

Insight Review on Management of Nephrolithiasis Using Medicinal Plants

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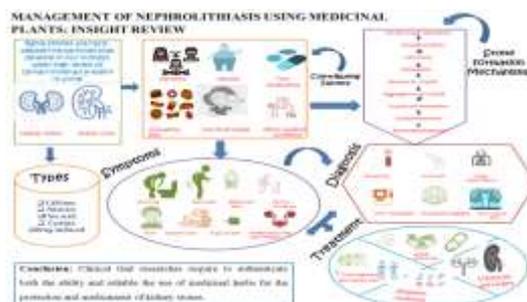
ABSTRACT:

Background: Urolithiasis or kidney stone is the oldest and most widespread painful urological disorder. Lithiasis refers to the existence of a stone that has emerged in the kidney or any part of the urinary tract. Several conventional approaches for the management of nephrolithiasis or renal calculi such as hemorrhage, infection, urethral perforation, nausea and vomiting are associated with various side effects, which cannot be ignored. Literature has reported multiple medicinal plants and their active components useful in management of urolithiasis with higher safety index compared to conventional approaches.

Objectives: In this review article, the nephrolithiasis or urolithiasis properties of herbal medicinal plants in the management of kidney stone highlighted.

Conclusion: In consideration of this, current review has summarized the general and comprehensive updated overview of nephrolithiasis activity of medicinal plants. Science direct, Pub Med, Google and Scopus database have been searched for conclusively relevant compositions on herbs and herbal plant based renal calculi studies. The outcomes were screened through analysis of previous abstracts published review and research articles.

Graphical Abstract



1. Introduction

Urolithiasis or kidney stone is the oldest and most widespread painful urological disorder. Lithiasis refers to the existence of a stone that has emerged in the kidney or any part of the urinary tract¹. A survey by WHO has been reported that about 3- 20% of the world population have the tendency to develop urinary stone during the life span of 70 years. However, urolithiasis incidence varies in different countries². In India most “Stone belt” state is

Rajasthan, Maharashtra, Gujrat, Uttar Pradesh, Punjab, Haryana and Delhi. The development of renal stones is associated with multivariate pathogenesis³. Various studies done till date revealed that internal factors (altered oxalic acid metabolism, level of phosphorus, calcium, along with uric acid) and exogenous variables (dietary patterns, dehydration, hot weather, and use of hard water) contribute to pathogenesis of lithiasis⁴. According to report 12% of Indian people have urinary stone, out of 50% may end up with kidney lose or damage. Presence of renal stones is sometimes asymptomatic and observed only during imaging. However, common symptoms observed in individuals having stones are⁵:

- Unbearable pain in the back side of the body and below the ribs.
- Reduced volume of urine.
- Severe stomachache that radiates to the lower abdomen
- Pain and pelvic girdle.
- A feeling of sharp pain in the form of waves with fluctuating intensity.
- Pain or burning sensation during urination.
- Vomiting with abdominal pain (Fig. no.1).

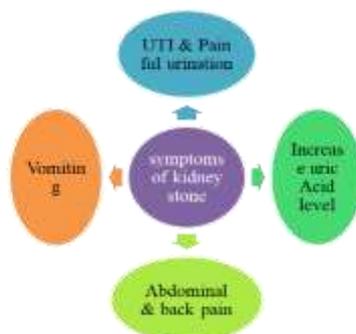


Fig. No. 1 Symptoms of Kidney Stone

Kidney stone development is an intricate process regulated by various metabolic alterations. Some factors which prove the cases of urolithiasis include release of reactive oxygen species i.e., ROS, formation of oxalates, hormonal disbalances, etc. However, the most prominent cause of urolithiasis is the oxidative stress⁶. The most prevalent known cause of calcium kidney stone disease is hypercalciuria or high calcium excretion in the urine. Around 75% of kidney stones have a calcium-based composition, i.e., calcium oxalate, calcium phosphate, and a mixture of calcium and phosphate⁷ (Fig. no.2). Nearly ten percent of renal stones are based on uric acid, 1% is based on cystine, and the rest are struvite. Mixed stones exhibit diverse components like uric acid in aggregation with calcium⁸.



Fig. No. 2 Types of Stone

Stone genesis initiates with the supersaturation of urine with calcium, oxalate & phosphate. The process of crystal aggregation accelerates due to enhanced nucleation resulting in rapid

crystal growth⁹ (Fig. No. 3). Several stone inhibitor ions like magnesium and citrate are present in urine which forms soluble complexes with calcium ions.

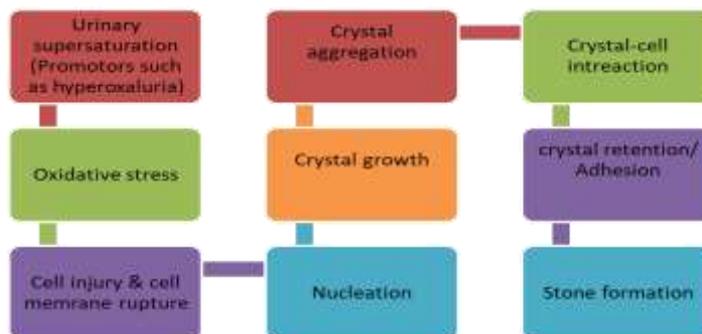


Fig. No. 3 Process of Stone Genesis

Thus, these ions reduce the supersaturation, nucleation and calcium oxalate quantity under normal physiology. But the individual capacity may differ from person to person¹⁰. The failure of normal physiology with drug treatment or critical cases leads to surgical treatment. The widely used surgical procedure is extracorporeal shock wave lithotripsy (ESWL)¹¹. Apart from this a patient can also undergo for ureteroscopy and percutaneous nephrolithotomy for removal of stones. But it's very unfortunate that the people suffering from urolithiasis show almost 50% recurrence rate even after surgery. Other factors like hypertension, tubular necrosis, and various problems related to kidney worsen the cases of surgical treatments¹². Therefore, renal stone treatment requires preventive and curative therapy for better relief. However, currently, available drugs are not effective in facilitating the complete removal of stones¹³. Even large doses are required to meet the therapeutic concentration at the target site and are usually associated with several severe side effects¹⁴.

The World Health Organization (WHO) reports that non-conventional medicine provides primary healthcare to 85% of the global population living in developing countries¹⁵. There has been a paradigm shift to plant-originated drugs as these drugs are inexpensive compared to synthetic drugs¹⁶. Herbal plants often exhibit a wide range of beneficial effects, including litholytic, anti-calcifying, analgesic, antioxidant, diuretic, antibacterial, and anti-inflammatory qualities, without prominent undesirable effects¹⁷. Herbs containing polyphenols, flavonoids, tannins, and glycosides have found potential use as alternative to pharmacological drugs in urolithiasis by effectively reducing calcium and magnesium levels¹⁸. The pharmacological action may be an outcome of suppression and inactivation of cascade of events and other signaling pathways involved in development of kidney stones¹⁹.

Problems of Various Conventional Treatment Approaches

Conventional approaches are associated with various side effects from mild to severe depending upon class of drug used in the management of urolithiasis. The prominent threatening side effects are cardiovascular, upper respiratory tract infections, gastric disturbance (diarrhea, constipation vomiting & nausea), blurred vision, cataract etc.^{20,21} (Table No.1)

Table No: 1 Problems of Various Conventional Treatment Approaches

S. No.	Drugs	Target	Mechanism of action	Limitations	Ref.
1	Allopurinol	Liver (Inhibitor of xanthine oxidase)	Reducing the production of uric acid.	Lower blood cells, Shortening of breath, Inflammation on face or throat, Skin reaction (rash & blister), Eye pain.	22
2	Thiazide	Sodium chloride symporter	Reduce urine calcium levels and increase blood calcium.	Light headache, Blurred vision, Loss of appetite, Itching, Weakness	23
3	Tamsulosin	Alpha adrenergic receptor antagonist	Alpha - blockers used in the stone passage have been to reduce the urethra spasm, high pressure proximal to the stone.	Headache, Dizziness, Runny & stuffy nose, Joint pain, Weakness	24
4	Potassium citrate	-	Potassium Citrate decrease urinary excretion of calcium.	Feel tingly, Swelling & rapid weight gain, Fast or slow heart rate.	25
5	Nifedipine	Influx of calcium ions	Nifedipine causes the chance of stone expulsion, reduces the pain, and also decreases the time to stone expulsion.	Dizziness, Light headedness, Bloating or swelling of the face	26
6	Lupeol	It normalizes high elimination of renal enzyme in the urine.	Lupeol reduces uric acid level whichever overcome the formation of uric acid stone and can high glucose-amino glycans, that suppress the crystal development.	Skin atrophy, weight gain, gastritis.	27

The multifaceted pharmacological actions of medicinal plants including their diuretic, stone dissolution and inhibition property, antioxidant, inhibitory effects on Kininase II (ECA), antiphlogistic property, spasmolytic and pain reliving activity as well as their ability to balance the inhibitors and promoters of crystallization and alter urine ion concentrations are beneficial in the treatment of kidney stones^{28,29}. Kidney stone problems have long been treated using traditional medicine. Most of the traditional and folklore systems use herbal approach for management and treatment of ailments (Table no. 2). Modern treatment interventions for kidney stones are wrought with side-effects, hence the need for alternative therapies such as plant-based medicines^{30,31}.

Herbs Exhibiting Urolithiasis Activity

Table No. 2 Herbs Exhibiting Urolithiasis Activity

S. No.	Name & Source	Active Constituents	Uses	Discussion	Ref.
1	<i>Alhagi mannifera</i> (Fabaceae) Manna grass Roots	Flavonoids, flavone glycosides, Alhagidin, Alhagitin, proanthocyanidins , triterpenes, tannin	Pain, Kidney stone, Laxative Diuretic	Reduce calcium oxalate kidney stone	32.
2	<i>Aerva lanata</i> (Amaranthaceae) Mountain knotgrass Leaves	Quercetin and betulin	Diuretic, anti- inflammatory, anthelmintic, anti-bacterial and mild analgesic effects, Lithiasis, cough, asthma etc.	inhibition of the activity of Oxalate oxidase enzyme	33.
3	<i>Ammannia baccifera</i> (Lythraceae) Blistering ammannia Root	Ethanollic extract	Scabies, common cold, spinal disease, gastroenteropathy , aphrodisiac and Kidney stone etc.	Ethanollic extract of A. baccifera (2g/kg/day, po) was found to be effective in reducing the stones, dissolution of pre-formed ones and increase in urinary excretion of calcium, magnesium and oxalate along with reduction of calcium and magnesium levels in the prophylactic group	34.
4	<i>Aegle marmelose</i> (Rutaceae) Bael	Leaves extract	Antidiarrheal & antimicrobial, Antiviral & radioprotective,	Inhibit the growth of the brushite urinary stone crystals	35.

	Leaves and fruit		Anticancer & antipyretic, treatment of ulcer, antigenotoxic, diuretic, anti-fertility and anti-inflammatory properties, urinary stone etc.		
5	<i>Borhaavia diffusa</i> (Nyctaginaceae) Punarnava Root	Aqueous extract.	Anti-diabetic and diuretic properties, Pain relief, anti-inflammation, Digestive disorder, Stone. Etc.	Extract possibly inhibited calcium oxalate crystallization, diuresis and hypo-oxaluria may justify its prophylactic use in urolithiasis.	36.
6	<i>Bombex ceiba</i> (Bombacaceae) Red-silk Cotton tree Fruit	Fruit extract (carbohydrates, glycosides, flavonoids, tannins and phenolic compound)	Diarrhea, Constipation, Piles, Urinary disorder, Gynecological disorder, kidney stone.	Aqueous and ethanol extracts of <i>B. ceiba</i> fruit significantly ($p < 0.05$) reduced the elevated urinary oxalate, showing a regulatory action on endogenous oxalate synthesis. The increased deposition of stone forming constituents in kidneys of calculogenic rats was also significantly lowered with curative treatment of aqueous and ethanol extract.	37.

7	<i>Blumea balsamifera</i> (Asteraceae) Sembung Flowering plant	Extract.	Wounds healing, Rheumatism, Anti-diarrhea Anti-spasm, colds and coughs, Kidney stone.	Decreased crystal size, shifted crystal phase from COM to COD (calcium oxalate monohydrate & calcium oxalate dihydrate) and prevented the aggregation of calcium oxalate crystals.	38.
8	<i>Daucus carota</i> (Apiaceae) Wild carrot Rhizomes	Carrot extract	Dropsy, Chronic dysentery, Kidney ailments, and worms, Nervine tonic, and for uterine pain, Kidney stone etc.	Inhibition of nucleation, growth and aggregation of calcium oxalate crystal (Anti- calcifying property)	39.
9	<i>Cynodon dactylon</i> (Poaceae) Bermuda grass Root	Extract	Cancer, cough, Spasm, diarrhea, Dropsy dysentery, epilepsy, Headache, Hemorrhage, antioxidant, Anti- hypertension, hysteria, measles, rubella, Snakebite, sores, stones, tumors, Urogenital disorders.	A minimum dose of 200 mg/kg C. dactylon reduced stone formation and simultaneously increased total antioxidant power of serum and preserved MDA content and water.	40.
10	<i>Costus speciosus</i> (Costaceae) Wild Ginger Tubers	flavonoids, saponins and other phenolic compounds	Pneumonia, constipation, skin diseases, fever, asthma, bronchitis, inflammation, anemia, rheumatism, dropsy, cough, urinary diseases and jaundice	Significant reductions of the excretion of urinary total protein, creatinine, sodium, and potassium and also reduced the size, proportion and urinary crystal	41.

				crystallization of monohydrate crystal.	
11	<i>Ceropegia bulbos</i> (Apocyanaceae) Caudiciform Tubers	Swarsa (Whole plant extract)	cure deafness, tubers & kidney stone, urinary tracts diseases, etc.	Ultrasound examination significantly show reduction in size of the calculus. (50 ml of Swarasa daily for 10 days significantly reduced kidney stone size)	42.
12	<i>Mimosa malacophylla</i> (Fabaceae) Touch-me-not Leaves	Aqueous ethanolic extract	Antibacterial & antivenom Antifertility & anticonvulsant Antidepressant & aphrodisiac Urogenital disorders & piles Dysentery, sinus and wounds healing and Kidney stone etc.	Aqueous extract shows good (anti- calcifying property as compared to alcoholic extract) inhibited crystallization of calcium oxalate	43.
13	<i>Nigella sativa</i> (Ranunculaceae) Black seed seed	Polyphenolic compounds	Antihypertensive, liver tonics, diuretics, digestive, anti-diarrheal, Bitter tonic, analgesics, anti-bacterial and in skin disorders, kidney stone	significant positive effects on disappearance or reduction of size of kidney stones.	44.
14	<i>Pimpinella anisum</i> (Apiaceae) Olive Fruit	Aqueous extract	Analgesic & carminative Aromatic & disinfectant Diuretic & kidney protective etc.	Nephron-protective potential against harmful effect induced by lead toxicity on kidney.	45.
15	<i>Phyllanthus fraternus</i> (Euphorbiaceae) Gulf Leaf-Flower Entire plant	Plant infusion	Diuretic, Spasm, Gonorrhea, Laxative Malaria, Excretion of stone	Significant decrease in urinary oxalate and uric acid in patients with hyperoxaluria	46.

				and hyperuricosuria.	
16	<i>Rosmarinus officinalis</i> (Lamiaceae) Rosemary Leaves	ethanolic extract	Headache, Spasm Epilepsy, Stomach pain Rheumatic, Memory enhanced.	Ethanollic extract (100mg/kg and 200mg/kg), significantly decreased serum creatinine level, serum urea level, urine calcium level, protein level in urine and serum uric acid and increased serum calcium level, protein level in serum	47.
17	<i>Tamarix gallica</i> (Tamaricaceae) Tamarisk leaves	Acid fraction	Abdominal pain, Diarrhea Liver disorder, anti-lithiasis, anti-inflammatory	The acid fraction of the extract show activity remarkable in the formation of urinary lithiasis (calcium oxalate)	48.
18	<i>Tridax procumbens</i> (Asteraceae) Tridax daisy Leaves	Successive extraction	Diarrhea, Liver disease, Bacterial infection, Boils, blister and wound healing, Antihypertensive	Ethyl acetate extract showed good antilithiatic activity as compared to other extract (Reduced oxalate and inhibited calcium oxalate precipitation in kidney).	49.
19	<i>Mentha piperita</i> (Lamiaceae) Peppermint Entire herb	Methanolic extract	Topical preparation Aromatherapy, Mouth washes, Cooling effect Inflammation	demonstrated the prophylactic and curative potential against urolithiasis, as it provides scientific	50.

				credence for the folkloric claim against kidney stone disease	
20	<i>Tribulus terrestris</i> (Zygophyllaceae) Gokhru Fruit	Aqueous extract	Skin and eye disorder Chest pain, Heart Disease Dizziness, Diuretic Kidney stone, Bitter tonic	Study lends scientific evidence to the safe, preventive and curative potential of statistically optimized aqueous extract of <i>T. terrestris</i> at a dose of 750 mg/kg body weight	51.
21	<i>Zea mays</i> (Poaceae) Dry corn silk	Infusion of corn silk	Nutrition, Source of protein, starch, oil. As a food sweetener	Higher potential to solubilized calcium and kidney stones in infuse	52
22	<i>Macrotyloma uniflorum</i> (Leguminosae) Horse gram Seed	Aqueous extract	Amenorrhoea, Bile stone Kidney stone, Rheumatism, Piles Diabetes, Goiter	Buffer and water extract of <i>M. uniflorum</i> seeds were found the most potential lead for the kidney stone degrading biocatalyst. (due to the presence of polar compounds and proteins)	53,5 4
23	<i>Bryophyllum pinnatum</i> (Crassulaceae) Pattharchatta Leaves	Hydro alcoholic extract	Diabetes, Diuresis Kidney stone Respiratory tract infection Wounds healing Insects bite	Reduced Sodium oxalate stones in kidney	55,5 6

Recent Reported Medicinal Plants and Their Products Having Urolithiasis/Nephrolithiasis Property

- ❖ *Cynodon dactylon* and *Dolichos biflorus* (seed extract) reported to have, the ability of the excretion of stones from kidney and urinary tract with decreasing the size of stone⁵⁷
- ❖ Reported that the aqueous extract (*Spinacia oleracea* leaf and *Coriandrum sativum* seed) inhibited significant inhibitory potential against the crystallization process by in vitro method and conclude that, present phytoconstituents in mixture (aqueous extract) can be used medicinally to prevent kidney stone formation and recurrence⁵⁸.
- ❖ Studied on traditional medicinal plant used to treat stone problems (*Piper nigrum*, *Aegle marmeplos*, *Plantago major*, *Curcuma longa*, *Ficus carico*, *Allium odorosum*, *Mentha arvensis*, *Centella asiatica*, *Celtris australis*, *Cyprus rotundus*) and evaluate in vitro for determination of effectiveness in urinary tract stone and conclude that *Piper nigrum* extract shows the highest inhibition efficiency in urinary medium though it gives lowest efficiency in aqueous medium⁵⁹
- ❖ Evaluation of in-vitro anti-nephrolithiasis effects of selected medicinal plants (*Bryophyllum pinnatum*, *Duranta erecta*, *Cynodondactylon*, *Duchesnea indica*, *Taraxacum officinalis*). Result demonstrate that *Bryophyllum pinnatum* was highly significant as compared to the other plant extracts⁶⁰.
- ❖ Demonstrate the anti-urolithiasis impact against calcium oxalate stones on ethanolic extract of Halfa-bar (*Cymbopogon Proximus*) and parsley (*Petroselinum sativum*) and concluded that both plants have ability to decreased the CaOx deposition, improved renal architecture, increased urine pH, decreased lithogenic components, enhanced renal function, and diuresis as its anti-urolithic mechanisms⁶¹.
- ❖ Studied on inhibition of kidney stone by hydroxy-citric acid (HCA) which, is mainly found in *Garcinia cambogia* and *Hibiscus sabdariffa* and conclude that HCA can regulate lipid metabolism and inhibit CaOx formation, and may be a therapeutic option for the treatment of kidney stone⁶².
- ❖ Evaluate the crystallization inhibition of calcium oxalate crystal formation of ethanolic leaves extract of *Tamarindus indica*, *Cordia dichotoma* and *Cynodon dactylon* and result demonstrated that alcoholic extract of *Cynodon dactylon* leaves have comparable activity to that of cystone in terms of inhibiting the formation of calcium oxalate precipitate⁶³.
- ❖ In vivo studied on the inhibitory effect of *Peganum harmala* L and concluded that that *Peganum harmala* seeds and its main alkaloids significantly inhibited urolithiasis⁶⁴.
- ❖ Evaluate in-vitro Anti- urolithiasis activity of successive extraction (fruit- seeds) of *Melia azedarach* and result concluded that all extract showed good activity against stone by inhibiting the crystallization of calcium oxalate⁶⁵.
- ❖ In- vivo studied on Anti-urolithiasis and nephroprotective activity of botulin and quercetin in a combination with the piperine (bio-enhancer) and results showed that above mentioned combination exhibited anti-urolithiasis effect by reduction in the formation of calculi⁶⁶.
- ❖ Demonstrated in-vitro anti -urolithiasis activity of ethanolic extract of *Saponaria officinalis* and results showed that ethanolic extract of mentioned drug have ability to suppress the growth of calcium oxalate crystals⁶⁷.
- ❖ Prepared and evaluate in-vivo anti-urolithiasis activity of herbal solution (containing five herbs extract i.e. *Tribulus terrestris*, *Urtica dioica*, *Adiantum capillus-veneris*, *Stigma maydis* (corn silk), and *Cucumis melo*) and concluded that oral solution of above-mentioned herb reduces the size and expulsion of stone from patients having urolithiasis problem⁶⁸.
- ❖ Performed in-vitro anti-urolithiasis activity of Indian medicinal plants (*Ocimum kilimandscharicum*) and concluded that ethyl acetate extract show good activity may be due to the presence of phytoconstituents (terpenoids, flavonoids and phenolic compounds)⁶⁹.

- ❖ Demonstrate in-vitro activity of few medicinal plants extracts (aqueous, methanolic, and hot aqueous extracts of the leaves of *Indigofera oblangifolia* leaves and barks of *Capparis catrilaginea*) (and vegetable collection of *Fagonia indica* results showed that mentioned extract have stone (calcium oxalate) dissolving property⁶⁷⁰.
- ❖ Evaluate in-vitro activity of aqueous extract of *Piper betle* and concluded that present phytoconstituents in aqueous extract have potential effect on reduce and dissolve the crystallization of calcium oxalate and struvite stone⁷¹.
- ❖ Demonstrate in-vitro urolithiasis activity of methanolic extract of *Tridax procumbenes* on calcium oxalate crystals (prepared by precipitation methods) and concluded that this plant shows significant primary evidence as anti-urolithiasis effect by stone dissolving property⁷².
- ❖ Assessment of in-vitro urolithiasis activity of aqueous extract of *Berberis aristate* and results revealed the effective ness in preventing the crystallization and inhibit the aggregation of calcium oxalate stone⁷³.
- ❖ Evaluate in-vitro urolithiasis activity of saponin rich fraction from methanolic extract of *Achyranthes aspera* and results revealed that saponin present in methanolic extract significantly dissolve calcium oxalate renal stone⁷⁴.
- ❖ Evaluate in-vitro urolithiasis activity on hydro-ethanolic extract of *Cucumis callosus* fruits and results shows the beneficial effect (crystal inhibition, reduce renal crystal deposition and decrease lipid peroxidation) on calcium oxalate urolithiasis and renal function at multiple targets involves like glycol-oxalate pathways, antioxidant⁷⁵.
- ❖ Demonstrate antibacterial (against *E. coli*, *P. Mirabilis*, *K. pneumoniae* and *S. aureus*) and anti-lithiasis effect of hydro-alcoholic extract and infusion of *Punica granatum* and result revealed that extract possess significant effect on inhibition of calcium oxalate stone due to the presence of tannin, flavonoids and their derivatives⁷⁶.
- ❖ Evaluate anti-urolithiasis activity of ethanolic extract of halfa-bar (*Cymbopogon Proximus*) and Parsley (*Petroselinum sativum*) and results concluded that combination of both extracts have potency by lowering calcium action against calcium oxalate stone^{77,78}.
- ❖ Studied in-vivo anti-urolithiasis effect of aqueous and ethanolic extract and essential oil of *Saussurea costus* and this study results explored the effect of different dose of *Saussurea costus* on various parameters, which provide potential therapeutic effect in the management of lithiasis⁷⁹.
- ❖ Explored in-vitro efficacy of aqueous extract of *Bergenia ligulata* (Paashanbheda) roots in the management of urolithiasis and conclude that aqueous extract of drug has significant effect by inhibiting the nucleation and aggregation calcium oxalate crystals⁸⁰.
- ❖ Evaluate in-vivo anti-urolithiasis effect of polyherbal formulation LACTN (prepared by mixing 5 herbs i.e. *Lens culinaris*, *Allium cepa*, *Cucumis melo*, *Triticum aestivum*, *Nastarium officinale*) and concluded that due to anti-lithogenesis effect foresaid formulation have the ability to remove the present stone and also inhibit the new stone formation⁸¹.

Basic Diet to Avoid Kidney Stone Formation

Diet has a major influence on the formation and management of kidney stones.

Diet avoided or should be taken in less quantity following diet should be follow: Cabbage, Tomato, Spinach, Mushroom and Black tea etc. are eat in less quantity on daily basis^{82, 83} (Fig. no. 4).

For renal calculus made of uric acid – avoid diet or eat less. Non-vegetarian diet, fish, Bean, Sea food, Apricot, Grapes, Cheese and also eat less salt.

Eat food in more quantity: Horse gram seed, Coconut, water, pineapple, Banana, Carrot, Lemon, Orange, Sweet lime, Chickpea, Bitter gourd, Green vegetables (except spinach), Rice, Wheat etc., increase fluid intake also in daily basis^{84,85}.

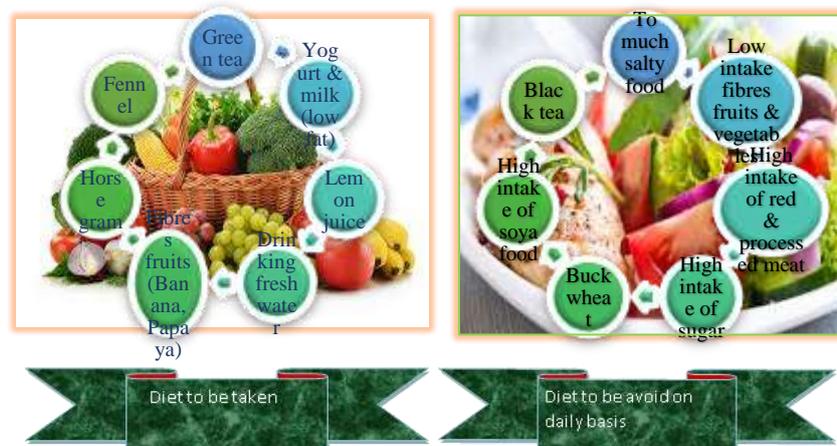


Fig No. 4 Balanced Diet to Avoid Kidney Stone

Role of Diet in Renal Stone

(Diet to be taken): Daily intake diet play a major role in the formation of kidney stone. For protection of kidney stone, we can include the below mention diet⁸⁶.

Green Tea: Green tea is rich in antioxidants and contains the polyphenol compounds like; catechins which were found in four different hydro soluble forms as: epigallocatechin-3-O-gallate (EGCG), epicatechin-3-O-gallate (ECG), epigallocatechin (EGC), and epicatechin (EC). It also contains caffeine in majority which has been reported to have hypercalciuric & diuretic effect. Caffeine also show inhibitory effect on urinary stone genesis⁸⁷.

Yogurt and Milk: Yogurt is a food produced by bacterial fermentation of milk. It is a good source of calcium which can bind with the oxalates that decrease the risk of kidney stone formation⁸⁸.

Lemon Juice: Diluted lemon juice if intake daily it can increase urine citrate and also reduce the risk of kidney stone formation⁸⁹.

Drinking Water: Drinking fresh water will hydrate our body and dilute urine which did not aggregates crystals and reduce the risk of stone formation⁹⁰

Fibers and Fruits: Fruits are rich in calcium, magnesium, potassium and fibers which provide an alkali load which, increase the urinary citrate (known as stone formation inhibitors⁹¹).

Horse Gram: Horse gram contains various phytoconstituents like polyphenolic compounds, flavonoids and steroids has to be reported diuretic and anti-urolithiasis property⁹².

Fennel: Fennel contain volatile oil, glycoside, flavonoids and phenolic compounds which decrease the uric acid level and also possess diuretic property, it might be beneficial in the management of kidney stone by promoting the urine production⁹³.

(Diet to be Avoid): Daily intake diet play a major role in the formation of kidney stone. Some food should be avoided or take in less quantity for protection from new genesis of stone⁹⁴.

Too much Salty Food: Food contain high salt may increase the risk of kidney stone because high salt consumption can reduce the calcium excretion and also have the chances of recurrence of stone even unhealthy dietary schedule also have risk of calcium oxalate renal stone^{95,96}.

High Intake of Sugar: Food contain high sugar can lead to less urine volume and elevated urinary calcium which, may increase the risk of kidney stone formation and it is also reported

that if high intake or consumption of sugar is remarkable associated with higher prevalence of renal stone⁹⁷.

High Intake of Soya Food: Food are rich in soya content have high concentration of oxalates, accumulation of this may cause kidney stone^{98,99}.

Black Tea: Habitual black tea consumption may risk of kidney stone formation because of intestinal hyperabsorption of oxalates¹⁰⁰.

High Intake of Processed Meat: It is reported that people consuming red and processed meat have higher risk or hospitalized for kidney stone as compare to vegetarian (consume fresh fruits, vegetable high in magnesium) people¹⁰¹.

2. Conclusion

Current review article discloses the outcome found from the existing literature source that various medicinal plants with their Phyto-constituents used in the management of nephrolithiasis or kidney stone. In current years, it has been detected that various herbal bioactive have great and effective approach for the treatment on kidney stone. Herbal plants and their derived product may reduce the rate of reoccurrence rate of kidney stones. However, clinical trial researches needed to confirm both the ability and safety of the use of medicinal plants and derived products for the prevention and treatment of Nephrolithiasis or Urolithiasis.

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