



OVERVIEW ON SELECTED MEDICINAL PLANTS USED IN THE MANAGEMENT OF UROLITHIASIS

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ABSTRACT

Urolithiasis, which is referred to as the process of formation of calculi (singular calculus) in the urinary system. Urinary stones affect 10–12% of the population in industrialized countries. The use of plant products with claimed uses in the traditional systems of medicine assumes importance. Herbal medicines have several phyto-constituents and exert their beneficial effects on urolithiasis by multiple mechanisms. In siddha system of medicine the prime choice is given to the selection of medicinal herbs for both prevention and treatment. The medicinal plants that has the potency to interrupt in the stone formation as well as efficacy to break the already existing stones are preferred. The plants

that has a diuretic property can wash out the residues and deposits of stone in the kidney and urinary tract. Also prevents the further formation of calculus. The plants that has the above properties and possess effective Anti-Urolithiatic Activity and Diuretic Activity are discussed.

KEYWORDS: Urolithiasis, Calculi, Siddha, Diuretic.

INTRODUCTION

Urolithiasis or nephrolithiasis are the oldest and wide spread painful urological disorders.^[1] It is the third most prevalent disorder in urinary system.^[2]

Urolithiasis, which is referred to as the process of formation of calculi (singular calculus) in the urinary system includes Nephrolithiasis (Renal Calculi or Kidney Stones), Ureterolithiasis (Ureter Calculi) and Cystolithiasis (Bladder Calculi).

It is a multifactorial disease owing to multiple genetic or environmental factors that regulates calcium salt precipitation in the urinary system. With its multifactor aetiology and high rate of recurrence, urinary tract stone disease provides a medical challenge.^[3]

Urinary stones affect 10–12% of the population in industrialized countries.^[4, 5] There are only a few geographical areas in which stone disease is rare, e.g., in Greenland and in the coastal areas of Japan.^[5] The incidence of urinary stones has been increasing over the last years while the age of onset is decreasing.^[6] With a prevalence of > 10% and an expected recurrence rate of ~ 50%, stone disease has an important effect on the healthcare system.^[7]

The use of plant products with claimed uses in the traditional systems of medicine assumes importance. Herbal medicines have several phyto - constituents and exert their beneficial effects on urolithiasis by multiple mechanisms. In siddha system of medicine the prime choice is given to the selection of medicinal herbs for both prevention and treatment. The art of herbal healing has been evolved as a part of Indian culture since antiquity. Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for prevention of diseases and ailments.^[8] Interest in herbal drugs is growing due to their efficiency, low toxicity and absence of side effects^[9]

Various Plant drug have been employed during ages to manage urolithiasis. References prove that litholytic herbs for treatment of renal stones are used since ancient periods before inventing modern treatments.^[10] Scientific studies are mostly focused on phytotherapy as it is proved to be vital in preventing reoccurrence of stones.^[11]

Siddha system of medicine is an age old traditional system with unique properties in not only treating a disease but gives us an immense perception and approach to lead a healthy life. Siddhars are the spiritual scientists and they have classified diseases into 4448 numbers.^[12] Kalladaippu is one among them. The clinical features of kalladaippu can be correlated with Urolithiasis.

Siddha system of medicine is a traditional system of medicine nurturing the mankind from time immemorial. The WHO has estimated that approximately 60 to 70 % of the world's population rely on traditional medicine for their health needs.^[13]

According to Siddha Materia Medica the medicines are obtained from herbs, metals, minerals and animals products.^[14] However herbal preparations are given the prime priority over the other forms of preparations.

So here the article is focused on the Review of major indigenous herbs used in the management of kalladaippu.

Prevalence

Of the total global population, urolithiasis occurs approximately about 12 % and it is estimated at 1-5% Asia, 5-9% Europe, 13% North America. In India, 12 % of the populations are expected to have urolithiasis and also nearly 15% of the population of North India suffers from kidney stones.^[15] It is a male predominant disorder where the epidemiological data revealed that it occurs at a ratio of 2:1 /3:1 i.e., it occurs 12 % in men and 6 % in women between the ages 20 to 40 in both sexes with recurrence 70-81 % in males and 47-60 % in females.^[16]

Kalladaippu

Kalladaippu is described in the Siddha Classical Literature.^[17] The clinical features of Kalladaippu can be correlated with Urolithiasis. A urinary disease denoted by the sudden obstruction of the urinary tract while passing urine by excretion of small sand like granules.^[18] It comprises of nephrolithiasis (the formation of kidney stones), ureterolithiasis (the formation of stones in the ureters), and cystolithiasis (the formation of bladder stones).

Etiology

In Siddha system the well-being of the human is based on the proper balance and synchronisation of the three vital forces or humors namely Vali, Azhal and Iyam. It is the mutthodam theory. Derrangements in these three humors results in the formation of diseases. Kalladaippu (Urolithiasis) comes under Neerinai Arukkal Noigal, producing low output of urine due to various aetiological factors like dietary intake of food that increases Vali and Azhal kuttram, Drinking of contaminated water, Intake of putrefied food and starch

substances, Intake of food while indigestion.^[19] The etiology of this disorder is multifactorial and is strongly related to dietary lifestyle habits or practices^[20]

Risk factors

Increased rates of hypertension and obesity, which are linked to nephrolithiasis, also contribute to an increase in stone formation.^[21] People with certain medical conditions, such as gout, diabetes, hypertension and those who take certain medications or supplements are at risk for renal stones.^[22]

Classification

According to the siddha text kalladaippu is classified into four types^[23]

- ❖ Vatha kalladaippu
- ❖ Pittha kalladaippu
- ❖ Kaba kalladaippu
- ❖ Mukkutra kalladaippu

Signs and Symptoms

Dysuria, hematuria, intense colicky pain radiates from the costal arch obliquely to the lower abdomen, groins, and testes. Nausea and vomiting present, Obstruction of urine causing severe pain in the genitalia and upper part of the anal region, during excretion of urine the movement of stone causes intense pain and inflammation of the urinary tract.

Table 1.1: Major and subtypes of stones in urolithiasis according to chemical components^[78]

Major Type	Subtypes
Calcium Stone (70-80%)	Calcium oxalate monohydrate (40-60%) Calcium oxalate dehydrate (40-60%) Calcium hydrogen phosphate (brushite) (2-4%) Calcium orthophosphate (<1%)
Uric Acid Stone (5-10%)	-
Cystine Stone (1%)	-
Struvite (1%)	-
Xanthine Stone (1%)	-
Mixed Stones (50-60%)	Mixed calcium oxalate-phosphate (35-40%) Mixed uric acid-calcium oxalate (5%)

Selected Medicinal Plants Used In the Management of Urolithiasis

The medicinal plants that has the potency to interrupt in the stone formation as well as efficacy to break the already existing stones are preferred. The plants that has a diuretic property can wash out the residues and deposits of stone in the kidney and urinary tract. Also prevents the further formation of calculus. The following plants has the above properties and possess effective anti urolithiatic activity and diuretic activity.

1.1 *Aerva lanata* (Linn.) - Sirupeelai

The whole plant, especially the leaves, is edible. The leaves are put into soup or eaten as spinach or as a vegetable.^[24] In the traditional system of medicine, the plant is being used as Diuretic, Antihelminthic, Antidiabetic^[25], for arresting haemorrhage during pregnancy, burn healing, as an Antiinflammatory, for head ache, skin disease, to dissolve kidney and gall bladder stones (Yoga et al., 1979), to treat nasal bleeding, cough, scorpion stings, fractures and spermatorrhoea.^[26]

The whole plant of *A. lanata* contains β -Sitosterol, α -amyrin, betulin, hentriacontane, sitosteryl palmitate, D-glucoside, glycosides, Kaempferol-3-galactoside and Kaempferol-3-rhamnogalactoside, starch, free: sugars (fructose, galactose, rhamnose and sucrose).^[27, 28] Alkaloids, phenolic compounds, phytosterols, carbohydrates, proteins, amino acids, flavonoids and quinones were identified in different solvents extracts.^[29] The herb *Aerva lanata* commonly known as Pashanabheda has been claimed to be useful for its diuretic, anthelmintic, anti-diabetic, expectorant, hepato-protective, and antimicrobial, cytotoxic activity, antiurolithiatic and anti-inflammatory activity.^[30, 31]

Its diuretic action is said to be very effective in the treatment of urethral discharges and gonorrhoea and is of value in cases of lithiasis and as an anthelmintic. The whole plant or parts of it is used as a diuretic herbal drink, tea, porridge, extract or as a decoction with other herbs.^[32] The plant extract has also been reported to possess anti-inflammatory, antimalarial, antivenin, analgesic and sedative activities.^[33]

Anti-urolithiatic activity aqueous suspension of aerial parts of *A. lanata* (2 g/kg) against calcium oxalate (ethylene glycol) induced urolithic rats showed significant decrease in the enzymes related to stone synthesis and produced cytoprotective mechanism.^[34] Aqueous extract of dried flower of *A. lanata* (3.2 mg/kg) against ethylene glycol induced renal calculi

in experimental rats showed better anti urolithiatic activity than the standard cystone tablet.^[35]

1.2 *Crateva magna* – Mavilangu

Crateva magna, is well known traditional plant used to treat various ailments in particular to urolithiasis^[36], hepatoprotective^[37], cardioprotective^[38], anti-arthritic^{[39][40]} and rubefacient.^[41]

The decoction of the bark is useful in the treatment of urinary organs^[42] and leaves are used as vegetable and the dried leaves are smoked in caries of nasal bones, the smoke being exhaled through the nose in neurologic pains.^[43] The leaf and stem bark have been evaluated for their antioxidant activity and inhibition of key enzymes relevant to hyperglycemia.^[44]

The decoction of bark skin or roots is beneficial in urinary calculi, dysuria and cystitis. The decoction of leaves effectively alleviates the fever and associated delirium. The fresh juice of its leaves is useful as a bitter tonic. It is used as a cholegogue, anthelmintic and anti-amoebic in both intestinal and hepatic infestations.^[45]

The anti-urolithiatic activity of *Crataeva magna* was investigated in experimental albino rats. The ethanol extract (400mg/kg bw) of *Crataeva magna* in rat models result in reduced serum creatinine and calcium, urine oxalate and kidney weight significantly with a marked increase in final body weight and urine volume output. The result shown by ethanol extract (400mg/kg bw) group was compared to standard polyherbal drug treated group and thus exhibited potent anti urolithiatic activity.^[46]

Anti-urolithiatic Rats (in-vivo) Stem bark powder, ethanolic extract - Lowering intensity of cellular infiltration in renal tube^[47] Reduction in oxalate levels of urinary and renal tissues along with reduced liver glycolate oxidase activity^[50] Stem bark powder - Reduction in phosphate, calcium and oxalate content of previously formed stones^[47] Stem bark powder - Decrease in urinary enzymes levels^[49] Lupeol reduces oxalate level; promote super saturation in renal tissues by diuretic activity^[50] Stem bark powder, ethanolic extract Reduction in crystal deposition leading to minimized tubular damage.^[48]

1.3 *Ocimum gratissimum* L. - Elumichan thulasi

Ocimum gratissimum L. (Lamiaceae) is an herbaceous perennial plant commonly known as scent leaf. It is found in tropical Asia especially India. *Ocimum gratissimum* L. var. *clocimum* is a new hybrid strain of *Ocimum gratissimum*, developed by Sobti et al. from

Indian Institute of Integrative Medicine formerly Regional Research Laboratory Jammu Tawi. It has been used extensively in the traditional system of medicine in many countries. It has been reported to be rich in plant chemicals. The plant is known to contain alkaloids, tannins, flavonoids and oligosaccharides.^[51] It is used in the treatment of various diseases like cancer^[52], Antinociceptive, Anti-Inflammatory^[53], Antidiarrhoeal^[54], Antibacterial^[55], Antifungal^[56], Wound-Healing^[57] And As Nephroprotective.^[51]

The in-vitro results revealed that the plant extract has potent anti Urolithiatic ability in both nucleation assay (with maximum inhibition of 66.08% at 1000 mg/ml extract concentration) and synthetic urine assay (with maximum inhibition of 62.07% at 100% extract concentration).^[58]

1.4 Tribulus terrestris L - Nerunjil

Tribulus terrestris L., is commonly known as puncture vine, caltrop, yellow vine, goat head and devil's horn. It is a member of the Zygophyllaceae family and is widely distributed in both tropical and mild temperate regions.^[59] All plant parts of *T. terrestris* have antimicrobial and antifungal activity, but the activity of fruits was the best one.^[60] Its diuretic activity is due to high concentration of potassium salts present in it. It is antiurolithiatic and is reported to inhibit stone formation.^[61,62] It has immunomodulatory^[63], analgesic^[64] and anti-inflammatory activities.^[65] It also relaxes spasm of smooth muscle.^[66] The extract is also used for urinary dysfunction, asthma and ophthalmia.^[67, 68]

Ethanollic extract of the fruits of *Tribulus terrestris* showed significant dose dependent protection against urolithiasis of rats induced by glass bead implantation.^[69]

The effect of aqueous extract of *Tribulus terrestris* reduced oxalates in rats, where oxalates induced by sodium glycolate. The glycolate resulted in hyperoxalurea and increased the activities of oxalate synthesizing liver enzymes like glycolate oxidase, glycolate dehydrogenase and lactate dehydrogenase and decreased kidney LDH activity, where the extract has reversed the activity of above said enzymes.^[70]

Ethanollic extract of the fruit of *Tribulus terrestris* showed significant dose dependent protection against urolithiasis of rat's bead implantation. The effect of aqueous extract of *Tribulus terrestris* reduced oxalates in rats, where oxalate induced by sodium glycolate. The glycolate resulted in hyperoxaluria and increased the activities of oxalate synthesizing liver

enzyme like glycolate oxalate, glycolate dehydrogenase and lactate dehydrogenase and decreased LDH activity. It was confirmed that the ethanolic extract of *Tribulus terrestris* possess potent anti urolithiatic activity.^[71] *T. terrestris* extract has a potential to inhibit nucleation and growth of the CaOx crystals^[72]

1.5 Moringa oleifera - Murungai

In the present study aqueous extract of bark of *Moringa oleifera* administered orally, was evaluated for its anti urolithiatic potential in albino rats of wistar strains. The stone were produced in this study by zinc disc foreign body insertion in the bladder supplemented with 1% ethylene glycol in drinking water. The reduction in weight of the stone was used as criteria for assessing the preventive or curative groups were used in both groups. The oral administration of the extract of bark of *Moringa oleifera* has resulted in significant reduction in the weight of bladder stones compared to control group. It was confirmed that aqueous extract of *Moringa oleifera* possess potent anti urolithiatic activity^[73]

Diuretic activity of *Moringa* exists in its roots, leaves, flowers, gum and the aqueous infusion of seeds.^[74] Studies indicate that the root-wood of *M. oleifera* is having antiurolithiatic activity.^[75] A study reported antiurolithiatic property from the aqueous and alcoholic extract of the root bark of *Moringa oleifera*.^[76] Both the extracts significantly lowered the urinary excretion and kidney retention levels of oxalate, calcium and phosphate.

Moringa oleifera Lam. The efficacy of the root bark of *Moringa oleifera* Lam. as an antiurolithiatic agent was investigated using an experimentally induced urolithiatic rat model. Hyperoxaluria was induced in rats using 0.75% ethylene glycol in water. Aqueous (AqE) and alcoholic extracts (AlcE) of the root bark of *M. oleifera* were given orally in curative and preventive regimens over a period of 28 days. Both the extracts significantly ($P < 0.001$) reduced by the extracts. The results were comparable with the standard drug, cystone. The reduction of stone forming constituents in urine and their decreased kidney retention reduces the solubility product of crystallizing salts such as calcium oxalate and calcium phosphate, which could contribute to the antiurolithiatic property of root bark of *M. oleifera*.^[77]

Table 1: list of plants used in Urolithiasis^[14]

S.No	Plant name	Family Name	Tamil name	Part Used	Uses
1.	<i>Aerva lanata</i>	<i>Amaranthaceae</i>	Sirupeelai	Whole plant	Decoction: 15 to 30ml Juice: 20 to 30ml
2.	<i>Crateva magna</i>	<i>Capparidaceae</i>	Mavilangu	Stem bark	Decoction : 15 to 30ml
3.	<i>Ocimum gratissimum</i>	<i>Lamiaceae</i>	Elumichan Thulasi	Whole plant	Decoction; 30 to 60ml
4.	<i>Tribulus terrestris</i>	<i>Zygophyclaceae</i>	Nerunjil	Whole plant Fruit	Decoction: 30 to 60ml Powder: 3 to 6 gm
5.	<i>Moringa oleifera</i>	<i>moringaceae</i>	Murumgai	Flower	Decoction: 15 to 30ml Powder: 3 to 6 gm

CONCLUSION

There are many plants used in the treatment of urolithiasis. Many siddha formulations are prepared with these medicinal plants. They possess rich phytochemical and many other chemical compositions. Synergistic effect of those compositions helps to cure diseases with great potency and efficacy. Thus I conclude that the above article explains about the Siddha view of urolithiasis (Kalladaippu) and selected plants used in the siddha system for the treatment of urolithiasis.

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