stress and histology of kidney. *Bryophyllum pinnatum* is generally known as Pattharcaṭṭa in Indian traditional systems of medicine which recommends its stone dissolving power. The current study found that hydro-alcoholic extracts of *Bryophyllum pinnatum* had a beneficial impact in reducing NaOx-induced changes in urine and serum biochemical parameters, oxidative stress and histology of kidney [4].



Figure 3: *Bryophyllum pinnatum*.

Nigella sativa

Thymoquinone is constituent of *N. sativa* and responsible for its pharmacological activities particularly for treating nephrolithiasis. In a prior ponder, *N. sativa* had useful effect on CaOx stone kept in rodent kidneys by decreasing the number and size of these stones [5]. Too, thymoquinone contains a significant antioxidant effect by cleaning free radicals and superoxide anion when the stone is kept within the kidney that leads to epithelial tissue damage and production of free radicals and superoxide anions. These items stimulate heterogenic crystal nucleation. The thymoquinone can restrain the cyclooxygenase and 5-lipoxygenase pathways resulting in the inhibition of the inflammatory process. Dark seed appears to be secure in food during pregnancy. Be that as it may, taking bigger medicinal amounts is likely unsafe. It can slowdown or stop the uterus from contracting. Dark seed might slow blood clotting and increase the risk of bleeding. Also, dark seed might lower blood sugar and blood pressure levels in a few people [6].

Punica granatum

Pomegranate has long been utilized in traditional medication. Pomegranate natural product, known as “a pharmacy unto itself” [7], is a rich source of polyphenols, alkaloids, and anthocyanins (flavonoid antioxidants), which are highly capable of scavenging free radicals [8]. All parts of this plant can be utilized in traditional remedies for preventive and therapeutic purposes. Pomegranate seeds were utilized for regulating urine discharge and the burning sensation of urine; its seed oil, juice, blossoms, and peel are utilized for protection against nephrotoxicity [9], and the extracts for renal failure [10] and renal arteries [11]. The anti-hypercalciuria and anti-urolithiasis effects of this plant attracted considerable attention toward pomegranate for utilize within the prevention of renal calculus formation. Its therapeutically beneficial phytochemicals are responsible for muscle relaxation within the urinary and biliary tract; consequently, stones can be effortlessly expelled from the kidney [12].



Figure 4: *Punica granatum*.

Rubia cordifolia

Rubia cordifolia (madder or Indian madder) from the coffee family (Rubiaceae) and has been utilized as a common nourishment colorant. Phytochemical screening of *R. cordifolia* contain different bioactive phytochemicals, including glycosides, triterpenoids, anthraquinones, saponins, quinones, and tannins, which make it beneficial for the treatment of a few diseases such as jaundice, diabetic foot ulcer, and cardiovascular sicknesses. It was found to be effective within the treatment of several kidney illnesses and had preventive impacts on urinary stones [13]. The hydro-alcoholic extract of *R. cordifolia* roots effectively retained the excretion of calcium in ethylene glycol-induced renal stone arrangement in rats, and, more critically, avoided hyperoxaluria and hypocitraturia by diminishing the arrangement of urinary oxalate and directing the re-adsorption of tubular citrate (expanding the level of urinary citrate), individually. The preventive part of this extract against kidney stone arrangement was moreover due to its inhibitory impact on the deposition and development of calcium oxalate crystals by reestablishing magnesium levels, its preventive impact on proteinuria, and its suppressive impact on acid uric excretion. The nephro-protective impact of this medicinal and dietary plant might be to a great extent attributed to its antioxidant properties [13].

Parsely

Petroselinum crispum belonging to the family Umbelliferae is commonly known as an herb, spice, and vegetable, and is broadly distributed in Western Asia, the Mediterranean, and several European nations. Different pharmacological activities, such as antioxidant, anti-inflammatory, diuretic, nephro-protective, enzyme-modulatory, and anti-hypertensive activities, have been reported for this plant [34]. These useful activities may be due to its bioactive constituents, including flavonoids, carotenoids, coumarins, tocopherol, and ascorbic acid. Parsley and its extracts have been utilized potentially as a complementary/alternative treatment for different renal illnesses. *P. crispum* has been utilized as a promising anti-urolithiasis remedy. Its ethanolic extract prevented the nucleation and precipitation of calcium oxalate, urine supersaturation, and urinary protein excretion in a rodent show of calcium stone formation [37]. The high content of chlorophyll and magnesium in parsley may be a reason for its inhibitory effect toward the dehydration of calcium oxalate and hyperoxaluria, respectively [36]. Parsley was found to be effective in controlling urinary pH at a value at which calcium oxalate crystals can be maintained as dispersed particles, and the elimination of these crystals might be facilitated [37].

Shatavari

Shatavari contains many useful compounds like tannic acid, volatile oil, mucilage, saponins, flavonoids, asparagine, sitosterol, sapogenin, and asparagenin. It is useful in removing stones from the urinary tract. Its pharmacological activities are antispasmodic, aphrodisiac, demulcent, antibacterial, diuretic, anti-diarrheal, anti-tumor, expectorant, antiepileptic, galactagogue, stomachic, anti-inflammatory, appetizer, and tonic. It is known in Ayurveda for its benefits to kidney health [39].

Arjuna

Common name is Arjun. Its chemical constituents are arjunetin, friedelin, beta-sitosterol, arjunic acid and ellagic acid. It is utilized in hyperlipidemia and cardiovascular disorder. Its pharmacological actions are hypo-cholesterolemic and cardioprotective. Bark of *Terminalia arjuna* was investigated for its inhibitory effect on calcium oxalate and calcium phosphate crystal formation [40]. Kidney issues Utilization of boiled arjuna tree bark fluid makes a difference to break the kidney stones which will have formed into little pieces and after that eventually flush them out through urine. It works as a good antioxidant so it makes a difference in stopping early aging and help in maintaining body physical make-up. Arjuna is more effective in tuberculosis cough by stop blood in cough and healing the ruptured arteries in lungs. Arjuna maintains normal urine stream and makes a difference in kidney functioning flourishes the therapeutic aspect of bark, roots and leaves. Bark powder Bark powder of arjuna has diuretic properties that remedy cirrhosis [44].



Figure 5: Arjuna.

Chhota Gokhru

Tribulus terrestris (TT) has long been utilized in traditional medication for the treatment of kidney illnesses with advantageous impacts on kidneys, it having several uses like, anti-oxidative, anti-apoptotic, vasodilator, urea depletion, and kidney stone excretion effect. Inquire about has appeared that utilization of 500 or 300 mg/kg TT diminishes the apoptosis record in renal tissue [46].



Figure 6: Chhota Gokhru.

The nitrate content present in seeds and fruit part of the TT plant is responsible for diuretic property. Furthermore, the aqueous extract of TT plant contains potassium salt in high concentration. It is used in Ayurveda for urinary tract health and to treat kidney stones. Also acts as a diuretic and helps in breaking down stones, especially when combined with other herbs [31].

Crateva nurvala

Part of plant used are roots. Common known as Varuna. Its chemical constituents are triperpenoids, flavonoids, glucocapparine, betulinic acid, cadabicine, glucosilinate, ceryl alcohol, lupeol, and flavonoids. It is utilized in dysuria, amoebic diarrhea, renal illnesses, and swollen gums. Its pharmacological used as lubricant, diuretic, and lithotriptic. Urolithic property of *Crataeva nurvala* has been reported [21]. The medicate Varuna inhibit the stone formation due to the anti-lithogenic action and the anti-crystallization property. The drug diminishes the urinary pH toward acidic. The diuretic activity of this drug properties the metabolic correction of the serum and urinary electrolyte levels.

Abutilon indicum

The mainly part of plant used are leaves, root, flower, seed, and bark. Common name is Indian mallow. Its chemical constituents are cineole, geraniol, and tocopherol oil. It is utilized in diabetes mellitus, liver disorders, and degenerative illnesses. Its pharmacological activities are hypoglycemic, antibacterial, analgesic, anti-inflammatory, hepatoprotective, and antioxidant [22].



Figure 7: *Abutilon indicum*.

Common nettle

Urtica dioica or "Stinging Nettle", which belongs to the nettle genus of Urticaceae family, is used as tea in Austrian medicine [32,33]. Herbal therapy, stinging nettle is utilized to treat urinary tract infections. The utilize of nettle leaf as a supportive therapy in patients with lower urinary tract infections (together with immunological and antibacterial treatment) and to prevent and treat the formation of urinary stones has been approved by researchers. It was too said to be utilized in Greece as a urinary assist and as an astringent for the treatment of kidney stones. It has shown a long history of beneficial therapeutic effects toward urinary ailments, particularly with the urinary tract and kidney stones. Its major bioactive phytochemicals include flavonoids, anthocyanins, and saponins [32]. These phytoconstituents provide the possibility of inhibition of calcium and oxalate statement and crystals growth. Supplementation of the methanolic extract *U. dioica* to rats with kidney stones (induced by ethylene glycol and ammonium chloride) was found to be associated with decreased urinary creatinine level and reduction of supersaturation of lithogenic enhancing agents. This extract potentially dissolved the lithiasis and overcame the hyperoxaluria and crystalluria induced by ethylene glycol [33].

Saffron

Saffron and its constituents may diminish and inhibit several types of renal disease such as kidney stones, nephrotoxicity, renal ischemia reperfusion, etc. Antioxidant activity of saffron may diminish lipid peroxidation products and anticipates renal diseases. Saffron could be a medicinal herb with lower toxicity on normal body cells [23]. Another mechanism about kidney stone and saffron appeared that oxalic acid metabolism and hyperoxaluria can be diminished by saffron administration. which are risk factors of kidney stone formation. Saffron and its compounds also diminished the development of renal failure and oxidative stress. Melondialdehyde (MDA) content increases the lipid peroxidation which was lowered by administration of saffron extract additionally makes a difference to prevent renal damage initiated by lipid peroxidation [24].



Figure 8: Saffron.

Maize

Corn silk is a rich source of potassium, soothing, relaxing diuretic and a superb cure for acute irritation of the urinary system, such as cystitis, urethritis and prostatitis. Too making a difference the section of urinary stones. Corn silk encourages urination, while the potassium in the herb balanced potassium loss caused by increased urination. It contains flavonoids (maysin), Estrangement, Alkaloids, Saponins, Volatile oil, Mucilage, Vitamins B, C and K, Silicon. It also has direct sums of Iron, Zinc, Potassium, Calcium, Magnesium and Phosphorus. Corn silk works basically within the urinary tract. The saponins generally act as an anti-inflammatory within the body and the Allentown as a recuperating agent, with the mucilage giving a demulcent or relieving impact to irritated tissues. The potassium balances out the diuretic impact of the herb, which is utilized in conditions of water retention. Their combined activity is useful for a number of urinary tract conditions, such as cystitis and prostatitis. Vitamin K is a fat solvent vitamin that is basic for blood clotting inside the body [26].



Figure 9: *Zea mays*.

Punarnava

The extract of *Boerhavia diffusa* was found to have a maximal “diuretic dose-response relationship” at 300 mg/kg (verbal). The test medicine also illustrated a maximum increase in urine volume and electrolyte excretion. *Boerhavia diffusa* Linn. expanded urination, hurried the process of killing the built-up crystal deposits, improved renal function by improving the removal of nitrogenous waste items, and decreased oxalate excretion most likely by interfering with digestion system. All of these activities together contribute to *Boerhavia diffusa* Linn’s anti urolithiatic properties [30].

Khella baladi

The decoction and/or powdered plant has been traditionally used for the treatment of renal colic, mild anginal symptoms, treatment of abdominal cramps. It is also employed as a supportive treatment for mild obstruction of the respiratory tract in asthma or spastic bronchitis, and postoperative treatment of conditions associated with the presence of urinary calculi. The plant and its extracts are also popular in the treatment of vitiligo and psoriasis, and are used as a lithotriptic agent. It is generally used to dilate bronchial, urinary, and blood vessels without affecting blood pressure. It is also internally used as an emmenagogue to regulate menstruation, as a diuretic, and in the treatment of vertigo, diabetes, and kidney stones. An infusion of the aerial parts has also been used to treat headaches [27].

Raspberry

Raspberry (*Rubus idaeus*, from the Rosaceae family), could be a commercial fruit crop grown in various European and Mediterranean countries and has been broadly utilized for dietary and therapeutic purposes.

Raspberry has been found to be capable of removing stones from the urinary tract even after acute administration. The prophylactic effect of raspberry on calcium oxalate renal stone formation has been reported. Its aqueous extract applied significant preventive effects on the deposition and precipitation of calcium oxalate within the kidney and eliminated the calcium oxalate matrix. The generation of malondialdehyde (MDA) and protein carbonyls was smothered in raspberry-treated creatures with decreased levels of urinary calcium and phosphorus. The presence of polyphenols and modification within the level of stone formation inhibitors (such as citrate, magnesium, and glycosaminoglycans) may be involved within the mechanism by which raspberry inhibits the growth of calculus. The methanolic extract of raspberry was found to be a strong diuretic by impression inhibiting the activity of aldosterone or epithelial sodium channels [28].

Roselle

Based on Thai traditional medication, *Hibiscus sabdariffa* is utilized for the prophylaxis and treatment of urinary stones. It has been found that the main active constituents of this plant include polyphenols, hibiscus anthocyanins, as well as L-ascorbic acid, quercetin, and protocatechuic acid. The aqueous plant extract had illustrated antiurolithiatic action due to the decreased deposition of stone-forming constituents within the kidneys and serum of ethylene glycol-induced urolithiatic rats. Besides, the plant extract had an antilithic impact on rats on a glycolate diet through the decrease in oxalate maintenance time within the kidneys and more excretion into urine. A clinical trial—which had tested a cup of tea made from 1.5 g of dry *H. sabdariffa* two times day by day on 18 patients for 15 days—revealed uricosuric impact and significant increase in uric acid excretion and clearance [29].

Cymbopogon citratus (Lemongrass)

This plant is widely known for its diuretic effect, often used to flush out toxins and promote urination. It possesses effects like stimulates urination, which helps in the expulsion of kidney stones. Its traditional name in Saudi Arabia is Izkhir, Athkhar, camel grass or Otrah, and is utilized within the people medication of Saudi Arabia for the treatment of gastrointestinal afflictions, insomnia, fever, stiffness antipyretic, anti-malarial, and antihelminthic renal antispasmodic and narcotic as well as a diuretic to avoid the formation of kidney stones [41].

Cucumis melo (Muskmelon or Cantaloupe Seeds)

The Muskmelon used in traditional remedies to promote kidney health. It acts as a diuretic, aiding in flushing out kidney stones and toxins from the body. *Cucumis melo* is effectively used for different organ diseases including heart, gastrointestinal and genitourinary problems, as *Cucumis melo* seeds are wealthy sources of many different phytoactive compounds such as triterpenoids, flavonoids, alkaloids, Grass and others. These components exhibit effective diuretic, lithotriptic and litholytic activities. prevention of progression of crystallization can prevent the stone formation for beyond any doubt [40].

Elymus repens (Couch Grass)

It is commonly used in traditional European medicine to treat kidney stones. It has a diuretic effect and helps reduce the risk of stone formation. Couch grass is utilized as a relaxing diuretic and to diminish pain and spasm within the urinary tract. It is also used in the control of side effects (cystitis, urethritis, prostatitis) of urinary infection, prostate infection, rheumatism, kidney stones and

urinary diseases in children with urinary system infections such as enuresis and urinary incontinence. Couch grass has also been utilized to clear the urinary tract during diseases due to its diuretic and antimicrobial effects [42].

Allium sativum (Garlic)

The garlic has various medicinal properties, including those that benefit kidney health. It also acts as an antioxidant and helps to prevent kidney stone formation by reducing oxidative stress [50].

Ocimum basilicum (Holy Basil)

It has often used in Ayurvedic medicine for kidney stone treatment. Holy basil also helps in maintaining kidney health and has diuretic properties that aid in expelling stones. The chemical constituents which have been separated from the plant include terpenoids, alkaloids, flavonoids, tannins, saponin glycosides, and ascorbic acid. Ordinarily, basil has been utilized as a medicinal plant in the treatment of migraines, coughs, diarrhea, obstruction, warts, worms, and kidney malfunctions. The consideration of the urinary chemistry with respect to the stone-forming minerals will give a great sign of the risk of stone arrangement. From the think about results, it is watched that hydroalcoholic extract appear the highest disintegration of calcium oxalate [43].

Conclusion

Medicinal plants offer promising potential for the prevention and management of nephrolithiasis (kidney stones). Numerous plants, such as *Tridax procumbens*, *Punica granatum*, *Abutilon indicum*, and Roselle, have demonstrated diuretic, anti-lithogenic, and antioxidant properties, which are crucial for dissolving existing stones, preventing stone formation, and improving overall kidney health. These plants often work by influencing urine composition, inhibiting crystal aggregation, or promoting stone expulsion. However, while traditional medicine and herbal treatments have been widely used for centuries, more rigorous clinical studies are needed to fully substantiate their efficacy and safety. Patients should consult healthcare providers before using these remedies, particularly because the interactions with conventional medications and individual health conditions need to be carefully considered. Incorporating medicinal plants into nephrolithiasis management could offer a more holistic, cost-effective, and accessible approach to addressing this condition, especially in regions where modern medical treatments may be less available. Integrating these herbal remedies into formal therapeutic protocols, backed by standardized dosages and quality control, could advance nephrolithiasis treatment while offering a more natural, patient-friendly approach to care.

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