

Updates on herbal remedy for kidney stone chronic disease

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Abstract: This review paper highlights the potentiality of medicinal plants in the kidney stone disease activity. Urolithiasis is a common disorder which has affected a considerable number of people worldwide. The problem of urinary stones or calculi is one of the major health disorder and many remedies including herbal have been employed. Kidney stones are called as renal calculi. Kidney stones are associated with chronic kidney disease. Kidney stones may cause extreme pain and blockage of urine flow. Kidney stones are a risk factor for chronic kidney disease and progression to end-stage renal disease. Persons with kidney stones are more likely to have traditional risk factors for chronic kidney disease (e.g., hypertension, pre-existing kidney disease, diabetes, proteinuria, and albuminuria). Drug therapy medications, such as protease inhibitors, antibiotics, and some diuretics, increase the risk of some types of kidney stones. Managing diet, medication use, and nutrient intake can help to prevent the formation of kidney stones. Obesity increases the risk of kidney stones. Medicinal plants are used as urolithotriptic agents. This review paper is aimed to explore and documentation of available herbal treatment for kidney stones. Some of the plant species listed in this review paper have the potential active compounds and may aid researchers for the future study of natural products, which may be useful to treat kidney stones.

Keywords: Kidney stone, herbal medicine, herbal therapy, nephrolithiasis, renal calculi urolithiasis.

I. INTRODUCTION

The development of urinary calculi or kidney stones is known as urolithiasis or nephrolithiasis (Ratna and Harika, 2015; Alelign and Petros, 2018; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Butterweck and Khan, 2009; Chitme et al., 2010; Colella et al., 2006). Kidney stones are associated with chronic kidney disease (Fontenelle and Sarti, 2019; Frassetto and Kohlstadt, 2011; Long and Park, 2007). Kidney stones are the most common urinary tract problems, after urinary tract infections and prostate diseases (Alelign and Petros, 2018; Hall, 2009; Butterweck and Khan, 2009; Wedro, 2007). Furthermore, 12% of the men at the age of 20-40 years develop kidney stones than women (6%). Kidney stones are often more commonly found in males than females due to a longer urethra (Hall, 2009; Taylor et al., 2004; Winston, 2011; Manjula et al., 2015). Kidney stones vary in size and may be found anywhere in the urinary tract from kidney to the bladder (Alelign and Petros, 2018; Rule et al., 2009; Kakitapallia et al., 2020). The urinary tract infection

involves infection in the kidneys, ureters, bladder or urethra. The diagnostic protocol consists of urinalysis, urine culture, and imaging to confirm the diagnosis and assess for conditions requiring active stone removal, such as urinary infection or a stone larger than 10 mm (Alelign and Petros, 2018; Sharma and Filler, 2010; Frassetto and Kohlstadt, 2011; Long and Park, 2007). The common cause of kidney stones include the crystals of calcium oxalate, high level of uric acid and low amount of citrate in the body. Lifestyle modifications are the cornerstone of prevention of kidney stone in the patients with low risk of recurrence, whereas citrate supplementation and medications were recommended for patients with recurrent stones (Frassetto and Kohlstadt, 2011; Long and Park, 2007). A balanced diet is ideal for preventing stone recurrence (Alelign and Petros, 2018). The diet should be high in fiber and vegetables, with normal calcium content and limited sodium and animal protein (Fontenelle and Sarti, 2019; Frassetto and Kohlstadt, 2011; Long and Park, 2007). Calcium oxalate occurred kidney stones is the most common kidney stone disease in India. The patients suffering from kidney stone health disorder detected higher lipid level in the blood as compared to normal individuals. A small reduction in urinary oxalate has been found to be associated with significant reduction in the formation of calcium oxalate stones. Therefore, oxalate-rich foods should be advised to avoid by the patients of kidney stone disease. Further high levels of calcium in the blood and urine also led to the formation of kidney stones (Pak et al., 2003). The risk factors for kidney stones are obesity, insulin resistance, gastrointestinal pathology, living in warmer climates, and certain dietary patterns and medications (Frassetto and Kohlstadt, 2011; Kakitapallia et al., 2020).

II. HERBAL MEDICINE TREATMENT FOR KIDNEY STONE DISEASE

Plant derived medicines have played a pivotal role in the kidney stone disease (Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019; Shirani et al., 2020; Manjula et al., 2015; Khan et al., 2019; Samaranayake et al., 2019; Kasote et al., 2017; Akram and Idrees, 2019; Karimi et al., 2017). Many of these natural products have pharmacological or biological activity that can be exploited in pharmaceutical

drug discovery and drug design (Malabadi et al., 2021; Pandey et al., 2013; Yuan et al., 2016; Malabadi and Chalannavar, 2020; Malabadi, 2008; Malabadi and Vijayakumar, 2008; Malabadi et al., 2009, 2010a, 2010b, 2011a, 2011b; Malabadi et al., 2012a, 2012b, 2012c, 2012d; Malabadi et al., 2016a, 2016c, 2016d; Malabadi et al., 2017a, 2017b; Malabadi et al., 2018). Medicinal plants reduce pain of kidney stones and prevent lithogenesis (Shirani et al., 2020; Yadav et al., 2011). Medicinal plants expel the stones from the kidney. Medicinal plants are commonly used for the treatment of kidney stones (calcium oxalate, uric acid, struvite and cysteine) (Amarasiri et al., 2020; Jha, 2010; Shirani et al., 2020; Yadav et al., 2011; Samaranayake et al., 2019; Akram and Idrees, 2019; Barros et al., 2003; Atmani, 2003; Manjula et al., 2015 Vanherweghem, 1997, 2000; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Sundaram et al., 2019).

Herbal therapy is the alternative option for the patients of kidney stones (Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019; Barros et al., 2003; Atmani, 2003; Manjula et al., 2015; Yadav et al., 2011; Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014; Begun et al., 2004; Prasad et al., 1994). *Ayurvedic* medicine holds promise as a complementary approach to the management and prevention of nephrolithiasis. Herbal medicines becomes integral part of daily life and helped in the prevention and treatment of kidney stone diseases (Nagpal and Sharma, 2020). Medicinal plants used in the treatment of kidney stone disease has been documented and listed in Table 1-7. There more than 108 medicinal plants (Table:1-7) have been used in the kidney stone disease (Akram and Idrees, 2019; Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014).

Plant-based preparations are very important in the Ayurvedic healing process (Malabadi et al., 2021; Malabadi and Chalannavar, 2020). The combination of herbal medicines with allopathic treatment have a great idea to get rid of all the complications related to kidney stones. The patients suffering from kidney stone disease has to undergo dietary therapy and cut down fat diet and increase the consumption of fibres of natural occurring plants and its herbal medicines (Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar

and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014). The mechanisms by which polyherbal drugs and their extracts act differ in many respects from the actions of single substances or synthetic drugs (Kumar et al., 2017; Sundaram et al., 2019). *Ayurveda* first seeks to diagnose patients' conditions before treating them with internal preparations, diet, and habit restrictions (Kumar et al., 2017). Polyherbal combinations have also proven very effective than single herbs (Kumar et al., 2017). In ayurveda, most of the classical preparations are polyherbal, with a combination of 3 to 30 plants involved (Kumar et al., 2017). These constituents are combined accurately, in such a way that the formula is balanced and reproducible (Kumar et al., 2017). One or two of the plants in these combinations will be active and the others will play a supporting role (Kumar et al., 2017). The supporting herbs will each have different actions, acting as catalysts to help proper absorption, transportation, and to reduce toxicity (Kumar et al., 2017; Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014). Herbs have been used in acute kidney stone treatment since antiquity, but many uncertainties surround their contemporary use (e.g., quality and safety, interactions with medications or anesthesia, lack of stone-specific effectiveness) (Frassetto and Kohlstadt, 2011; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019). However, phytonutrients in green tea, turmeric, and berries may reduce the risk of infection, parsley may promote diuresis, and the traditional herb *Agropyron repens*, *Kalanchoe pinnata* may help to achieve flushing of the urinary tract (Frassetto and Kohlstadt, 2011; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019). Therefore, this review paper gives comprehensive review on medicinal plants used in the treatment of urolithiasis.

Caffeine is one of the main components in caffeinated beverages worldwide (i.e., coffee, tea, soft drinks, and energy drinks) (Peerapen and Thongboonkerd, 2018). Previous retrospective and prospective studies have reported contradictory effects of caffeine on kidney stone risk (Peerapen and Thongboonkerd, 2018). Although it has a diuretic effect on enhancing the urinary output, it may slightly increase the stone risk index (Peerapen and Thongboonkerd, 2018). However, there are 3 large cohorts have suggested a preventive role of caffeine in kidney stone disease (Peerapen and Thongboonkerd, 2018). In addition, a recent *in vitro* study has addressed relevant mechanisms underlying the preventive role of caffeine against stone pathogenesis (Peerapen and Thongboonkerd, 2018).

Various human studies have suggested that diets with a higher intake of vegetables and fruits play a role in the prevention of kidney stones (Nirumand et al., 2018; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019). Medicinal plants such as *Camellia sinensis* (green tea), *Rubus idaeus* (raspberry), *Rubia cordifolia* (common madder), *Petroselinum crispum* (parsley), *Punica granatum* (pomegranate), *Pistacia lentiscus* (mastic), *Solanum xanthocarpum* (yellow-fruit nightshade), *Urtica dioica* (stinging nettle), *Dolichos biflorus* (horse gram), *Ammi visnaga* (khella), *Nigella sativa* (black-cumin), *Hibiscus sabdariffa* (roselle), and *Origanum vulgare* (oregano) demonstrated the promising role of dietary plants and phytophenols in the prevention and management of kidney stones (Nirumand et al., 2018; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019). Beside these dietary plants, phytochemicals—such as catechin, epicatechin, epigallocatechin-3-gallate, diosmin, rutin, quercetin, hyperoside, and curcumin—as antioxidant dietary phytochemicals were found to be effective for the prevention of urolithiasis (Nirumand et al., 2018; et al., 2020; Manjula et al., 2015; Khan et al., 2019; Samaranyake et al., 2019; Nagpal and Sharma, 2020; Gauri and Sanjay, 2020; Akram and Idrees, 2019; Amarasiri et al., 2020; Sundaram et al., 2019).

In a day-today life, diets have changed radically, with high intakes of animal protein essentially every day (Yarnell and Abasca, 2007). Therefore, nephron masses to handle additional challenges and increased the potential development of renal failure (Yarnell and Abasca, 2007). Therefore, lifestyle and dietary changes are critical in preventing the renal failure (Yarnell and Abasca, 2007). Hence vegetarian diet therapy is the best solution for the kidney diseases (Yarnell and Abasca, 2007). Chronic kidney failure is a significant problem and botanical medicine can be used to help the need for dialysis by treating the causes and effects of renal failure, as well as reducing the many adverse effects of dialysis itself (Yarnell and Abasca, 2007). Botanicals used to treat kidney failure include: *Rheum palmatum* (Chinese rhubarb, da huang), *Ephedra distachya* (ephedra) stem, *Geranium thunbergii* (Thunberg's cranesbill) root, *Cinnamomum cassia* (cassia) bark, Bao yuan da huang tang (a decoction of *Panax ginseng* [Asian ginseng] root, *Astragalus membranaceus* [astragalus] root, cassia bark, *Glycyrrhiza uralensis* [licorice] root, and Chinese rhubarb), *Lepedeza capitata* (round-headed lespedeza), *Silybum marianum* (milk thistle) seed, *Urtica dioica* (stinging nettle) seed, *Parietaria judaica* (pellitory-of-the-wall) herb, *Orthosiphon stamineus* (Java tea), *Cordyceps chinensis* (cordyceps, Chinese caterpillar fungus), *Centella asiatica* (gotu kola), and *Capsicum* spp. (cayenne) (Yarnell and Abasca, 2007). Botanical medicines offers many interesting possibilities to help to prevent or treat chronic renal failure (Yarnell and Abasca, 2007). However, it is unfortunate that many of these herbs are overlooked, and that the initial exciting research

findings have not been followed up with larger, and more rigorous trials (Yarnell and Abasca, 2007).

II. KIDNEY FUNCTIONS

The urinary system is consists of two major bean shaped kidneys, ureters, bladder and urethra. These bean shaped kidneys located just middle of the back and below the pairs of ribs (Khan et al., 2019; Manjula et al., 2015; Butterweck and Khan, 2009; Hall, 2009). The main function of kidneys is the removal of extra water and wastes from the blood, converting it to urine (Alelign and Petros, 2018; Manjula et al., 2015). They also keep a stable balance of salts and other substances in the blood. Kidneys are connected by a narrow tubes called ureters which carry the waste in the form of urine from the kidneys to the bladder, in the lower abdomen (Manjula et al., 2015; Alelign and Petros, 2018). Bladder is just like a balloon with elastic wall which stretch and expand to store the urine (Butterweck and Khan, 2009; Alelign and Petros, 2018; Fontenelle and Sarti, 2019). Bladder passes the urine through the urethra to outside the body (Manjula et al., 2015; Butterweck and Khan, 2009; Hall, 2009; Alelign and Petros, 2018).

III. FACTORS INFLUENCING KIDNEY STONE FORMATION

Increased body mass (obesity) is also a significant risk factor for developing renal stones (Taylor et al., 2004; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009; Alelign and Petros, 2018; Fontenelle and Sarti, 2019). Medications, such as protease inhibitors, antibiotics, and some diuretics, increase the risk of some types of kidney stones (Fontenelle and Sarti, 2019; Frassetto and Kohlstadt, 2011). Kidney stone chronic disease is mainly due to the high levels of calcium (hypercalciuria), high levels of oxalate (hyperoxaluria), higher levels of uric acid (hyperuricaemia), and low levels of citrate (hypocitraturia) (Khan et al., 2019). Managing diet, medication use, and nutrient intake can help to prevent the formation of kidney stones (Frassetto and Kohlstadt, 2011; Alelign and Petros, 2018). It is has also been reported that the increased dietary protein intake may elevate the rates of developing kidney stones (Hall, 2009; Winston, 2011; Bahmani et al., 2016; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006). It is believed that 1-2% of kidney stones are drug-induced (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009). For the prevention of calcium oxalate, cystine, and uric acid stones, urine should be alkalized by eating a diet high in fruits and vegetables, taking supplemental or prescription citrate, or drinking alkaline mineral waters (Nirumand et al., 2018; Fontenelle and Sarti, 2019; Frassetto and Kohlstadt, 2011). For the prevention of calcium phosphate and struvite stones, urine should be acidified; cranberry juice or betaine can lower

the urine pH (Fontenelle and Sarti, 2019; Frassetto and Kohlstadt, 2011; Alelign and Petros, 2018).

Kidney stones can also form, if the body has a low levels of magnesium and citrate, which help in preventing the crystal formation (Fontenelle and Sarti, 2019; Alelign and Petros, 2018). Formation of crystals is mainly due to alkaline urine, or too acidic, or if it becomes too concentrated (Bahmani et al., 2016; Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006; Coe et al., 2010). Renal tubular acidosis (RTA) is a medical condition that involves the accumulation of acid in the body due to a failure of the kidneys appropriately acidifying the urine (Alelign and Petros, 2018; Hall, 2009; Winston, 2011; Bahmani et al., 2016; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006).

Factors influencing kidney stones include a genetic factors, metabolic disorders such as diabetes, diseases like leukemia, Dent's disease and medullary sponge kidney, or hypocalcaemia (abnormally high amounts of blood calcium), diet imbalance, a poor intake of water, bacterial infections such as *Escherichia coli*, *Klebsiella*, *Staphylococcus*, or *Mycoplasma* (Alelign and Petros, 2018; Bahmani et al., 2016; Hall, 2009; Manjula et al., 2015; Butterweck and Khan, 2009; Winston, 2011; Colella et al., 2006). Poor diet is the leading cause of kidney stone formation (Alelign and Petros, 2018; Fontenelle and Sarti, 2019). The stone formation requires supersaturated urine. Super-saturation depends on urinary pH, ionic strength, solute concentration and complications (Manjula et al., 2015; Winston, 2011; Hall, 2009). This could be achieved due to alkaline urine, the presence of urea or ammonia in the urine, and higher concentration of minerals in the urine (Alelign and Petros, 2018; Bahmani et al., 2016; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006; Hall, 2009). Urine from the healthy humans consists of a large quantity of nitrogenous compounds, including 0.5 M urea as well as inorganic ions. Urine is neutral to slightly acidic, and under these conditions, ammonia becomes protonated with the concomitant generation of hydroxide, which increases urine pH (Alelign and Petros, 2018; Winston, 2011; Bahmani et al., 2016; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006). The alkaline pH causes the precipitation of normally soluble polyvalent cations and anions in urine, leading to the formation of urinary stones (Alelign and Petros, 2018; Winston, 2011; Bahmani et al., 2016; Manjula et al., 2015; Butterweck and Khan, 2009; Colella et al., 2006; Hall, 2009). One of the recent study reported that vegetarian diet is protectively associated with urinary tract infection particularly in female and for uncomplicated urinary tract infection (Chen et al., 2020). Therefore, vegetarian dietary therapy plays an important role in controlling kidney stone infections as compared to non vegetarian diet (Chen et al., 2020).

IV. TYPES OF KIDNEY STONE FORMATION

The most common types of kidney stones are calcium oxalate or calcium phosphate stones which account for 80-85% of all

stones (Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Alelign and Petros, 2018). Our daily diet containing oxalate and phosphate consumption and excess sodium may play an important role in the formation of calcium stones (Wedro, 2007; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; (Alelign and Petros, 2018; Fontenelle and Sarti, 2019). This will lead to the metabolic problems such as hypercalciuria (excess urinary calcium), hyperoxaluria (excess urinary oxalate), and hypocitraturia (lack of urinary citrate) are the most likely the primary causes (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Chitme et al., 2010). Uric acid stones are usually formed in the people with gout or gouty arthritis. Uric acid stones can often be dissolved by alkalinizing the urine (citrate or sodium bicarbonate is used), along with the increased water consumption.

The drug *Allopurinol* (Lupurin, Analogue of hypoxanthine Zyliprim) is also used to reduce uric acid excretion *via* the kidneys (Shah et al., 1972; Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Chitme et al., 2010). The drugs used for the kidney stone diseases are Amiloride (Midamor), Digoxin (Lanoxin), Gemfibrozil, Indinavir, Zonisamide, Cholic acid, Cholestyramine (Questran), Etidronate disodium bisphosphonate (Alok et al., 2013). Struvite stones are caused by chronic urinary tract infections which elevate the urinary pH, allows for bacteria growth (Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009). Women are more likely to develop this type of stone than men, and they can be very large in size leading to the urinary tract infections (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Chitme et al., 2010). Cystine stones are relatively uncommon, and they are caused by a rare genetic abnormality known as cystinuria (Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009). Other types of renal stone is caused by long-term treatment with certain medications (Fontenelle and Sarti, 2019).

V. KIDNEY STONE: SYMPTOMS AND RISK FACTORS

Kidney stones are common clinical disorders and have both high incidence and high prevalence in the world (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Hall, 2009; Bahmani et al., 2016; Manjula et al., 2015; Colella et al., 2006). Symptoms such as nausea and vomiting, fever, and blood in the urine are the signs of kidney stones. Patients suffering from kidney stones have severe colic pains that are not relieved by conventional pain killers and may require narcotic analgesics (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Bahmani et al., 2016; Chitme et al., 2010). Kidney stones may cause extreme abdomen pain and blockage of urine flow (Hall, 2009; Wedro, 2007; Bahmani et al., 2016; Manjula et al., 2015). Kidney stone symptoms are obstruction of urine, the presence of infection and edema (swelling). Kidney stones that cause

obstruction to the flow of urine set up an environment of urine (Alelign and Petros, 2018; Fontenelle and Sarti, 2019). The irritation caused by the kidney stones results in the secondary infections leading to pyelonephritis (inflammation of the kidney) an upper urinary tract infection, or cystitis (inflammation of the bladder) and urethritis (inflammation of the urethra), *i.e.*, a lower urinary tract infection (Hall, 2009; Bahmani et al., 2016; Manjula et al., 2015; Colella et al., 2006). In the severe cases, kidney stones can cause urinary obstruction, kidney infections, a feeling of sudden urinate, burning feeling at urination, male patients feel pain at the tip of their penis, and scarring and damage to the kidneys (Khan et al., 2019; Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Hall, 2009; Bahmani et al., 2016; Manjula et al., 2015; Colella et al., 2006).

The major risk factors for developing kidney stone chronic disease are 1) dehydration of the body, 2) kidney stones may be come by genetically, 3) Cystinuria is a genetic disorder that has increased the risk of developing cystine stones, 4) consumption of more amounts of proteins, fats, sodium and sugar in the diet may increase the risk of kidney stones, 5) people having kidney infections (especially women) and urinary tract infections can develop more easily struvite stones compare to other diseases, 6) metabolic syndrome developed kidney stones, and 7) obesity may increase risk of kidney stones (Khan et al., 2019).

VI. TREATMENT FOR KIDNEY STONE REMOVAL

The simple and the most common treatment for the removal of kidney stones is the natural passing. However, this option is often the most uncomfortable for the patient (Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009). However, natural remedies to pass kidney stones can only help with the smaller stones (Alelign and Petros, 2018; Fontenelle and Sarti, 2019). Two of the well-known methods being used for the removal of kidney stones are extracorporeal shockwave lithotripsy (ESWL) and surgical removal (Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009). Extracorporeal shockwave lithotripsy (ESWL), commonly known as lithotripsy (Shock Wave Therapy) is a technique that uses the shock waves produced outside the body to hit and break up the stones so that they can pass out of the body (Auge and Preminger, 2002; Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009).

Ureteroscopy is the procedure for removing the kidney stones which gets stuck in the ureters or bladder. This procedure is painful and contains a small wire which connects with a camera at the end. The wire is inserted into the urethra and passed into the bladder for the removal of stones with a cage connected (Khan et al., 2019). Further, medical therapy, drug therapy and dietary therapy leads to 30% risk reduction

(Delvecchio and Preminger, 2003; Alelign and Petros, 2018; Fontenelle and Sarti, 2019). Medical and drug therapy have also many side effects leading to the pain and failure of kidney function. There are potential risks with all of these therapies and prevention of future stones is highly desirable (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Kober et al., 2003; Winston, 2011). In an emergency with acute pain, immersion in a hot tub or hot bath or localized warming of the abdomen and lower back can significantly reduce pain and nausea (Kober et al., 2003; Winston, 2011). However, urinary stone is characterized by high recurrence rate, therefore, requiring a preventive treatment by using medicinal plants or phytotherapy (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011; Manjula et al., 2015; Butterweck and Khan, 2009; Bahmani et al., 2016; Chitme et al., 2010; Butterweck and Khan, 2009). Therefore, herbal medicine treatment is used in the kidney stone chronic disease, which is effective, and no side effects.

VII. PREVENTATION MEASURES OF KIDNEY STONE FORMATION

1. *Drink plenty of water.* Kidney stones need to be flushed out of the body. Hence be sure to drink lots of water to keep them moving along. Minimize coffee, alcohol, tea, and soda while passing a kidney stone as these can cause dehydration and make the pain worse. Hydration is key factor for both passing and preventing kidney stones (Winston, 2011) (Recommended).
2. *Lemon and olive oil :* Drink a mixture of lemon juice and olive (*Olea europaeae* : Family-*Oleaceae*) oil The lemon juice contains citrate that will help to break up the stones. Olive oil is used for the smooth passage of kidney stone from kidney to the bladder. Drinking fresh lemon juice and pure olive oil with additives like sugar to cease the kidney pain. The compound hydroxycitrate (HCA) can dissolve calcium oxalate crystals, the most common component for kidney stones (Alelign and Petros, 2018; Fontenelle and Sarti, 2019; Winston, 2011(Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieleley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014 (Recommended).
3. *Lemon juice* (about cup per day) helps to prevent the kidney stone formation (Winston, 2011; Touhami, et al., 2007; Aras et al., 2008; (Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieleley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976;

- Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014). (Recommended).
4. *Orange and pomegranate (Punica granatum) L.* juice have also been shown to be effective in preventing stone formation (Winston, 2011; Odvina, 2006). The seeds and the juice of pomegranate plays a vital role in removing the kidney stones since they are a good source of potassium. Potassium prevents the formation of mineral crystals that can develop into kidney stones. Pomegranate also reduces the formation of kidney stones due to its astringent properties, flushing out the toxins from the kidney and lowering the acidity levels in the urine (Winston, 2011; Alelign and Petros, 2018; Fontenelle and Sarti, 2019; (Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014). (Recommended).
 5. *Fresh tomato juice* (freshly juiced with no added salt) was found to be a rich source of citrate and magnesium, while being low in sodium (Yilmaz et al., 2008). It is believed that freshly made tomato juice will also inhibit the stone formation (Winston, 2011; Yilmaz, et al., 2008; Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014 (Recommended).
 6. *Kidney beans* known to remove kidney stones effectively and cleanse the kidneys. Kidney beans are high on fibers and are a good source of minerals and B vitamins that could help in cleaning the kidneys (Hesse et al., 1993) (Recommended).
 7. *Grapefruit and apple juices* actually increased risk of stone formation (one 8 oz. glass per day increased stone formation by 39-44%) (Winston, 2011; Goldfarb and Asplin, 2001).
 8. Cranberry juice and capsules increased oxalate levels in urine so should be avoided by people with calcium oxalate stones (Winston, 2011; Kelera et al., 2002; McHarg et al., 2003).
 9. *Excessive alcohol consumption*, tea, coffee, caffeinated beverages, wine or beer, is associated with the increased risk of developing kidney stones (Winston, 2011; Basso et al., 2007; Peerapen and Thongboonkerd, 2018).
 10. *Lowering animal protein and salt* decreased stone formation, changing the diet from animal to vegetable protein plays an important role in controlling kidney stone infections (Chen et al., 2020; Taylor et al., 2004; Winston, 2011; Breslau et al., 1988; Hesse et al., 1993).
 11. *Very high protein diets* do increase risk of oxalate and uric acid stones. Diets almost devoid of animal protein had a significant impact on preventing the stone reoccurrence (Hesse et al., 1993; Winston, 2011; Alelign and Petros, 2018; Fontenelle and Sarti, 2019).
 12. *Reduction of sodium* seems to play a much bigger role in preventing kidney stones than the protein reduction. Dietary calcium has been shown to bind oxalates and low calcium diets do not prevent kidney stones (Winston, 2011). Supplemental calcium (more than 2000 mg per day) was found to increase the risk of stones by 20%, but less than 1200 mg per day is actually believed to have a protective effect (Hesse et al., 1993; Williams et al., 2001; Winston, 2011; Alelign and Petros, 2018; Fontenelle and Sarti, 2019).
 13. *Increased dietary fiber* especially grains and legumes rich in phytates seem to help to prevent crystallization of oxalate and phosphate calcium salts. This offers a protective effect against calcium stone formation. In women, higher levels of dietary phytates helped to prevent the kidney stones (Curhan et al., 1996, 2004; Winston, 2011; Hesse et al., 1993).
 14. *Evidence also suggests that Eicosapentaenoic Acid (EPA)* found in salmon and other deep-sea fish, may help to prevent kidney stone formation (Winston, 2011).
 15. *Magnesium* – Men who consumed higher levels of dietary or supplemental magnesium had a reduced risk of developing kidney stones (Taylor et al., 2004). Magnesium decreases oxalate absorption and urinary excretion (Marz, 1999; Winston, 2011). The usual dose of magnesium for kidney stone prevention is 400- 600 mg per day.
 16. *Potassium citrate* – Oral potassium citrate supplementation has been shown to help to prevent the kidney stone formation (Taylor et al., 2004; Winston, 2011). Higher levels of potassium were also associated with decreased risk of kidney stones formation in men (Taylor et al., 2004; Winston, 2011).
 17. *Probiotics* – The use of lactic acid probiotics can reduce the oxalate production *via* their ability to metabolize oxalates (Siva et al. 2009; Winston, 2011).

18. *Vitamin E*: In human epidemiological studies low levels of vitamin E were also associated with a higher risk of stone formation (Winston, 2011).

19. *Vitamin C* – High levels of vitamin- C (1,000 mg per day), was associated with a greater risk of developing kidney stones than in men who took low levels of vitamin C (Taylor et al., 2004; Winston, 2011).

20. *Vitamin D* – High doses of vitamin-D have been linked to increased formation of calcium kidney stones in people with hyper-parathyroidism (Winston, 2011).

21. *Sodas and sugary drinks* are major culprits behind the causes of kidney stones. Sodas being filled with unhealthy chemicals, including high levels of processed bleached sugar, phosphoric acid, caffeine, and higher doses of fructose corn syrup (Taylor and Curhan, 2008). These ingredients are harmful to the body and especially harsh for urinary system (Winston, 2011; Basso et al., 2007).

22. *The phosphoric acid* in soda can create an acidic environment in kidney tract, leading to more kidney stones. Diets high in sodium are also associated with this condition. The amount of calcium in urine contributes to kidney stones and should therefore be reduced in the diet (Winston, 2011; Basso et al., 2007).

23. *Soaked- Dates-* have a high amount of fiber that helps to lower the risk of forming kidney stones. It also consists of magnesium that is responsible for cleansing the kidneys (Recommended).

24. *Basil (Ocimum sanctum) (Tulsi)* belongs to the family *Lamiaceae* is diuretic in nature and acts as a detoxifier agent which helps in removing the kidney stones. Basil lowers uric acid levels in blood, cleansing the kidneys. It consists of acetic acid and other essential oils that helps in breaking the stones down to pass through urine. It also acts as a pain killer (Manjula et al., 2015; Khan et al., 2019; Kasote et al., 2017; Liliane et al., 2000; Alok et al., 2013; Prachi et al., 2009; Kieley et al., 2008; Choubey et al., 2010; Ghatapanadi et al., 2010; Sharma et al., 2011; Kirtikar and Basu, 1933; Dush and Kashyap, 1979; Shrivastava, 1971; Kapoor and Kapoor, 1976; Mohammed, 2007; Ricardo and Manoj, 2009; Bahuguna et al., 2009; Sharma et al., 2008; Vargas et al., 1999; Cohen, 2014).

Table 1: Medicinal plants recommended for the treatment of kidney stone

Name	Family	Plant parts used	Therapeutic effect
1) <i>Ocimum sanctum</i> (Tulsi)	Lamiaceae	Leaf and stem	Kidney stone
2) <i>Punica granatum</i> (Pomogranate)	Punicaceae	Fruits	Kidney stone
3) <i>Terminalia arjuna</i>	Combretaceae	Stem bark	Kidney stone
4) <i>Terminalia chebula</i>			

(Alale mara) (Chebulic myrobalan)	Combretaceae	Stem bark	Kidney stone
5) <i>Zingiber officinale</i> (Ginger)	Zingiberaceae	Rhizome	Kidney stone
6) <i>Citrus limon</i> (Lemon)	Rutaceae	Fruits	Kidney stone
7) <i>Citrus sinensis</i> (Orange)	Rutaceae	Fruits	Kidney stone
8) <i>Solanum lycopersicum</i> (Tomato)	Solanaceae	Fruits	Kidney stone
9) <i>Tectona grandis</i> (Teak)	Verbenaceae	Stem bark	Kidney stone
10) <i>Mangifera indica</i> (Mango)	Anacardiaceae	Fruits	Kidney stone
11) <i>Moringa oleifera</i> (Drumstick) (Nuggekayi)	Moringaceae	Leaf and fruits	Kidney stone
12) <i>Curcuma longa</i> (Turmeric) (Arishina)	Zingiberaceae	Rhizome or root	Kidney stone
13) <i>Dolichos biflorus</i> (Horse gram)(Huruli)	Leguminoaceae	Seeds	Kidney stone
14) <i>Ammi visnaga</i> (<i>Visnaga daucooides</i>) (Khella Baldi or toothpick weed)	Apiaceae	seeds	Kidney stone
15) <i>Admania baccifera</i> (Dadamari)	Lythraceae	Aerial parts	Kidney stone
16) <i>Asparagus racemosus</i> (Shatavari)	Asparagaceae	Whole plant	Kidney stone

Table 2: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
17) <i>Plectranthus amboinicus</i> (Dodda pathre soppu) (Karpooa valli) (Indian borage or country borage) (Sambrani soppu)	Lamiaceae	Leaf and stem	Kidney stone
18) <i>Raphanus sativus</i> (Radish) (Mulangi)	Brassicaceae	Root	Kidney stone
19) <i>Celosia argental</i> (Sitivaraka) (Viratarvadigana)	Amaranthaceae	Aerial parts	Kidney stone
20) <i>Ficus carica</i> (Fig)	Moraceae	Fruits, latex	Kidney stone
21) <i>Mimosa pudica</i> (Touch me not)	Mimosaceae	Leaves	Kidney stone
22) <i>Olea europeae</i> (Olive)	Oleaceae	oil	Kidney stone
23) <i>Onosma bracteatum</i> (sedge)	Boraginaceae	Leaves	Kidney stone
24) <i>Pavonia odorata</i> (Fragrant Swamp Mallow)	Malvaceae	Rhizome, leaves	Kidney stone

25) <i>Phyllanthus emblica</i> (Gooseberry or Amla)	Euphorbiaceae	Fruits and seed	Kidney stone
26) <i>Tamarind indica</i> (Tamarindus)	Fabaceae	Fruits	Kidney stone
27) <i>Tinospora cordifolia</i> (Guduchi)	Menispermaceae	Leaf and stem	Kidney stone
28) <i>Tribulus terrestris</i> (Puncture Vine)	Zygophyllaceae	Leaf and stem	Kidney stone
29) <i>Tridax procumbens</i> (Coat buttons)	Asteraceae	Leaves	Kidney stone
30) <i>Tubiflora Acaulis</i> (Kuntze)	Acanthaceae	Leaves	Kidney stone
31) <i>Urginea maritima</i> (Squill bulb)	Asparagaceae	Bulb leaves	Kidney stone
32) <i>Urtica dioica</i> (Stinging nettles)	Urticaceae	Roots	Kidney stone

Table 3: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
33) <i>Zea mays</i> (Maize)	Poaceae	seed	Kidney stone
34) <i>Vernonia cinerea</i> (Little iron weed)	Compositae	Leaf	Kidney stone
35) <i>Santalum album</i> (Sandal)	Solanaceae	Oil and leaf	Kidney stone
36) <i>Rubia cordifolia</i> (Indian Madder)	Rubiaceae	Leaves & Roots	Kidney stone
37) <i>Solanum surattense</i> (Yellow-Berried Nightshade)	Solanaceae	Root	Kidney stone
38) <i>Rosmarinus officinalis</i> (Rosemary)	Lamiaceae	Leaves	Kidney stone
39) <i>Phyllanthus fraternus</i> (Gulf leaf-flower)	Euphorbiaceae	Whole plant	Kidney stone
40) <i>Pedaliium murea</i> (Burra Gokhru)	Pedaliaceae	Fruits	Kidney stone
41) <i>Pimpinella anisum</i> (Anise)	Umbelliferae	Fruits	Kidney stone
42) <i>Onosma bracteatum</i> (sedge)	Boraginaceae	Leaves	Kidney stone
43) <i>Mentha piperita</i> (Peppermint)	Lamiaceae	Whole plant	Kidney stone
44) <i>Hygrophila spinosa</i> (Gokulakanta)	Acanthaceae	Leaf	Kidney stone
45) <i>Tridax procumbens</i> (Coat buttons)	Asteraceae	Leaves	Kidney stone
46) <i>Grewia flavescens</i> (Sandpaper Raisin)	Tiliaceae	Root	Kidney stone

47) <i>Gomphrena celosioide</i> (Gomphrena Weed)	Amaranthaceae	Whole plant	Kidney stone
48) <i>Gynocardia odorata</i> (Coffee Plum)	Flacourtiaceae	Fruits	Kidney stone

Table 4: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
49) <i>Equisitum arvense</i> (Horsetail)	Equisetaceae	seed	Kidney stone
50) <i>Fogonia bruguieri</i> (Fagonia)	Umbelliferae	Fruit	Kidney stone
51) <i>Garcinia pictoria</i> (Tamal. Pers)	Guttiferae	Leaves	Kidney stone
52) <i>Gynocardia odorata</i> (Coffee Plum)	Flacourtiaceae	Fruits	Kidney stone
53) <i>Gomphrena celosioide</i> (Gomphrena Weed)	Amaranthaceae	Whole plant	Kidney stone
54) <i>Elettaria cardamomum</i> (cardamom)	Zingiberaceae	Roots	Kidney stone
55) <i>Solanum surattense</i> (Yellow-Berried Nightshade)	Solanaceae	Whole plant	Kidney stone
56) <i>Diospyros melaoxylon</i> (Digera muricata)	Ebenaceae	Fruit and bark	Kidney stone
57) <i>Digera muricata</i> (Digera muricata)	Amaranthaceae	Leaves	Kidney stone
58) <i>Daucus carota</i> (carrot)	Apiaceae	Rhizome	Kidney stone
59) <i>Desmodium styracifolium</i> (Osbeck)	Papilionaceae	Rhizome	Kidney stone
60) <i>Chimaphila numbellata</i> (Prince's pine)	Cruciferae	Flower	Kidney stone
61) <i>Corbichonia decumbens</i> (Forssk)	Molluginaceae	Leaves	Kidney stone
62) <i>Coculus hirsutus</i> (Cocculus Indicus)	Menispermaceae	Leaves	Kidney stone
63) <i>Chenopodium album</i> (Lamb's Quarters)	Chenopodiaceae	Leaves	Kidney stone
64) <i>Ceropegia bulbos</i> (Caudiciform)	Asclepidaceae	Tubers	Kidney stone
----- <i>Tribulus terrestris</i> (Gokshura fruit/root)	Zygophyllaceae	Fruit/root	Kidney stone
----- <i>Origanum vulgare</i> (doddapatre) (Maruga)	Lamiaceae	Aerial parts	Kidney stone
----- <i>Hibiscus sabdariffa</i> (Roselle) (Pundibeeza)	Malvaceae	Leaf, stem	Kidney stone

Table 5: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
65) <i>Alhagi mannifera</i> (Camels thorn)	Leguminosae	Roots	Kidney stone
66) <i>Armoracia lopathifolia</i> (Horse radish)	Brassicaceae	Seeds	Kidney stone
67) <i>Aerva javanica</i>	Amaranthaceae	seeds	Kidney stone
68) <i>Aerva lanata</i> (Gorkhabundi)	Amaranthaceae	Leaves	Kidney stone
69) <i>Arctostaphylos urausi</i> (Bearberry)	Asteraceae	Fruits	Kidney stone
70) <i>Ascyrum hypericoides</i> (Ascus)	Asclepidaceae	Roots/Leaves	Kidney stone
71) <i>Abutilon indicum</i> (Indian mallow)	Malvaceae	Whole plant	Kidney stone
72) <i>Aegle marmelose</i> (Wood apple, Bael)	Rutaceae	Fruit, Leaves, bark	Kidney stone
73) <i>Amaranthus spinosus</i> (Spiny amaranth)	Amaranthaceae	Root, Leaves	Kidney stone
74) <i>Amaranthus viridis</i> (Green amarnath)	Amaranthaceae	Whole plant	Kidney stone
75) <i>Argemone maxicana</i> (Slender amarnath)	Papaveraceae	Root	Kidney stone
76) <i>Ageratum conyzoides</i> (Goat weed)	Asteraceae	Leaves, stem	Kidney stone
77) <i>Amaranthus caudatus</i> (Love-lies-bleeding)	Amaranthaceae	Leaves	Kidney stone
78) <i>Asphodelus tenuifolius</i> (weed of fields)	Liliaceae	Leaves	Kidney stone
79) <i>Apium graveolens</i> (Lavender)	Apiaceae	Flowers, Leaves	Kidney stone
80) <i>Barbarea vulgaris</i> (Rocket)	Brassicaceae	Root, leaves	Kidney stone
----- <i>Phyllanthus niruri</i> (stone breaker) (Chanca piedra)	Euphorbiaceae	Aerial parts	Kidney stone

Table 6: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
81) <i>Berginia ligulata</i> (Pashanabhedha) (Hittaga, Hittulaka)	Saxifragaceae	Rhizome	Kidney stone

82) <i>Bridolia montana</i> (Chikitsa silianam)	Euphobiaceae	Bark, leaves	Kidney stone
83) <i>Bombex ceiba</i> (Silk Cotton tree) (Kempu buruga)	Bombacaceae	Stem, bark Leaves	Kidney stone
84) <i>Borhaavia diffusa</i> (Hogweed, Punarnava) (Gonajali, Kommegida)	Nyctagenaceae	Root	Kidney stone
85) <i>Blumea balsamifera</i> (Sambong) (Kukuraadra)	Asteraceae	Aerial parts	Kidney stone
86) <i>Capsella Bursa-pastori</i> (Shepherd's-purse)	Brassicaceae	Whole plant	Kidney stone
87) <i>Cucumis sativus</i> (cucumber) (Soutekayi)	Cucurbitaceae	Whole plant	Kidney stone
88) <i>Caesalpinia huga</i> (nicker nut) (Crested fever nut)	Caesalpinioceae	Root	Kidney stone
89) <i>Citrus japonica</i> (Celery) (Kumquat)	Rutaceae	Whole plant	Kidney stone
90) <i>Celosia argenta</i> (Silver cocks comb)	Amaranthaceae	Leaves, stem	Kidney stone
91) <i>Chelidonium majus</i> (Greater celandin)	Papaveraceae	Leaves	Kidney stone
92) <i>Cassia fistula</i> (Kakke gida or byategida) (Golden shower tree)	Caesalpinioidea	Fruit, seeds Flower, leaves	Kidney stone
93) <i>Ceropegia bulbos</i> (Bittiruka, Halike)	Asclepidaceae	Tubers, Leaves	Kidney stone
94) <i>Asphodelus tenuifolius</i> (weed of fields)	Liliaceae	Leaves	Kidney stone
95) <i>Cynodon dactylon</i> (Dogs tooth grass) (Garike hullu)	Poaceae	Root	Kidney stone
96) <i>Coculus hirsutus</i> (Aadama balli) (Patalgarudi)	Menispermaceae	Leaves	Kidney stone
97) <i>Trigonella foenum-graecum</i> (Fenugreek seed) (Menthe)	Fabaceae	Seed	- Kidney stone
98) <i>Asparagus racehorses</i> (Shatavari)	Liliaceae	Root	- Kidney stone

Table 7: Medicinal plants recommended for the treatment of kidney stone (Continued)

Name	Family	Plant parts used	Therapeutic effect
99) <i>Rubia tinctorum</i> (Rose madder or Indian common madder)	Rubiaceae	Root	Kidney stone

100) <i>Crataeva nurvala</i> (Three-Leaved Caper)	Capparidaceae.	Bark, leaves	Kidney stone
101) <i>Tribulus terrestris</i> (Gokshura)	Zygophyllaceae	Stem, bark Leaves	Kidney stone
102) <i>Eysenhardtia polystachya</i> (Kidney wood) (Palo Azul Herb)	Leguminosae	Leaf, stem, seeds	Kidney stone
103) <i>Tetraclinis articulate</i> (Thuja)	Cupressaceae	Aerial parts	Kidney stone
104) <i>Gomphrena celosioides</i> (Kasia)	Amaranthaceae	Whole plant	Kidney stone
105) <i>Ricinus communis</i> (caster bean) (Haralu)	Euphorbiaceae.	Root, Seeds, fruits, oil	Kidney stone
106) <i>Phyla nodiflora</i> (Frog fruit) (Jala hippali, ಕೆರೆಹಿಪ್ಪಲಿ Kere hippali)	Verbenaceae	Root, Aerial parts	Kidney stone
107) <i>Macrotyloma uniflorum</i> (horse gram) (huruli)	Fabaceae	seeds	Kidney stone
108) <i>Alisma Orientale</i> (Takusha)	Alismataceae	Leaves, stem	Kidney stone

VIII. CONCLUSION

The process of formation or appearance of a urinary stone anywhere in the renal tract is known as urolithiasis. They are crystal aggregations formed in the kidneys. Urinary stone is characterized by its high recurrence rate. However, medical treatment such as shock wave lithotripsy in therapeutic doses may cause renal injury, decrease in the renal function and an increase in stone recurrence. Drug treatment therapy has shown some feasibility in many randomized trials, but ends up with many health side effects. Therefore, natural products and homeopathy have been used to treat and/or to alleviate symptoms of kidney stone patients. During recent decades, medicinal plants have become more effective in kidney stone disease. Herbal medicine is an integral part of the development of modern civilization. Herbal medicines play a significantly benefits for the treatment of urinary stones because of efficacy, safety, lesser side effects as compared to synthetic drugs, cultural acceptability, and better compatibility with the human body. The major problem of our health system is lifestyle-related chronic diseases, many of which can be addressed through *Ayurveda* with its focus on healthy lifestyle practices and regular consumption as herbal remedies of urolithiasis. Medicinal plants play a vital role in kidney stone diseases. *Pashanbheda* is a drug mentioned in the *Ayurvedic* system of medicine for various ailments but mainly as a diuretic and lithotriptic. It is said to have property of breaking and disintegrating the stones which is widely used drug. *Ayurveda* has a holistic approach to the health and disease that focuses on preserving and promoting good health and preventing disease through healthy lifestyle practices.

Ayurveda's use of medicinal and culinary herbs draws upon India's incredible biodiversity with a variety that is unsurpassed by any medical system.

Antiurolithiatic potentiality of several plants and their formulations has been documented. However, the problems of using herbal medicines is the concentration of secondary metabolite is not well defined. Further, there should be enough clinical trial study should be conducted for the scientific validation. The current evidence to support their use alone, however, is inconclusive or inadequate. Some of the plants listed in this review paper is invalid due to lack of scientific proof. Present scientific studies provide scientific evidences for few of these claims however; they are insufficient to establish many of these plants and herbal formulations as therapeutic remedies for the treatment and management of urinary stones. This uncertainty is mainly caused by methodological limitations such as poor study design, relatively small sample sizes, inappropriate outcome measures and primary and secondary end-point selection, and invalid statistical analysis. In addition to this, there are many experimental issues and data presented is not enough for the scientific validation. Conversely, findings of pre-clinical and clinical studies about some plants and herbal formulations are promising, which underlines the utility of herbal remedies as an alternative medicines for the treatment and management of urinary stones in the future.

CONFLICT OF INTEREST STATEMENT

Authors declare that they have no conflict of interest.

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