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A Review on Kidney Stone and Its Herbal Treatment

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Abstract: Medicinal plants have been valued for millennia as a rich source of therapeutic compounds for the prevention of various ailments all throughout the world. Kidney stones and urinary calculi affect a huge percentage of the population nowadays. Stone sickness has become more prevalent as a result of changes in living conditions, such as industrialization and hunger. The most common stone recorded in India is calcium oxalate kidney stones. Changes in prevalence and incidence, the occurrence of stone kinds and stone position, and stone removal treatment are all discussed. Medicinal herbs have been utilised for centuries because they are safer, more effective, culturally acceptable, and have less adverse effects than manufactured medications. Patients are advised to consume a low-fat diet, as well as fibres from naturally occurring plants and herbal treatments. The current article discusses the steps that should be taken to maximise the potential of medicinal plants for stone dissolving action. Combining herbal remedies with allopathic treatment is an excellent way to eliminate all issues associated with kidney stones. The purpose of this article is to emphasise the use of herbs as a treatment for urinary stones.

Key words: Herbal plants, kidney stone, urinary stone, calcium oxalate crystals, treatment.

1. Introduction

In order to treat infectious and non-infectious diseases, the modern health care system offers a variety of therapeutic options. However, several of these medicines have their own drawbacks and are not accessible to the majority of the world's population due to cost and accessibility issues. As a result, over 75% of people, mostly from lower-income nations, still rely on herbal therapies to meet their fundamental healthcare needs [1, 2].

Traditional treatments for ailments that are not life threatening, such as urinary stones and haemorrhoids, should be examined in this regard. Urinary stones (calculi) are solid crystalline masses that can form anywhere in the renal tract, and urolithiasis is the condition in which a stone forms or appears anywhere in the urinary tract [3, 4].

Urolithiasis has a long history dating back to the dawn of civilisation. Paleopathological data suggests it first appeared roughly 7,000 years ago. Urinary stone formation is a global health issue that can affect anyone at any age. Men are three times more likely than women to be affected, but it is a rare illness among youngsters. Kidney stones affect about 0.1–0.4% of the population in the United States and Europe each year. Urinary stones affect 2–5% of the population in Asia, 8–15% of the population in Europe and North America, and 20% of the population in Saudi Arabia at some point in their lives, with a significant risk of recurrence. It has been discovered that around half of all patients will have a recurrence of stone(s) within ten years of the initial event.

Urinary stone incidence is not constant, and it typically varies by geography. Scandinavian and Mediterranean countries, the British Isles, Northern Australia, Central Europe, sections of the Malayan Peninsula, China, Pakistan, and Northern India have the highest occurrence. On the contrary, Central and South America, as well as some portions of Africa, have the lowest rates of kidney stone formation.

The size, location, X-ray properties, aetiology of formation, composition, and risk of recurrence can all be used to classify urinary stones. However, classification based on body location or chemical makeup is more common among these. The disorder nephrolithiasis occurs when a stone forms in the

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kidney. The terms ureterolithiasis and cystolithiasis (or vesical calculi) are used to describe stones that form in the ureter and cystolithiasis (or vesical calculi) are used to describe stones that form in the urinary bladder. Urinary stones are made up of protein-coated inorganic and organic crystals. Calcium, uric acid, struvite, and ammonium acid are the most prevalent components of urinary stones. Calcium oxalate, calcium phosphate, or both make up approximately 60–85 percent of human stones. Uric acid stones account for roughly 10–20 percent of total urinary stones, with the rest consisting primarily of struvite, carbonate apatite, and cystine. Table 1 Shows the types of Stones.

Table 1 Types of Stones.

Sr.No.	Type of stone	Composition	Frequency (%)	Causative factor
1	Calcium	Calcium oxalate or calcium phosphate or both	60-85	Hypercalciuria, primary hyperparathyroidism, low urine citrate level
2	Struvite (triple phosphate)	Mixture of magnesium, ammonium and phosphate	10-15	Urinary tract infection
3	Uric acid	Uric acid anhydrous/dihydrate	5-10	Hyperuricosuria, acidic pH or both
4	Cystine	Cystine	1-2.5	Cystinuria
5	Other (Purine, melamine, etc.)	-	1-5	Cystinuria

Calcium oxalate stones are more prevalent than calcium phosphate stones among calcium-derived stones. Hypercalciuria is a key risk factor for calcium nephrolithiasis pathogenesis. Struvite stones, which are a mixture of magnesium, ammonium, and phosphate, are the second most common urinary stones. Because of their possible link to certain urinary tract diseases, these stones are sometimes referred to as infection stones. Uric acid stones are the third most common type of urinary stone, and they can be caused by hyperuricosuria, acidic urine pH, or both. Cysteine stones, which rarely occur, are composed of cysteine and are caused by hereditary kidney transport abnormalities. Furthermore, melamine-related kidney stone disease has recently been discovered in youngsters.

Urinary stones are generated when urine becomes saturated with salts or when urine lacks the normal stone-forming inhibitors. Urolithiasis is impacted by a number of environmental and nutritional factors, including low urine volume and high-protein diets. Stone production may also be influenced by metabolic changes (for example, hypercalciuria and hyperuricosuria) and a lack of stone-inhibiting substances (citrate, magnesium, and glycosaminoglycans [GAG]). If there is no recurrent history, urolithiasis prevention becomes harder, as it typically has no apparent signs and might go unrecognised until it is well advanced. Urinary stones that are only a few millimetres in diameter might easily pass through urine. Stones with a diameter of less than 5 mm and stones with a diameter of 5–10 mm have a spontaneous passing rate of 68% and 47%, respectively.

Several ancient medical writings of ‘Ayurveda’, ‘Chinese’, and ‘Greek traditional medicine’ have detailed the symptoms, signs, and management of urinary stones. Some frequent symptoms of urinary stone illness include pain in the back or lower abdomen, blood in the urine, and pain during peeing. Along with the discomfort, other symptoms include nausea and vomiting. Urinary stone sufferers may experience discomfort in waves that begin in the belly and often radiates to the groyne, testis, or vulva with increasing intensity before dissipating after 20–60 minutes. Renal colic is the medical term for this type of discomfort.

Dietary manipulation or stone expulsive therapies do not work in the majority of urinary stone patients because the stones are too big or become stuck within

the urinary tract. Patients must be treated with contemporary interventional methods in these circumstances. However, most of these interventional techniques are difficult to assess and are nearly never appropriate for patients who have a high recurrence risk of urinary stones. Ancient herbal treatments, on the other hand, have been shown to be efficacious, as well as readily available and affordable. Despite their vast historical records of efficacy and use, widespread acceptance of these herbal treatments remains a challenge. It's possible that this is due to a lack of scientific evidence to back it up.

Nature has provided an abundance of therapeutic plants on our country. Throughout history, plants have been used as a traditional healing method. The WHO has a global list of 20,000 medicinal plants, of which India contributes 15-20%. According to the WHO, medicinal plants are used in 80% of the world's countries. A vast body of evidence has accumulated to illustrate the therapeutic potential.

Over 13,000 plants have been examined for various diseases and disorders all over the world in the last few years. Kidney stones are a common ailment that affects people all over the world. Calcium oxalate crystals make up for 75% of kidney stones.

In addition, the overuse of synthetic medications, which leads to a higher incidence of bad drug reactions, has prompted humans to seek safe cures in nature. Many attribute the origins to the WHO's Canberre conference in 1976, which pushed the concept of *Traditional Medicines for Underdeveloped Countries*.

Urinary stones, also known as calculi, are a very old disease for which numerous therapies have been used throughout history. These stones can be located in any region of the urinary tract, including the kidney, ureters, and urinary bladder, and can vary greatly in size. Linacre, who founded the college of physicians, died in London in 1518 of a urinary stone, which he could diagnose but not true [5].

1.1 Pathophysiology

1.1.1 Kidney stone

Renal calculi are the medical term for kidney stones. It's crystal aggregations that occur in the kidneys. Kidney stones are routinely excreted through the urine stream, and many stones are formed and excreted without producing symptoms. Stones that grow to a size of at least 2-3 mm before passing through the ureter can induce ureteral obstruction [6].

1.2 Etiology

Basic metabolic disorders such as renal tubular acidosis, modularly sponge kidney, Dent's disease, and hyperparathyroidism can induce kidney stones [7].

1.3 Types of Kidney Stones

Calcium (75 to 85%), struvite (2 to 15%), uric acid (6 to 10%), and cystine stones are the four principal forms of stones that form in the kidneys (1 to 2%). The distribution and frequency of these stones are determined by the geographical location of the living creature and the population under investigation. Long-term drug use seldom results in kidney stones, which account for roughly 1% of all cases [8]:

- Calcium stones: Hypercalciuria, which is induced by hyperparathyroidism, is linked to calcium oxalate, calcium urate, and calcium phosphate stones. Increased calcium absorption from the stomach leads to renal calcium or phosphate leak, hyperuricosuria, hyperoxaluria, hypocitraturia, and hypomagnesuria in people with the illness [9]
- Struvite stones: Struvite is made up of stones made of magnesium ammonium phosphate that grow to fill the collecting system (partial or complete staghorn calculi). Chronic urinary tract infections caused by Gram-negative urea-splitting rods such as Proteus, Pseudomonas, and Klebsiella species lead to this stage [10].
- Uric acid stones: The most common causes of uric acid stones are high purine consumption medicines or high cell turnover (e.g. malignancy),

both of which are common in gout patients. Uric acid stones are most commonly formed in urine that is somewhat acidic (pH 5.5). In nature, they are visible, and on X-ray film, they are usually radiolucent [11]

- Cystine stones: Cystine stones form as a result of cystinuria, a genetic intrinsic metabolic condition in which cystine re-absorption in the renal tubule is impeded. Because of the high sulphur concentration, these stones may be difficult to detect on X-rays. Several medicines can contribute to the production of renal stones in drug-induced stones [12]
- Drug-induced stones: Some medicines play a role in the production of renal stones and can also be used to treat another condition. Indinavir, atazanavir, guaifenesin, triamterene, silicate (antacids), and sulfa medications are the pharmaceuticals in question. These stones are extremely unusual and are frequently seen on X-Rays (radiolucent) [13] (See Fig. 1).

1.4 Sign & Symptoms

The subject did not say if he had kidney stones or not, and without that information, no symptoms could be detected. After passing through the kidney, the stone was carried to the bladder by the ureters. Simultaneously, some stones stay in the ureters, blocking urine passage out of the kidneys and causing it to enlarge; this is known as hydronephrosis [14]. The kidneys were in a lot of pain as a result of this. Common kidney stone symptoms are confirmed by a sharp, wavy ache in the back and its entire side that can spread to the lower abdomen or the vaginal area. Some of the female patients claim that the agony is worse than labour contractions during childbirth [15]. It creates a state of intermittent pain and discomfort. The signs and symptoms are as follows:

1) A sudden urge to urinate
2) Urination causes a burning sensation

1.5 Symptoms

Colicky pain is described as the worst pain a person has ever felt. Hematuria is the presence of blood in the urine as a result of slight damage to the inner of the kidney, ureter, and/or urethra. Pus in the urine is referred to as pyuria. Dysuria is a burning sensation during urinating. Oliguria is a condition in which the urine volume is diminished. Nausea and vomiting are caused by an embryological relationship with the colon, which triggers the vomiting centre. Hydronephrosis Kidney stone plugs ureter after renal azotemia [16].

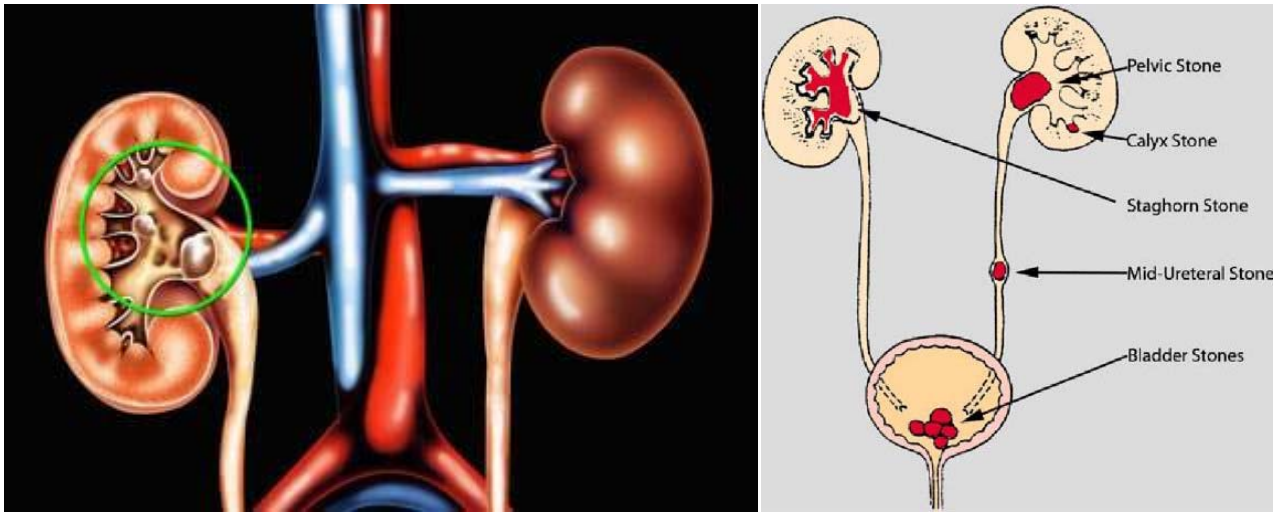


Fig. 1 Various Stones.

1.6 Risk of Factors

Dietary variables play a significant role in promoting or inhibiting kidney stone formation. Other factors that can cause a stone to form include the environment, body weight, DNA, and the amount of fluid consumed. The following are some of the factors that can enhance your chances of developing kidney stones [17]:

- The body's dehydration
- Kidney stones can be passed down through the generations. Cystinuria is a hereditary condition that raises the chance of cystine stones.
- Adding additional proteins, lipids, sodium, and sugar to your diet may raise your risk of kidney stones.
- In comparison to other disorders, people with kidney infections (particularly women) and urinary tract infections (UTIs) are more likely to develop struvite stones.
- Kidney stones arise as a result of metabolic syndrome.
- Obesity has been linked to an increased risk of kidney stones [18]

1.7 Mechanism of Stone Formation

- Age, profession, nutrition, climate, ancestry, sex, mentality, constitutions, and race are all factors to consider.
- Renal morphology that is abnormal, Urinary incontinence, Infection of the urinary tract, Anomalies in metabolism, Factors that are genetic.
- Stone-forming constituents are excreted more frequently, while inhibitors of crystallisation are excreted less frequently.
- Supersaturation state changes physico-chemically.
- Crystalline urine, aggregation, and crystalline urine growth are terms used to describe abnormal crystalline urine.
- The development of stone [19].

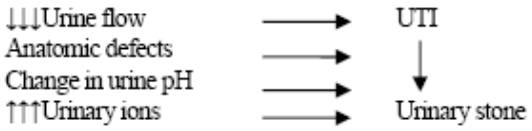
1.8 Lithiasis

A kidney stone is a hard mass formed in the urinary tract when crystals separate from urine. Urine normally contains substances that prevent or inhibit the formation of crystals in the urinary system. These crystals are small enough that they will pass through the urinary tract and out of the body in the urine unnoticed. Infection in the urinary system causes a less common sort of stone. This type of stone is referred to as struvite or infection stone. Uric acid stones are a less common sort of stone, while cystine stones are uncommon. Inorganic and organic crystals combine with proteins to form kidney stones. Many different solutes in the urine can crystallise and cause lithogenesis. Calcareous stones continue to be the most prevalent nephroliths, accounting for more than 80% of all stones [20].

1.9 Urinary Stone

Urine calculi are hard mineral masses trapped in the urinary system at any point. The kidneys, ureter, bladder, and urethra are organs in the urinary tract that filter blood to eliminate liquid waste (urine) expelled from the body. Stones grow in the kidney and then migrate through the urinary canal, where they can become lodged in smaller tubes, such as bladder stones, ureteric stones, and kidney stones.

Pathophysiology of urinary stones



It's possible that the condition is excruciatingly painful. Urolithiasis is a complicated condition that involves a number of physicochemical phenomena that can occur simultaneously or sequentially. The mechanism by which calcium oxalate crystals are maintained in the kidney and become renal stones is unknown. In newborns and young children, a urinary tract infection (UTI) is a major risk factor.

Urease-splitting Proteus, Klebsellia, Pseudomonas, Staphylococcus, and anaerobes are the most typically isolated microbes. These microorganisms break urea, raising the urinary pH and the concentration of magnesium ammonium phosphate ions in the urine, creating a favourable environment for stone formation [21].

1.10 Composition of Kidney Stone

A kidney stone is a collection of crystals that have coalesced to form a hard lump in one or both kidneys. They can be a few millimetres long or several centimetres long. The majority of stones will pass through the body unaided in the urine, but some will require medical assistance to be removed. Phosphate, uric acid, magnesium ammonium phosphate, apatite, and struvite crystals have been used to create urinary stones. Five Calcium-containing stones make up around 75% of all urinary calculi, and they can take the form of crystals of pure calcium oxalate (50%) or calcium phosphate (5%), or a mixture of both (45%). The acidity of urine and the concentration of specific chemicals in the urine can both be affected by food [22]. Any of the given qualities may have an elevated risk of producing a stone, according to a 24-hour urine collection:

1. High calcium levels (hypercalciuria)
2. High oxalate levels (hyperoxaluria) Uric acid levels that are too high (hyperuricaemia)
3. Citrate deficiency (hypocitraturia) [23]

The blood contains typical components such as calcium, oxalate, uric acid, and citrate. Any liquid's acidity is measured in pH. Acidic is defined as a pH < 7, whereas alkaline is defined as a pH > 7. The pH of normal urine varies during the day depending on nutrition, although it normally falls between 5 and 8. Calcium oxalate stones can form in urine at any pH. Uric acid stones are more likely to form in acidic urine, whereas calcium phosphate stones are more likely to form in alkaline urine [24].

1.11 Chemistry of Urinary Stones

Urinary stones in children have a chemical composition that is comparable to that of urinary stones in adults (Figure 2). About half of it is calcium oxalate, 15-25% is calcium phosphate, and 10-15% is mixed (calcium oxalate and calcium phosphate). Struvite (magnesium ammonium, phosphate) accounts for 15-30%, cystine for 6-10%, and uric acid for 2-10% [25, 26].

Most of these stones are visible on plain radiographs due to their relatively high densities (based on their calcium content), but some are better than others.

Fig. 2 Urinary stones.

2. Diagnosis

Blood tests**:** Detect an excessive amount of calcium or uric acid in the blood. The findings of a blood test can help doctors monitor the health of the kidneys and may prompt them to look for other medical issues [27].

Urine testing:A 24-hour urine collection test can reveal whether your kidneys are excreting too many stone-forming minerals or not enough stone-preventing chemicals. For this test, the doctor may suggest that at least two urine samples be collected over two days [28].

Imaging examinations: It may reveal the presence of kidney stones in the urinary tract. Simple abdominal X-rays, which can miss small kidney

stones, are replaced with high-speed or dual-energy computed tomography (CT), which can detect even minute stones [29]. Another imaging option is an ultrasonography, which is a non invasive test that involves injecting dye into an arm vein and collecting X-rays (intravenous pyelogram) or CT pictures (CT urogram) as the dye passes through the kidneys and bladder[30].

3. Treatment

Several therapeutic options for urinary stone disorders have been developed in the previous few decades. However, because the majority of these treatments are surgical, they are costly and not usually readily available. Many people choose or only have access to traditional herbal treatments to treat urinary stones as a result of this, such as Ayurveda (Table 2).

3.1 Ayurveda

Ayurveda is a Sanskrit word which means the knowledge of life span. It is a one of the ancient medicinal systems, which originated around 3,000 years ago in the Indian subcontinent. It is based on the theory of Panchmahabhutas, i.e. all objects and living bodies are composed of the five basic elements such as earth, water, fire, air, and sky. Ayurvedic therapies are based on the principle that each person's body (prakriti) is made up of three doshas or bodily humours (vata, pitta, and kapha), and that their imbalance causes disease. Urinary stones are referred to as mutraashamari (mutra-urine; ashma-stone; ari-enemy) in Ayurveda, and urolithiasis is one of the eight most problematic disorders (mahagad) [31].

Sleshmaashmari (phosphatic stone), pittaashmari (urate stone), vataashmari (oxalate stone), and sukraashmari (calcium oxalate stone) are four forms of urinary calculi described in Ayurvedic writings (spermolith or seminal concretions).

Herbal formulae, alkaline solutions, and surgical techniques are used in Ayurvedic medicine to treat and cure urinary stones. Shodhana (external and internal oleation, and induction of sweating, as well as panchakarma procedures including medicated emesis, purgation, and enemas) and Shamana therapy are advised in Ayurveda for the treatment of urinary stone illnesses [32].

Oral prescriptions of herbal remedies such as teekshnaushna (penetrative), ashmaribhedana (linthnotriptic), and mutraladravyas are the most common (diuretics). In Ayurveda, herbal medications and their formulations are often used to treat urinary stone disease.

Table 2 Adopted from The Ayurveda Pharmacopoeia of India Part I–VI, 2004–2009.

Sr. No.	*Botanical name*	Family	Sanskrit name	Part used whole plant	Dose/Mode preparation
1	*Aervalanata* (L.) Juss.	Amaranthaceae	Gorakshaganja, Astmabayda, Bhadra, Pashanabheda, Pattura	Whole plant	50–100 ml, decoction
2	*Anisomeles malabarica* (L.) R. Br. ex Sims	Lamiaceae	Sprkka	Whole plant	3–5 g, powder
3	*Anogeissus latifolia* Wall. ex Guillem. & Perr.	Combretaceae	Dhava	Stem bark	30–50 ml, decoction
4	*Apium graveolens* L.	Apiaceae	Karaphsa	Root	5–7 g, powder
5	*Asparagus officinalis* L.	Liliaceae	Dvipantara Satavari	Root	3–6 g, powder
6	*Baliospermum solanifolium* (Burm.) Suresh	Euphorbiaceae	Hastidanti	Root	1–3 g, powder
7	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae	Kushmand	Fruits	5–10 g, powder
8	*Bergenia cilliata* (Haw.) Sternb.	Saxifragaceae	Asmabhedaka	Rhizome	3–6 g, powder

Table 2 continued.

9	*Butea monosperma* (Lam.) Taub. (Lam.)	Leguminosae	Palasah	Seed	0.5–1 g, powder
10	*Calamus rotang* L.	Arecaceae	Vetra	Rhizome	50–100 ml, decoction 5–10 g, powder
11	*Carica papaya* L.	Caricaceae	Erandkarkati	Root	2–6 g, powder
12	*Carthamus tinctorius* L.	Compositae	Kusumbha	Fruit Leaves	2–4 g, powder
13	*Cassia fistula* L.	Leguminosae	Krtamalaka	Stem bark	50–100 ml, decoction
14	*Celosia argentea* L.	Amaranthaceae	Sitavaraka	Seed	3–6 g
15	*Coscinium fenestratum* (Gaertn.) Colebr.	Menispermaceae	Kalambaka	Root Stem	–
16	*Dalbergia sissoo* DC.	Leguminosae	Krsana	Heart wood	5–10 g, powder 10–20 g, decoction.
17	*Dendrophthoe falcate* (L.f.) Ettingsh.	Loranthaceae	Vrkshadani	Fruit/Leaves/ Stem/Root/flowers	10–20 ml, juice
18	*Diospyros malabarica* (Desr.) Kostel.	Ebenaceae	Tinduka	Fruit	5–10 g
19	*Garcinia pedunculata* Roxb. ex Buch.-Ham.	Clusiaceae	Vrntamlaphala	Fruit	5–10 ml, juice
20	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae	Kokilaksha	Roots	3–6 g, decoction
21	*Hyoscyamus niger* L.	Solanaceae	Khurasani, Yavani	Seed	125–500 mg, powder
22	*Imperata cylindrica* (L.) Raeusch.	Poaceae	Yajnmula	Root	10–20 g, decoction
23	*Momordica dioica* Roxb. ex Willd.	Cucurbitaceae	Karkotaki	Root	3–6 g
24	*Moringa oleifera* Lam.	Moringaceae	Sobhanjana	Root bark	25–50 g, powder
25	*Ocimum tenuiflorum* L.	Lamiaceae	Krishnatulasi	Whole plant	1–3 ml, juice
26	*Phyllanthus acidus* (L.) Skeels	Phyllanthaceae	Komala Valakala	Fruit	10–20 g
27	*Saccharum spontaneum*L.	Poaceae	Kaasaa	Roots	3–6 g, powder
28	*Salvadora persica* L.	Salvadoraceae	Pilu	Fruits Leaves Root bark	10–20 g, decoction
29	*Sesamum indicum* L.	Pedaliaceae	Tila	Seeds	5–10, powder
30	*Sesbania bispinosa* W.F. Wight	Leguminosae	Utkata	Root	3–6 g
31	*Stereospermum chelonoides* (L.f.) DC.	Bignoniaceae	Amogha, Tamrapushpi	Roots	5–10 g, powder 25–50 ml, decoction
32	*Tribulus terrestris* L.	Zygophyllaceae	Gokshur	Root Fruit	20–30 g, decoction 3–6 g, powder
33	*Typha elephantine* Roxb.	Typhaceae	Eraka	Root	Root
34	*Typha australis* K. Schum. & Thonner	Typhaceae	Gunthah	Rhizome root	3–6 g, powder
35	*Vallaris solanacea* Kuntze	Apocynaceae	Asphota	Root	3–6 g, powder
36	*Vigna unguiculata* (L.) Walp.	Leguminaceae	Kulattha	Seeds	12 g, decoction

4. Herbal Drugs

Natural plants are harvested for their therapeutic characteristics and biological activity in the treatment of human diseases. Around 3,500 big species are being monitored for their medicinal usefulness in the fight against human disease.

Kidney stones can be treated using herbs and herbal medicines. These medications have piqued people's curiosity due to scientifically demonstrated benefits such as immunomodulation, adaptogenicity, and antimutagenicity. Furthermore, the overuse of synthetic pharmaceuticals, which leads to a higher rate

of bad drug reactions, has prompted humans to return to natural therapies.

5. *Pashanbheda* Drugs

The literal meaning of *Pashanbheda* (*Bergenia ligulata*) is stone-breaking (Pashan is stone and bheda means to break, in Sanskrit). It's a succulent perennial herb that grows up to 50 cm tall. It grows from 2,000 to 2,700 metres in the temperate Himalaya (from Kashmir to Nepal) and is fairly prevalent in Central and East Asia, including Pakistan [33].

Several Ayurvedic Acharyas mentioned this herb and suggested that it be used to treat urinary stones. It was advised by Charak Samhita for painful micturition, breaking up calculi, and removing abdominal tumours. The plant has diuretic action, antiurolithic, antipyretic, hepatoprotective, anti-diabetic and other medicinal qualities [34].

Fig. 3 ***Pashanbheda*** **drugs.**

In the past decade, there have been attempts to study clinical trials of the *Pashanbhed* plant, which is used to dissolve kidney stones. As shown in figure 3 [35].

Pashanbhed is a medication used in Ayurvedic medicine to treat a variety of diseases, primarily as a diuretic and lithotriptic. It is commonly used medicine that is supposed to have the ability to shatter and disintegrate stones [36]. Its identity, however, is still up for debate. *Alternanthera sessalis* and Aerva spp. are examples of diuretic and other plants. In the south of India, Pashanbhed has been applied to a variety of plants, including *Rotula aquatica* in Mysore, *Ammannia baccifera* in Kerala, *Bauhinia racemosa*, Coleus spp., Bryophyllum spp., *Didymocarpus pedicellata*, *Ocimum basilicum* in Bengal, and many others. *Bergenia ligulata* is now known as Bergenia ligulata syn [37]. This name is commonly used to refer to *Saxifraga ligulata*. Bergenia ligulata's chemical efficacy in dissolving urinary stones fully validates the use of different names given to it, such as Pashanbheda, Pashana, Asmaribheda, Ashmabhid, Ashmabhed, Nagabhid, Upalbhedak, Parwatbhed, and Shilabhed (dissolving or penetrating stones or slabs) and so on. It is prescribed for painful micturition, the treatment of abdominal tumours, and the dissolution of calculi [38].

Sushruta Samhita (170 AD-340 BC) describes the medicine in Chikitsasilianam under numerous names, including Pashanbhed for uric acid calculi and Ashnibhid for biliary calculi. Decoctions of Pashanbhed, Ashmantaka, Satavari, Vrihati, Bhalluka, Varuna (*Crataeva nurvula*), kulatha, kola, and kataka seeds have been detailed in the Sushruta Samhita for Vataja Ashmari patients, whereas Kusa, Ashmabhid, Patala, Trikantaka, Sirisha, Punarnava, and Silajatu and Meduka flower for Pittaja Ashmari have been mentioned. Upalbhed for acute discomfort due to obstructed micturition, Pashanbhed for uric acid calculi, and Ashmabid for biliary calculi are mentioned in the chiktsit Sthanam by Ashtang Hridaya (341 AD-434 AD) [39]. In the Susruta Samhita, 'Kurantika' or 'Sitivaraka' (Celosia argental) is tested in 'Viratarvadigana', which is stated to have a

special activity in urinary disorders such as calculi (ashmari), gravels (sarkara), dysuria (mutra krichhra), and urine suppression, among others.

As lithotriptic plants, Aerva spp., *Ammania baccifera*, and *Nothosasrva brachiata* have been described from South India. In the Indian system of medicine, Celosia argental is regarded to be specialised for the treatment of ashmari, or urinary stones [40]. Stones are dissolved and excreted using an aqueous decoction. *Didymocarpus pedicellata*, also known as Patharphodi or Shilapushp, is effective in the treatment of kidney and bladder stones, while *Homonoia riparia*, also known as Pashanbhed or kshudra Pashanbhed, is effective in the treatment of vesical calculi. For bladder stones, *Rotula aquatica* syn. *Rhabdias lycioides*, also known as Pashanbhed, is beneficial. *Bergenia ligulata*, syn. *Saxifraga ligulata*, also known as Pashanbheda, has diuretic and lithotriptic properties, whereas *Kalanchoe pinnata*, syn. Others, such as *Bryophyllum calycinum*, also known as Pashanbhed in Bengal, have neither diuretic norlithotriptic properties. *Bridelia montana*, also known as Pashanbhed, has not demonstrated any of these behaviours [41].

Practitioners in the unani system of medicine have prescribed *Berberis vulgaris*, *Cantharis spp.*, and *Lycopodium spp.* for the treatment of urinary calculi, whereas in the homoeopathic system of medicine, *Berberis vulgaris*, *Cantharis spp.*, and *Lycopodium spp*. are used [42].

6. Chhota Gokhru Drugs

*Tribulus Terrestis*is also known as Gokharu and Vine Puncture. These plants belong to the Zygophyllaceae family and are annual yellow flowering plants. These plants thrive in hot climates and can be found in India, Pakistan, France, China, and Africa. In India, this is the most traditional medicinal plant (Figure 4). It's been used to treat sexual and kidney problems.

Fig. 4 Chhotagokhru plant.

This plant is an Ayurvedic rasayana, or nephroprotective agent, that is extensively used to treat urinary tract disorders in India and China. It has been shown in animal experiments to prevent kidney stones from forming and may even assist to reverse early stage Urolithiasis. In vitro research backs up the animal findings, implying that Tibullus may also protect against calcium oxalate-induced kidney injury [43].

It's used as a tonic, aphrodisiac, pain reliever, and astringent to kill parasitic worms in the stomach. Diuretic, antihypertensive, nephroprotective, and nephrolithiatic. *Tribulus terrestis* extract has diuretic, analgesic, antidiabetic, antitumor, anthelmintic, astringents, antidiabetic, cardio tonic, and antibacterial properties.

6.1 Chemical Constituents

Tribulus terrestris steroidal Saponin is one of the most important components. It contains terestrosins A, B, C, D, and E desgalactotigonin. Gitonin, desglucolanatigonin. Sapogenins such as diosgenin, chorogenin, hecogenin, and neotigogenin are present in the hydrolyzed extract. Other steriodal compounds

have been identified from the herb's aerial portions, including terestroside F, tribulosin, trillin, gracillin, and dioscin. It also contains phytosterols such as -sitosterol, stigmasterol, and terestiamide, a cinnamic amide derivative [44].

6.2 Diuretic Activity

TT's diuretic qualities are due to the high levels of nitrates and basic oil found in its green vegetables. The presence of potassium salts in high concentration can also be blamed for the diuretic action. Fluid concentrations of TT were assessed using a rodent diuretic model, and contractility tests were performed on the leaf meal and isolated guinea pig ileum. A positive diuresis was induced by the watery concentrate of TT in an oral dose of 5 g/kg, which was slightly higher than that of furosemide. The sodium and chloride concentrations in the urine were increased. The diuretic action of TT remove, as well as the increased composition of the smooth muscles it generated, aided in the movement of stones along the urinary stream. Tested various concentrates of TT organic products for diuretic movement in mice, including fluid, methanolic, Kwatha high strength, Kwatha low strength and Ghana powder. Kwatha high strength had a diuretic effect comparable to that of the reference standard furosemide, as well as a potassium-saving effect that was especially favourable. TT's diuretic properties make it a good antidote for hypertensive specialists [45].

7. Another Herbal Drugs Are as Follows

Celosia argental (Viratarvadigana): For the treatment of urinary stones, the Indian medical system is thought to be unique. The aqueous decoction of this plant is used to dissolve and excrete stones. Kidney and bladder stones can be treated using *Didymocarpus pedicellata*, also known as Patharphodi or Shilapushp [46].

Fenugreek seed (*Trigonella foenum-graecum*): In northern Africa, the seeds of this shrub are extensively used to prevent and treat kidney stones. Fenugreek seed was proven to dramatically reduce calcification in the kidney and help avoid kidney stones in an animal research [47].

Shatavari root (*Asparagus racehorses*): In test animals, this key Ayurvedic Ramayana (rejuvenative treatment) was discovered to decrease the production of calcium oxalate stones [48].

Chancapiedra/Stonebreaker (*Phyllanthus niruri*): The Chanca stone buster is a tropical plant that has a long history of use for preventing and passing kidney stones. This herb has been shown to help prevent kidney stones in a number of in vitro and animal investigations [49].

Origanum vulgare: This plant is commonly used as a spice and medicine, and it has properties such as lithotripter, diuretic, and antispasmodic. The crude aqueous metabolic extract of *O. vulgare*'s aerial portion inhibited the nucleation and aggregation of calcium oxalate crystals in vitro, as well as the amount of crystals generated in calcium oxalate detestable solutions [50].

Barberry root bark (*Berberis vulgaris*): Barberry has been demonstrated to decrease oxidative stress-induced kidney injury by inhibiting calcium oxalate crystallisation. The most successful preparation was the water extract [51].

Black cumin seed (*Nigella sativa*): The usage of this plant significantly prevented test animals from experimentally induced calcium oxalate stone formation in animal tests [52].

Punarnava herb (*Boerhaavia diffusa*): This widespread Indian plant is utilised to help expel kidney stones and as a kidney restorative. It inhibited the production of struvite stones in an in vitro research; whether it can do so in vivo is uncertain [53].

Varuna bark (*Crataeva nurvala*): This Ayurvedic herb reduced urinary calcium excretion and kidney stone formation when taken daily [54]. This Ayurvedic herb is used to prevent kidney stones and to treat kidney stones when combined with banana

stem (Muse paradisiacal). This formula helped to dissolve renal calculi, facilitated their passage, and reduced pain, according to the authors of a recent human study [55].

Evening primrose seed oil (*Oenothera biennis*): In a human research, regular administration of EPO (1,000 mg/day) raised citraturia (urine citrate levels) while lowering urinary oxalate, calcium, and the Tiselius risk index, which is a risk indicator for kidney stone formation [56].

Rupturewort herb (*Herniariahirsuta*): This herb prevented the accumulation of CAOx crystals in the kidneys of test animals in animal experiments [57].

Ammi visnaga: Patients with renal stones have traditionally utilised various types of tea made from the fruits of *Ammi visnaga* in Egypt and around the world [58]. This fruit's aqueous extract aided in the breakdown of cystine stones in the kidneys. The fruit and its two main ingredients, khellin and visnagin, have shown to be helpful in the treatment of kidney stones caused by hyperoxaluria [59].

Hibiscus sabdariffa: *Hibiscus sabdariffa* is used for the prevention and treatment of urinary stones in Thai traditional medicine [60]. A clinical investigation on 18 individuals found a uricosuric effect and a significant rise in uric acid excretion and clearance from the kidneys by urine after drinking a cup of tea brewed from 1.5 g of dry *H. sabdariffa* two times daily for 15 days [61].

8. Synthetic Drug Used in Treatment of Stone Diseases [62]

1. Amiloride (Midamor) – Diuretics
2. Allopurinol (Lupurin, Zyloprim) - Analogue of hypoxanthine
3. Cholestyramine (Questran) - Bile acid sequestrates
4. Cholic acid - Bile acid derivatives
5. Digoxin (Lanoxin) - Cardiac glycoside
6. Etidronate disodium - Bisphosphonate
7. Fluvastatin (Lescol) - Statin
8. Gemfibrozil - Fibric acid derivatives
9. Indinavir - Peptidomimetic hydroxyethylene
10. Zonisamide - Sulphonamide Derivatives

9. Researchers Reported for Stone Dissolving Activity

- Aqueous and alcohol extracts of *Jasminum auriculatum* Vahl (Oleaceae) flowers are reported for kidney stone [63]
- Aqueous of extracts of *Herniaria hirsute* L. are reported for nephrolethiasic [64]
- Ethanolic extracts of leaves of *Hibiscus sabdariffa* Linn are used for kidney stone [65]
- The acute diuretic effect of the water extract of the aerial parts of *Retama raetam* (RR) is used for kidney ailments [66]
- The chronic diuretic effects of the water extract of the whole plant of *Spergularia purpurea* are used for kidney stone [67]
- Aqueous extracts *Rosmarinus officinalis* and *Centaurium erythraea* are used for kidney ailments [68]
- Ethanolic extract of *Ammannia baccifera* (Bhatjambol) was found to be effective in reducing the formation of urinary stones (prophylactic) [69]
- *Crataeva nurvala* (Varun) were found to possess significant anti-hyperoxaluric and anti-hypercalciuric activity [70]
- The aqueous extracts *Sesbania grandiflora* are used for antiurolithiati [71]
- The Aqueous extract of the bark of *Raphanus sativus* was tested for its antiurolithiatic and diuretic activity [72]

10. Challenges and Future Aspects of Medicinal Plants

Medicinal plants are becoming extremely significant in the development of novel medications. Herbal medications are popular because of their safety, efficacy, and lack of side effects. Plants and plant products have been used to treat and prevent diseases with varied degrees of success. Natural plant-derived

goods are currently in high demand in many nations throughout the world [73].

Nature is the best combinatorial chemistry and has probable answers to all diseases for mankind, as evidenced by the preceding explanation. Stone illnesses necessitate the use of medicinal plants. People's attention has already been drawn to herbal treatments as a result of the negative effects of modern medicine. To improve public acceptance and knowledge, it is critical to build trust and faith in the safer indigenous system by demonstrating its efficacy in the treatment of diverse ailments. Because health-care systems are becoming increasingly expensive, we must incorporate herbal medicine systems into our health-care systems. Let us hope that in the future, natural goods will be able to compete with contemporary pharmaceuticals, providing additional benefits such as increased safety and reduced costs.

Due to socioeconomic circumstances, the majority of the world's population is now unable to access modern health care facilities for the treatment of urinary stones. As a result, people continue to rely on locally accessible herbal treatments to treat urinary stone problems. Some of these traditional antiurolithiatic claims have been validated in recent investigations, but they are insufficient to establish many of these plants and herbal formulations as therapeutic therapies for urinary stone treatment and maintenance. Therefore, in addition to chemical characterisation of antiurolithiatic herbs, more clinical research is needed to support traditional antiurolithiatic claims made by these plants and herbal combinations.

References

[1] Guptam, R., and Chadha, K. L. 1995. Medicinal and Aromatic Plants in India. In: *Advances in Horticulture: Medicinal and Aromatic Plants.* New Delhi: Malhotra Publishing House; pp. 44.

[2] Pareek, S. K. 1996. Medicinal Plants in India: Present Status and Future Prospects. In: *Prospects of Medicinal Plants*. pp. 14.

[3] Dahanukar, S. A., Kulkarni, R. A., and Rege, N. N. 2000. "Pharmacology of Medicinal and Natural Products." *Indian J Pharmacol* 32 (4): S81-S118.

[4] European markets for urinary stone removal devices and equipment report. California: Life Science Intelligence Inc; 2008. pp. 453.

[5] McNutt, W.F. 1893. Chapter VII: Vesical Calculi (Cystolithiasis). In: Diseases of the Kidneys and Bladder: A Text-book for Students of Medicine, IV: Diseases of the Bladder, J.B. Lippincott Company, Philadelphia, pp.185-186.

[6] Collins, C. E. 2005. *A Short Course in Medical Terminology*. Philadelphia: Lippincott Williams & Wilkins.

[7] Moe, O. W. 2006. "Kidney Stones: Pathophysiology and Medical Management." *Lancet* 367 (9507): 333-44.

[8] Stamatelou, K. K., Francis, M. E., Jones, C. A., et al. 2003. "Time Trends in Reported Prevalence of Kidney Stones in the United States: 1976-1994." *Kidney Int* 63 (5): 1817-23.

[9] Soucie, J. M., Thun, M. J., Coates, R. J., et al. 1994. "Demographic and Geographic Variability of Kidney Stones in the United States." *Kidney Int* 46 (3): 893-9.

[10] Lee, Y-H., Huang, W-C., Tsai, J-Y., et al. 2002. "Epidemiological Studies on the Prevalence of Upper Urinary Calculi in Taiwan." *Urol Int* 68 (3): 172-7.

[11] Safarinejad, M. R. 2007. "Adult Urolithiasis in a Population Based Study in Iran: Prevalence, Incidence, and Associated Risk Factors." *Urol Res* 35 (2): 73-82.

[12] Scales, C. D. Jr., Smith, A. C., Hanley, J. M., et al. 2012. "Prevalence of Kidney Stones in the United States." *EurUrol* 62 (1): 160-5.

[13] Trinchieri, A., Coppi, F., Montanari, E., et al. 2000. "Increase in the Prevalence of Symptomatic Upper Urinary Tract Stones during the Last Ten Years." *Eur Urol* 37 (1): 23-5.

[14] Trinchieri, A., Ostini, F., Nespoli, R., et al. 1999. "A Prospective Study of Recurrence Rate and Risk Factors for Recurrence after a First Renal Stone." *J Urol* 162 (1): 27-30.

[15] Levy, F. L., Adams-Huet, B., &Pak, C. Y. 1995. "Ambulatory Evaluation of Nephrolithiasis: An Update of a 1980 Protocol." *Am J Med* 98 (1): 50-9.

[16] Pak, C. Y., Britton, F., Peterson, R., et al. 1980. "Ambulatory Evaluation of Nephrolithiasis. Classification, Clinical Presentation and Diagnostic Criteria." *Am J Med* 69 (1): 19-30.

[17] Su, C. J., Shevock, P. N., Khan, S. R., and Hackett, R. L. 1991. "Effect of Magnesium on Calcium Oxalate Urolithiasis." *J Urol* 145 (5): 1092-5.

[18] Ettinger, B., Citron, J. T., Livermore, B., and Dolman, L. I. 1988. "Chlorthalidone Reduces Calcium Oxalate

Calculous Recurrence But Magnesium Hydroxide Does Not." *J Urol* 139 (4): 679-84.

[19] Urinary stone diseases. [Online] Available from: https//www.healingrosacea.com/urinary-stone-diseases/2/. [Accessed on 20 June, 2011].

[20] Pak, C. Y. C., Heller, H. J., Pearle, M. S., et al. 2003. "Prevention of Stone Formation and Bone Loss in Absorptive Hypercalciuria by Combined Dietary and Pharmacological Interventions." *J Urol* 169 (2): 465-9.

[21] Materazzi, S., Curini, R., D'Ascenzo, G., and Magri, A. D. 1995. "TG-FTIR Coupled Analysis Applied to the Studies in Urolithiasis: Characterization of Human Renal Calculi." *Thermochimica Acta* 264: 75-93.

[22] Callaghan, D., &Bandyopadhyay, B. C. "Calcium Phosphate Kidney Stone: Problems and Perspectives."*J Physiol* 6 (8):118-125.

[23] Kawano, P. R., Cunha, N. B., Silva, I. B. L., et al. 2016. "Effect of Dietary Supplementation of Vitamin D on Ethylene Glycol-induced Nephrolithiasis in Rats."*J Nut Food Sci* doi: 10.4172/2155-9600.1000499.

[24] Ankur, C., Amarchand, P., Aadarsh, C., et al. 2010. "Potential of Medicinal Plant in Kidney Gall and Urinary Stone." *International Journal of Drug Development & Research* 2 (2): 431-47.

[25] Milliner, D. S. Calculi. 2004. In: Kaplan BS, Meyers KE, editors. *Pediatric Nephrology and Urology: The Requisites in Pediatrics*. America: Mosby; pp. 361-374.

[26] Polinsky, M. S., Kaiser, B. A., & Balnarte, H. J. 1987. "Urolithiasis in Childhood." *Pediatr Clin North Am* 34 (3): 683-710.

[27] Pak, C. Y. C., Sakhaee, K., & Fuller, C. 1986. "Successful Management of Uric Acid Nephrolithiasis with Potassium Citrate." *Kidney Int* 30 (3): 422-8.

[28] Coe, F. L., Clark, C., Parks, J. H., and Asplin, J. R. 2001. "Solid Phase Assay of Urine Cystine Supersaturation in the Presence of Cystine Binding Drugs." *J Urol* 166 (2): 688-93.

[29] Dolin, D. J., Asplin, J. R., Flagel, L., et al. 2005. "Effect of Cystine-binding Thiol Drugs on Urinary Cystine Capacity in Patients with Cystinuria." *J Endourol* 19 (3): 429-32.

[30] Griffith, D. P., Khonsari, F., Skurnick, J. H., and James, K. E. 1988. "A Randomized Trial of Acetohydroxamic Acid for the Treatment and Prevention of Infection-induced Urinary Stones in Spinal Cord Injury Patients." *J Urol* 140 (2): 318-24.

[31] World Health Organization, 2001. Legal status of traditional medicine and complementary/alternative medicine: a worldwide review. Available on: https://apps.who.int/iris/handle/10665/42452.

[32] Sridevi, V., Rajya Lakshmi, I., & Sanjeeva Rao, I. 2004. "Urolithiasis (Mutrashmari)." In: Lakshmi Chandra Mishra (editor). Scientific basis for Ayurvedic Therapies. Boca Raton. CRC press LLC; pp. 536-548.

[33] Udupa, K. N., Chaturvedi, G. N., and Tripathi, S. N. 1970. "Advances in Research in Indian Medicine." California: Banaras Hindu University; pp. 77-78.

[34] Chunekar, K. C. 1969. "In Vanasuhadi Anushandhan Durshika". 5th edition (Chaukhamba vidyab hawan Varanasi) pp. 13.

[35] Bhandari, C. R., and Basu, B. D. 1948. In: Vanasuhadi Chandrodaya, 2nd edition. Gyan Mandir, Bhanupura publisher Indor; pp. 48.

[36] Kirtikar, K. R., and Basu, B. D. 1933. "Herbal Plants in Urolithiasis." In Indian Medicinal Plants. 2nd edition. Lalit Mohan Basu publisher Allahabad; pp. 56.

[37] Dush, B., and Kashyap, L. 1979. "Herbal Plants in Kidney Stone." In: Materia medica of Ayurveda. New Delhi: Concept Publishing Co.; pp. 89.

[38] Bhishagratna, K. 1981. "Kidney Stone." In: An English translation of the sushruta samhita based on original sanskrit text. Amrica: General Books LLC; pp. 106.

[39] Shah, C. S., Shan, N., and Mody, K. D. 1972. "Drugs Used in Urolithiasis." *Q J Crude Drug Res* 12: 1882-93.

[40] Dubey, S. D., Singh, R. S., Sen, S. P., and Kumar, N. 1982. "Disease of Kidney Stone and Urinary Tract." *Med Surg* 22: 9-12.

[41] Shrivastava, J. G. 1971. "Herbal Plants Used in Stone." *Q J Crude Drug Res* 11: 1683-9.

[42] Chopra, R. N., Nayer, S. L., and Chopra, I. C. 1956. *Glossary of Indian Medicinal Plants*. New Delhi, Council of Scientific & Industrial Research.

[43] Duke, J. A. 2002. *Handbook of Medicinal Herbs*. United States: CRC Press, pp. 595.

[44] Wu, T. S., Shi, L. S., and Kuo, S. C. 1999. "Alkaloids and Other Constituents from *Tribulus terrestris*." *Phytochemistry* 50 (8): 1411-5.

[45] Xu, Y-J., Xu, T-H., Zhou, H-O., et al. 2010. "Two New Furostanol Saponins from *Tribulus terrestris*." *J Asian Nat Prod Res* 12 (5): 349-54.

[46] Baxmann, A. C., Mendonca, C. D., and Heilberg, I. P. 2003. "Effect of vitamin C Supplements on Urinary Oxalate and pH in Calcium Stone-forming Patients." *Kidney Int* 63 (3): 1066-71.

[47] Goldfarb, D. S., & Asplin, J. R. 2001. "Effect of Grapefruit Juice on Urinary Lithogenicity." *J Urol* 166 (1): 263-7.

[48] Yagisawa, T., Ito, F., Osaka, Y., et al. 2001. "The Influenceof Sex Hormones on Renal Osteopontin Expression and Urinary Constituents in Experimental Urolithiasis." *J Urol* 166 (3): 1078-82.

[49] Dey, J., Creighton, A., Lindberg, J. S., et al. 2002.

"Estrogen Replacement Increased the Citrate and Calcium Excretion in Rates in Postmenopausal Women with Recurrent Urolithiasis." *J Urol* 167 (1): 169-71.

[50] Eskelinen, M., Ikonen, J., and Lipponen, P. 1998. "Usefulness of History-taking, Physical Examination and Diagnostic Scoring in Acute Renal Colic." *EurUrol* 34 (6): 467-73.

[51] Glowacki, L. S., Beecroft, M. L., Cook, R. J., et al. 1992. "The Natural History of Urolithiasis." *J Urol* 147 (2): 319-21.

[52] Cooper, J. T., Stack, G. M., and Cooper, T. P. 2000. "Intensive Management of Ureteral Calculi." *Urology* 56 (4): 575-8.

[53] Lopes, T., Dias, J. S., Marcelino, J., et al. 2001. "An Assessment of the Clinical Efficacy of Intranasal Desmopressin Spray in the Treatment of Renal Colic." *BJU Int* 87 (4): 322-5.

[54] Kober, A., Dobrovits, M., Djavan, B., et al. 2003. "Local Active Warming: An Effective Treatment for Pain, Anxiety and Nau-sea Caused by Renal Colic."*J Urol* 170 (3): 741-4.

[55] Segura, J. W., Preminger, G. M, Assimos, D. G., et al. 1997. "Ureteral Stones Clinical Guidelines Panel Summary Report on the Management of Ureteral Calculi." *J Urol* 158 (5): 1915-21.

[56] Auge, B. K., and Preminger, G. M. 2002. "Surgical Management of Urolithiasis." *Endocrinol Metab Clin North Am* 31 (4): 1065-82.

[57] Sofer, M., Watterson, J. D., Wollin, T. A., et al. 2002. "Holmium: YAG Laser Lithotripsy for Upper Urinary Tract Calculi in 598 Patients." *J Urol* 167 (1): 31-4.

[58] Delvecchio, F. C., and Preminger, G. M. 2003. "Medical Management of Stone Disease." *Curr Opin Urol* 13 (3): 229-33.

[59] Parks, J. H., Goldfischer, E. R., and Coe, F. L. 2003. "Changes in Urine Volume Accomplished by Physicians Treating Nephrolithiasis." *J Urol* 169 (3): 863-6.

[60] Borghi, L., Schianchi, T., Meschi, T., et al. 2002. "Comparison of Two Diets for the Prevention of Recurrent Stones Inidiopathic Hypercalciuria."*N Engl J Med* 346 (2): 77-84.

[61] McHarg, T., Rodgers, A., and Charlton, K. 2003. "Influence of Cranberry Juice on Theurinary Risk Factors for Calcium Oxalate Stone Formation." *BJU Int* 92 (7): 765-8.

[62] Brunton, L., Chabner, B., & Knollman, B. Goodman & Gilman's: The Pharmacological Basis of Therapeutics. New York: McGraw-Hill Professional; 2010.

[63] Bahuguna, Y., Rawat, M. S. M., Juyal, V., and Gupta, V. 2009. "Antilithiatic Effect of Flowers of *Jasminum auriculatum* Vahl." *International Journal of Green Pharmacy* 3 (2): 155-158.

[64] Atmani, F., Slimani, Y., Mimouni, M., et al. 2004. "Effect of Aqueous Extract from *Herniaria hirsuta* L on Experimentally Nephrolithiasic Rats." *J Ethnopharmacol* 95 (1): 87-93.

[65] Betanabhatla, K. S., Christina, A. J. M., Sundar, B. S., et al. 2009. "Antilithiatic Activity of *Hibiscus sabdariffa* Linn on Ethylene Glycol Induced Lithiasis in Rats." *Natural Product Radiance* 8 (1): 43-47.

[66] Maghrani, M., Zeggwagh, N-A., Haloui, M., and Eddouks, M. 2005. "Acute Diuretic Effect of Aqueous Extract of *Retama raetam* in Normal Rats." *J Ethnopharmacol* 99 (1): 31-5.

[67] Jouad, H., Lacaille-Duboi, M. A., and Eddouks, M. 2001. "Chronic Diuretic Effect of Water Extracts of *Spergularia purpurea* in Normal Rats." *J Ethnopharmacol* 75 (2-3): 219-23.

[68] Haloui, M., Louedec, L., Michel, J. B., and Lyoussi, B. 2000. "Experimental Diuretic Effects of *Rosmarinus officinalis* and *Centaurium erythraea*." *J Ethnopharmacol* 71 (3): 465-72.

[69] Prasad, K. V., Bharathi, K., and Srinivasan, K. K. 1994. "Evaluation of *Ammannia baccifera* Linn for Antiurolithic Activity in Albino Rats." *Indian J Exp Biol* 32 (5): 311-3.

[70] Anand, R., Patnaik, G. K., Kamal, R., and Bhaduri, A. P. 1995. "Antioxaluric and Anticalciuric Activity of Lupeol Derivatives." *Indian J Pharmacol* 27 (4): 265-8.

[71] Doddola, S., Pasupulati, H., Koganti, B., and Prasad, K. V. 2008. "Evaluation of *Sesbania grandiflora* for Antiurolithiatic and Antioxidant Properties." *J Nat Med* 62 (3): 300-7.

[72] Vargas, R., Perez, R. M., Perez, S., et al. 1999. "Antiurolithiatic Activity of *Raphanus sativus* Aqueous Extract on Rats." *J Ethnopharmacol* 68 (1-3): 335-8.

[73] Sharma, A., Shanker, C., Tyagi, L. K., et al. 2008. "Herbal Medicine for Market Potential in India: An Overview." *Academic Journal of Plant Sciences* 1 (2): 26-36.