

Exploring the Potential of Medicinal Plants in Preventing and Treating Kidney Stones: An Anti-Urolithiatic Perspective

¹Adarsh.M , ²Dr.R.Nethaji, ³Dr.Vimal KR

¹Primary author, ²professor and head, ³Associate professor

Department of pharmaceuticals

Devaki amma memorial college of pharmacy

Near calicut university, chelembra-673634

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ABSTRACT

Kidney stone formation is a acute in some places that they are called stone belts . The most prevalent and widespread disease in the world .None of the known and available treatments prevent the reoccurrence of kidney stone formation .The present review discuss the causes ,cure and treatment of kidney stone formation .Herbal extract may prevent stone formation because of many reason like they may have diuretic activity ,crystallization inhibiting activity .There are some general measures of prevention of kidney stone formation.

I. INTRODUCTION

Urolithiasis is the process of formation or deposition of calculi in the urinary tract, which is considered as third most common disorder estimated to occur in around 12% of the global population world wide .[1]

The formation of calcified renal stone is a physicochemical event leading to crystal nucleation , aggregation and growth assisted by many biological process including urine volume , PH , increased calcium oxalate or sodium oxalate ,and urates .At present over 90%

Upper urinary tract patients have been treated according to the size, type, and position of stones with a success rate 68 to 86 %

The large number of people nearly 4-5% of the human population suffer from urinary stone problem all over the globe .[2]Kidney stone formation is a complex that results from succession of several physicochemical events including supersaturation ,nucleation , growth,

Aggregation and retention within the kidneys. Urinary stones affect 10-12% of the population in industrialized countries .

In ayurvedic system of medicine in india , plants which belongs to ‘pashanabheda ‘ Group are

claimed to be useful in the treatment of urinary stones .pashanabeda is the sanskrit term used for plants with diuretic and antiurolithiatic activities

Drug with multiple mechanisms of protective action may be one way forward in minimizing tissue injury in human disease .[3]

Herbal medicines contain several phytoconstituent and exert their beneficial effect by multiple mechanisms like.

- By increasing the urine volume , pH and anti-calcifying activity (diuretic activity)helps in spontaneous passage .
- By improving renal function
- Regulation of oxalate metabolism
- Exerts significant anti infective action in against the major causative organisms (antimicrobial activity)

Some plants and plant products with anti urolithiatic activity



Rats were used to study the impact of C. **nurvala bark** decoction on calcium oxalate urolithiatic caused by 3% glycolic acid. By decreasing the action of the live enzyme glycolic acid oxidase, the decoction demonstrated

remarkable effectiveness in avoiding the buildup of calcium and oxalate in the kidney. The levels of intestinal NaZ, KZ-ATPases were observed to be rapidly and effectively decreased by treatment with *C. nurvala* bark decoction.[4]



In a rat model of urolithiasis generated by administration of calcium oxalate seed into rat bladders, **Phyllanthus niruri** inhibits crystal formation. Higher levels of glycosoamino glycans incorporation in calculi could be the cause of the effect[36]. *P. niruri* extract (0.2 mg/ml) was added to unfiltered urine samples from Wistar rats and healthy humans in order to induce calcium oxalate precipitation. The results of these in vitro investigations revealed that the extract may prevent the formation of early stages of stones[6]



Plectranthus amboinicus Lour

The fresh juice of Leaves of *Plectranthus amboinicus* Lour. is effect against renal calculi particularly of calcium oxalate origin induced by administration of 1% ethylene glycolated water[7]

- The aqueous extract of **Melia azedarach** Linn. was studied against ethylene glycol induced nephrolithiasis in male albino wistar

rats. The aqueous extract of *M. azedarach* reduced urinary calcium, oxalate, phosphate and elevated urinary magnesium levels and urine volume[8]

- Experimental studies carried out on *Crataeva nurvala*, *Tribulus terrestris* and *Dolichos biflorus* showed them to be effective in preventing the deposition of stone material on glass beads in the urinary bladder of rats. All the three plants were shown to dissolve phosphate type of calculi in an in vitro model, where as oxalate, uric acid and cystine stones were not dissolved by *C. nurvala* and *D. biflorus* extracts. *T. terrestris* dissolved uric acid and cystine stones to some extent. Clinical studies carried out on *C. nurvala* showed that it changes the urinary chemistry of patients and thus it reduces the Lithogenic potential[9]
- *Costus spiralis* is extensively used in Brazilian folk medicine for expelling urinary stones. Aqueous extract of *C. spiralis* when used at a dose of 0.25 and 0.5 g/kg / day for 4 weeks significantly reduced the growth of calcium oxalate calculi in the urinary bladder of rats[10]
- Investigations on the effect of *Ammi visnaga* seeds on kidney stones revealed that the antilithiatic effect is mainly because of highly potent diuretic activity and amelioration of uraemia and hyperbilirubinemia by seeds of *Ammi visnaga*[11]



Aerva lanata

The effectiveness of the two Siddha medications **Aerva Lanata** and Vediuppu Chunam as antilithic medicines was investigated in rats

using a model of urolithic rats that contained 0.75% ethylene glycol in drinking water[12].



Moringa oleifera

- The Moringa oleifera Lam. root wood extracts, both aqueous and alcoholic, significantly decreased the increased urinary oxalate levels, demonstrating a regulatory impact on endogenous oxalate production in hyperoxaluria caused by ethylene glycol.[13]
- The aqueous extract of Raphanus sativus showed antilithiatic activity on implants of calcium oxalate crystals or zinc discs in the urinary bladder of rats. The effect however is unrelated to increased diuresis or to a change of the muscarinic receptor affinity of the bladder smooth musculature to cholinergic ligands[14]

Anti-urolithiatic activity of extracts

To cause calcium oxalate urolithiasis, an ethanol and ammonium chloride-induced hyperoxaluria model was used. Six animals each made up each of the twelve groupings made up of 72 total animals. Group 1 acted as the control group and received 1ml/kg of distilled water.[15]

All of the remaining groups underwent a 28-day calculi-inducing treatment regimen consisting of 0.75%v/v ethylene glycol with 1%w/v ammonium chloride in drinking water ad libitum for three days to speed up lithiasis, followed by 0.75%v/v ethylene glycol alone for 25 days.

Group II served as the induction control group and received 1ml/kg of distilled water. From the first day to the 28th day of calculi induction, groups III to XII, which functioned as test groups, received the extracts at doses of 100 and 300 mg/kg, respectively.[16]

Collection and analysis of urine

All of the animals were housed in separate metabolic cages on the 28th day of the calculi induction treatment, and 24-hour urine samples were taken. The following parameters were assessed in the collected urine samples.

Urine volume

Urine output For 24 hours, the animals were kept in separate metabolic cages. Using a measuring cylinder, the total volume of urine was recorded in milliliters (ml).[17]

TREATMENT OF KIDNEY STONE

NATURAL TREATMENT

Most small kidney stone wont require invasive treatment .you may be able to pass a small stone by:

Drinking water

Drinking water.drinking as much as 2to 3quarts (1.8to 3.6 liters)a day will keep your urine dilute and may prevent stones from forming .drink enough fluid -ideally mostly water to produce clear or nearly clear urine.

Pain relievers .

Passing small stone can cause some discomfort .to relive mild pain ,your doctor may recommended pain relievers such as ibuprofen (advil,morten)or naproxen sodium (aleve).

Drink lemon juice

Lemons contain citrate, which helps break down calcium deposits and slow the growth of kideny stones.

A 2019 Cross sectional study found that sugar free lemon juice was an effective remedy for kidney stones.in addition ,lemon juice contains citrate which reduces the amount of calcium in the leading to a lower risk of kideny stones.

Manage weight

A 2019 study showed that out of 146 people with recurring kideny stones.43.8% had obesity or overweight.

Although this does not suggest causally the research indicates there may be a link between weight and kideny stones.in addition the study authors believe that metabolic conditions such as high cholestrol and high blood pressure may contribute to kideny stone formation .

Avoid sugary or caffeinated drinks

Carbonated, caffeinated and alcoholic drinks can increase a person's risk of developing stones. Research from 2020 suggests that drinking caffeine can increase the risk of stones. In addition, drinks and sodas that contain natural or artificial sugars can also lead to kidney stones.[18]

Try wheat grass juice

Wheatgrass is younger grass of wheat used in juices or powder for humans and animals to eat. It contains nutrients and antioxidants that benefit health.

According to a 2017 study, wheatgrass extract inhibited crystal growth by 88% during the initial formation.

TREATMENT AND SURGERY

Alpha blockers: these drugs relax the ureter, alleviating painful spasms and helping the stone pass.

Calcium channel blockers: these drugs widen the ureter, helping the stone pass through.

Lithotripsy: this procedure uses sound waves to break the stone into smaller fragments that can pass more easily.

Kidney stones larger than 6mm require immediate surgery. A stone this large can stick in the ureter [19]

Most advanced treatment

Using sound waves to break up stones

For certain kidney stones depending on size and location, a doctor may recommend a procedure called extracorporeal shock wave lithotripsy.

ESWL uses sound waves to create strong vibrations (shock waves) that break the stones into tiny pieces that can pass in urine.

Using scope to remove stones

To remove a smaller stone in your ureter or kidney, your doctor may pass a thin lighted tube (ureteroscope) equipped with a camera through your urethra and bladder to your ureter.

Percutaneous nephrolithotomy

(PCNL): this procedure involves a small incision in the back to access the kidney and remove larger kidney stones using special tools.

Kidney homogenate analysis

The abdomen was cut open to remove both kidneys from each animal. Isolated kidneys were cleaned of extraneous tissue and rinsed in ice-cold physiological saline. The left kidney was finely minced and 10% homogenate was prepared in Tris-HCl buffer (0.02 mol/l, pH 7.4). The

homogenate was used for measurement of various biochemical parameters.[21]

Regulate oxalate metabolism

Hyperoxaluria is a most significant risk factor in the pathogenesis of renal stone. It has been reported that oxalate plays an important role in stone formation and has about 15-fold greater effect than urinary calcium. Increased oxalate concentration is responsible for precipitation and deposition of CaOx crystals. Aqueous extract of *Tribulus terrestris* interferes with the metabolism of oxalate in male rats fed sodium glycolate.

Glycolate feeding results in hyperoxaluria as well as increased activities of oxalate synthesizing enzymes of the liver i.e., glycolate oxidase (GAO), glycolate dehydrogenase (GAD) and lactate dehydrogenase (LDH) and decreased kidney LDH activity.[20] *T. terrestris* administration to sodium glycolate fed rats produced a significant decrease in urinary oxalate excretion, and a significant increase in urinary glyoxylate excretion, as compared to sodium glycolate fed animals and similar results were observed for *Aerva lanata*.

Improve renal function

In urolithiasis, the Glomerular Filtration Rate (GFR) decreases due to the obstruction to the outflow of urine by stones in the urinary system, due to these waste products, particularly nitrogenous substances such as urea, creatinine and uric acid get accumulated in blood[19]. Herbal therapy improves the renal function by increasing the excretion of urea and creatinine. Most of the phytotherapeutic agents exert their antiurolithiatic effect through this mechanism. *Moringa oleifera* and *Rubia cordifolia* significantly lower serum levels of accumulated waste products BUN and creatinine is attributed to the enhanced GFR[22].

Clinical and pharmacological studies

In recent few years a number of proprietary composite herbal drugs have also been introduced for dissolving kidney calculi of which mention may be made *Cystone* [20] (Himalaya drug Co. Bombay) and *Calcuri* (Charak Pharmaceuticals Bombay). These drugs are commonly used in India. *Saxifraga ligueata* and *tribulus terrestris* are the two common plant ingredients of both these herbomineral preparations. Ureteric calculus disappeared within 55 days of treatment with *Cystone*, a herbal mineral composition [21]. *Cystone* works by relaxing the detrusor muscles and increasing the

diuresis by virtue of its high content of natural mineral salts. Cystone has also been found to be useful in urolithiasis ,crystalluria and urinary tract infection.

II. DISCUSSION

The antiurolithiatic activity of medicinal plants refer to their ability to prevent or treat the formation of kidney stones, known as urolithiasis .

Urolithiasis is a common condition characterized by the formation of solid masses in the urinary tract , usually composed of calcium , oxalate , uric acid , or other substance

Various medicinal plants have been traditionally used in different parts of the world to treat urolithiasis .These plants often contain bioactive compounds that possess anti-inflammatory ,diuretic , antioxidant ,and antispasmodic properties ,which may help in preventing the formation of kidney stones or promoting their dissolution and elimination .

Several studies have investigated the effect of medicinal plants on urolithiasis in both animal models and human trials. These studies have shown promising results ,indicating the potential of these plants as alternative or complementary therapies for urolithiasis .another study investigated the effects of the aqueous extract of tribulus terrestris on calcium oxalate stone formation in rats .the extract was found to inhibit the crystallization of calcium oxalate and decrease the deposition of stone forming substance in the kidneys .

III. CONCLUSION

Medicinal plants have shown potential in preventing or treating urolithiasis due to their anti inflammatory ,diuretic ,antioxidant ,antispasmodic properties .However ,more research is need to full establish their therapeutic potential and determine their optimal use in the management of kidney stone.

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