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Review Article

Herbal Drug Use to Treat Urolithiasis: An Updated Review

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Abstract

World Health Organization (WHO) estimates that 12% of the world's population suffers from urolithiasis, a disorder that causes stones to develop in the kidney, bladder, and/or urethra (the urinary system). The illness increases the likelihood of developing chronic renal illnesses in addition to impairing kidney function. Three phases make up the mechanism for the production of stones: nucleation, growth, and aggregation of crystals. Because of their medicinal and antioxidant properties, as well as their active substances, medicinal plants have positive benefits on human health. The traditional medicinal herbs' diuretic qualities are increasingly being backed by scientific research. Urinary calculi patients complain of hematuria, discomfort, or infection. Individuals with tiny, non-obstructing stones or staghorn calculi have moderate, easily managed symptoms in addition to other symptoms. The illness increases the likelihood of developing chronic renal illnesses in addition to impairing kidney function. Therefore, a plant's or a herbal formulation's antiurolithiatic effect may be the result of a combination of its antioxidant, diuretic, and crystallization-inhibiting **properties.**

Keywords: Urolithiasis, diuresis, herbal drug, calcium oxalate stone

Introduction

Urolithiasis, from the Greek ouron, meaning "urine," and lithos, meaning "stone," refers to the state of the urinary system when stones are created or found.[1] The physiochemical alterations in renal function that cause supersaturation, nucleation, growth, aggregation, and retention mechanisms to occur are often the cause of crystal formation. The majority of disorders that are linked to kidney stones include type 2 diabetes mellitus, hypertension, blood pressure, and, in certain circumstances, obesity and arthritis.[2] Without intervention, stone formation has a very high probability of recurrence following a first stone. They come in a variety of forms, the most popular of which are calcium oxalates; other forms include magesium ammonium phosphate (struvite), uric acid, or cystine. There are several steps involved in the pathophysiology of calcium oxalate stone formation, including nucleation, crystal development, crystal aggregation, and crystal retention. Stone formation has been linked to low urine volume, low urine pH, calcium, salt, oxalate, and urate.[3] Calcium-containing kidney stones might be calcium phosphate, calcium oxalate, or a combination of phosphate and oxalate. Urinary stone treatment often involves crusher, medication therapy, and surgery. Research indicates that traditional medicine, including herbal medications, is used by individuals in various cultures and countries to treat kidney stones.[4] Herbal remedies are rich in phytoconstituents and work to treat urolithiasis through a variety of processes, including: Relieves calculi's binding mucin (lithotriptic action), oxalate metabolism regulation, Maintain a balance between the crystallization promoter and inhibitor in urine to influence crystal nucleation, aggregation, and growth (the action known as crystallization inhibition), as well as the inhibition of ACE and phospholipase A2.[3] In order to dissolve calculi in the kidney and bladder, the commercially available composite herbal formulations cystone (himalaya drug company, India), calcuri (charak pharmaceuticals, bombay, India), and chandraprabha bati (baidyanath, India) have been utilized extensively in clinical settings.[3] Kidney stones are more common in Iran (5–10%), Italy (3.1%), the US (12%), Germany (6.8%), the UK (3%), and Sweden (9.5%).[4] Herbs are regarded as a rich source of traditional knowledge and have long been acknowledged for their alleged therapeutic benefits. Many medicinal plants have been used for a variety of diseases all throughout the world.[5] Additionally, polyherbal mixtures have shown to be far more beneficial than single herbs[6]. These days, herbal

medications are sold in a variety of dose forms, including syrups, tablets, and capsules. Even yet, further investigation is required to fully comprehend the fundamental ideas and effective mechanisms of action of every plant that reduces kidney stones.[2] In this article , we will discuss about an updated review on herbal drug use to treat urolithiasis.

Analysis of stone

Following Shock Wave Lithotripsy, Ureteroscopy, and Percutaneous Nephrolithotomy surgery, stone analysis must be reviewed. As a result, the stone is sent for examination following its surgical removal. Following the stone's examination, the stone's calcium, uric acid, and other compositions are examined. Ultrasonography has been determined to be the most effective approach for diagnosing kidney stones since it can precisely describe the size and position of the stone in the kidney or urinary tract.[2]

Kidney Functions

The bladder, urethra, and ureters—the two main kidneys that resemble beans—make up the urinary system. These kidneys, which resemble beans, are situated beneath the pairs of ribs and in the center of the back. The kidneys' primary job is to filter excess water and waste from the blood and turn it into urine. Urine is expelled from the body by the bladder through the urethra.[6]

Sign and Symptoms

Urinary calculi patients complain of hematuria, discomfort, or infection. Individuals with tiny, non-obstructing stones or staghorn calculi have moderate, easily managed symptoms in addition to other symptoms.[1]

Self-passing of stone by urine

The size of the kidney stone usually determines whether or not it passes through the urine. Smaller stones are readily removed and don't require medicine of any kind. Stones pass through normal passageways such that the discharge of the stone is not even noticed. Overconsumption of water is defined as the daily requirement of more than five liters.[2]

Herbs

Senna septemtrionalis (Viv.) (Fabaceae Family)

Prostaglandins and nitric oxide are probably involved in the diuretic actions of S. septemtrionalis extract. D pinitol was the primary component of the ethanol extract of S. septemtrionalis, according to a chemical study performed using the gas chromatography mass spectrometry technique (GC/MS).[5,7]

Lemon and olive oil

Mix lemon juice with olive oil (Olea europeae: Family: Oleaceae). The citrate in the lemon juice will aid in dissolving the stones. Kidney stones can be easily transferred from the kidney to the bladder by using olive oil. To stop kidney discomfort, drink pure olive oil and fresh lemon juice with added sugar. Lemon juice aids in preventing the development of kidney stones.[6]

Kalanchoe pinnata (Lamk.) (Crassulaceae)

It belongs to the family Crassulaceae and is a succulent plant. The K. pinnata ethyl acetate fraction's strong diuretic impact is probably caused by the large amount of flavonoids and polyphenols it contains. Quercetin, kaempferol, epigallocatechin gallate and apigenin, are the main bioactive chemicals of *K. pinnata* leaves, according to chemical analysis.[5,8]

Orange and pomegranate

Juice from (*Punica granatum*) L. has also been demonstrated to be useful in avoiding the development of stones. Because of its astringent qualities, pomegranate also lessens the risk of kidney stones by eliminating toxins from the kidney and reducing urine acidity.[6]

Ocimum sanctum (Tulsi)

It is a member of the Lamiaceae family of plants. It has diuretic properties and functions as a detoxifier to aid in the removal of kidney stones. Basil helps to cleanse the kidneys by lowering blood levels of uric acid. It contains acetic acid along with other essential oils that aid in liquefying stones so they may be passed through the urine.[6]

Cissus gongylodes

The most common forms of urolithiasis crystals were dissolved by the extract, which also suppressed the major inflammatory pathways. The leaf portion is utilized.[9]

Alismatis rhizome

Dried rhizomes called AR are used as traditional Chinese medicinal herbs. The main chemical components of AR include triterpenoids, sesquiterpenoids (orientanone, alismol, alismoxide, orientalol A, and orientanone), diterpenoids, and essential oils. The main aroma-active chemicals in AR are δ-elemene, β elemene, spathulenol, γ -cadinol, and γ - eudesmol. For more than a millennium, AR has been used to treat a number of illnesses, including as nephropathy, hyperlipidemia, diabetes, vertigo, edema, fluid and phlegm retention, and urinary tract infections.[5]

Zea mays, Pyrrosia calvata, Plantago asiatica, and *Desmodium styracifolium*

Herbs are combined into a fine powder. In varied degrees, the extract reduced the levels of vimentin and elevated those of CK18 and E cadherin. Moreover, it decreased the expression of collagen II, a hallmark of fibrosis produced by CaOx.[9]

Nigella sativa L. (Ranunculaceae)

Often called black cumin or black seed, this fascinating herb belongs to the Ranunculaceae family and is becoming more and more well-known. Unsaturated fatty acids, in particular linoleic, oleic, and eicodadienoic acids, are abundant in the fatty oil that is derived from the seeds.[6] According to the study, N. sativa crude

extract has a great deal of promise as a diuretic and might prove to be a viable treatment option for hypertension linked to renal problems.[10]

***Moringa stenopetala* (Baker f.) Cufodontis (Moringaceae)**

Local populations rely on the cooked leaves of M. stenopetala as a mainstay food, and the plant's leaves, seeds, and roots are widely used in traditional medicine to cure a range of conditions, including as leishmaniasis, high blood sugar, stomachaches, and hypertension. These results imply that M. stenopetala may inhibit the Na+/K+/Cl− co-transporter at the thick action seen in the loop diuretic furosemide, hence inducing its diuretic effect. The significant urine output and observed potassium loss at higher extract doses—both of which are hallmarks of loop diuretics—may be explained by this suggested mechanism. To completely understand M. stenopetala's diuretic mechanism, more study is necessary.[5,11]

Taraxacum officinale

Strong anti-nephrolithiasis action was demonstrated by T. officinale extract, which was on par with potassium citrate. Aerial portion that has dried is used.[9]

***Citrullus lanatus* (watermelon) (Cucurbitaceae)**

Moreover, watermelon is high in healthful unsaturated fatty acids, carbs, and necessary and non-essential amino acids. Watermelon has long been used to treat renal disorders and encourage urine. Rats were used to test the diuretic effects of watermelon pulp extract. Previous research has demonstrated that steroidal substances derived from medicinal plants exhibit natriuretic and anti-urolithiasis properties.[5,12]

Ceterach officinarum

The extract exhibited strong antioxidant properties and had a strong anti-calcium oxalate aggregation inhibitory effect. The development of calcium oxalate dehydration is one of its adverse effects.[9]

Bergenia ligulata

In the in vitro calcium oxalate crystallization test, the extract demonstrated the ability to avoid the crystallization trough. Moreover, DPPH tests supported the ability to reduce the kidney damage caused by oxalate crystals by producing Reactive Oxygen Species (ROS). The extract's diuretic and antilithiatic properties were shown in Wistar rats.[13]

Tribulus terrestris

Fruit pieces that have ripened and dried are utilized for extraction. Potential preventive and therapeutic effects against experimentally produced nephrolithiasis were demonstrated by the extract.[9]

The most significant medicinal plants used in traditional Iranian medicine to treat kidney stones are the following: *ferrula persica, Apium graveolens, Nigella sativa*, P*eucedanum officinalis, Allium sativum, Centaurea cyan, Brassica rapa, Armenica vulgaris, cucumber, Atriplex hortensis, Cucurbita maxima, Zingiber zerumbet, Arnebia euchroma, and Origanum majorana*.[4] *Tanacetum parthenium* (leaves and blossoms), *Cincer arietinum* (seeds), *Cucumis melovar* (fruit), *Cucurbita maxima* (seeds), *Arnebia euchroma* (root), *Ferula persica* (gum), and other significant plants also were extracted in traditional medicine to cure kidney stones.[4]

Conclusion

The multicausal character of urolithiasis, various biochemical abnormalities that cause urolithiasis, and various chemical types of renal stones may be the primary obstacle to the creation of a standard medication. In contemporary medicine, the ideal kidney stone treatment has still not been discovered. Kidney stones have been treated using natural and ayurvedic botanicals, which have gained popularity. Urolithiasis is the term used to describe the development or presence of a urine stone anywhere in the renal system.

Because of their effectiveness, safety, lack of adverse effects as compared to synthetic pharmaceuticals, cultural acceptance, and superior body compatibility, herbal medicines are highly beneficial for the treatment of urinary stones. The issue with employing herbal remedies is that secondary metabolite concentrations are not well known. It is challenging to comprehend the correct pathophysiology of the antiurolethic action of these plant elements since various formulations operate through different mechanisms. Furthermore, herbal medications are now sold in a variety of dose forms, including syrups, tablets, and capsules. To fully comprehend the fundamental ideas and appropriate mechanisms of action of any plant that reduces kidney stones, more study is still required.

In addition, sufficient clinical trial research needs to be done in order to provide scientific validity. Further research is essential to elucidate the mechanisms of action and pinpoint the relevant phytochemicals.

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