

# Exploring Citrus Lemon and Water Barley: Innovative Approaches to Kidney Stone Treatment & Enhancing Kidney Health Naturally

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## Abstract:

Kidney stones, a prevalent urological disorder, significantly impact global health, with recurrent episodes leading to severe discomfort and potential complications. In recent years, there has been an increasing interest in natural remedies, particularly in regions where conventional treatments may be less available. This review explores the therapeutic potential of Citrus lemon (lemon) and Hordeum vulgare (barley) water in the management and prevention of kidney stones. Citrus lemon are widely popular around the world and it is rich in citric acid, has been used to prevent stone formation due to its ability to increase urinary citrate levels, which inhibit stone formation. On the other hand, barley water, known for its diuretic properties, may aid in flushing out small stones and preventing the aggregation of crystals. This review suggest that, how citrus lemon and water barley helps in prevention of kidney stone. The findings suggest a synergistic potential when both remedies are used in combination, which gives a better approach to kidney stone prevention and treatment.

**Keywords:** Kidney stones, Urological disorder, Citrus lemon, Barley water, Synergistic potential.

## Introduction:

Kidney stones have affected mankind for thousands of years, with records dating back to 4000 B.C. [1]. Kidney stones are mainly lodged in kidney, urethra and urinary tract[2]. Kidney stones are categorized into five main types based on their mineral composition: calcium oxalate, carbapatite, urate, struvite (magnesium ammonium phosphate) and brushite. The most common type of kidney stones are calcium oxalate and calcium phosphate[3]. Initially, kidney stone formation may not cause any symptoms. However, as the condition progresses, it can lead to symptoms such as intense cramping pain known as renal colic, flank pain (pain in the back or side), blood in the urine (hematuria), and obstructive uropathy (a blockage in the urinary tract). Other complications may include urinary tract infections, blockage of urine flow, and hydronephrosis (swelling of the kidney due to urine buildup). These issues can result in nausea, vomiting, and significant discomfort during a stone event[4]. Some studies suggest that the occurrence of kidney stones is expected to rise due to various environmental factors, including shifts in lifestyle and dietary habits, as well as the effects of global warming[5,6,7].

**Citrus Lemon:** Citrus or Lemon, a significant medicinal plant from the Rutaceae family, originated in the tropical and subtropical regions of Southeast Asia[8]. Taxonomic classification of citrus lemon is shown in table 1. Citrus lemon are widely popular around the world and are renowned for their high nutritional value[9]. Citrus lemon has many bioactive components such as citric acid, Ascorbic acid, minerals, flavonoids and essential oils[10]. Lemons have the highest concentrations of citric acid among citrus fruits[11]. Several parts of Citrus species are natural sources of carbohydrates, dietary fibres, water-soluble vitamins and phytochemicals such as flavonoids, limonoids and carotenoids[12]. Citric acid plays an important role in prevention of calcium stone[13].

**Water Barley:** In India it is also known as (Jau ka pani); "jau" means Barley and "Pani" means water. It is made by boiling barley grains in water[14]. Its Scientific Name is Hordeum vulgare Linn. And its Family Name is Poaceae[15]. Barley water is made from one of the oldest cultivated cereal grains, which currently ranks fourth or fifth globally in terms of acreage and crop production[16]. Barley is rich in nutrients because it contains variety of minerals including calcium, zinc, iron, potassium, phosphorus, magnesium[15].

## CITRUS LEMON

### Taxonomic Classification[17]

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales

Family	Rutaceae
Genus	Citrus L.

**Table:1****Common names<sup>[18]</sup>**

English	Lemon
Hindi	Nimbu, Bara Nimbu, Pakari Nimbu
Sanskrit	Jambira
French	Citro

**Table:2****Morphology of Plant:**

Lemons grow on small, thorny trees that reach a height of 10 to 20 feet. The leaves are dark green and arranged alternately along the stem. The lemon tree produces fragrant, white flowers with five petals. A specific cultivar, known as 'Pink Lemonade,' features striped fruit and variegated leaves. The color of lemon fruit ranges from greenish-yellow to bright yellow. While lemons and limes are quite similar, lemons are yellow when ripe, tend to be slightly larger, and are distinct from the green color of ripe limes<sup>[17]</sup>. The common names of citrus is shown in Table 2.

**Chemical compositions:**

juice is primarily composed of fruit acids, mainly citric acid (8%), along with sugars. The lemon peel consists of two layers: the outer layer (pericarp or zest) contains an essential oil (6%) that is made up of approximately 90% limonene, 5% citral, and traces of citronellal,  $\alpha$ -terpineol, geranyl acetate, and linalyl. The inner layer (mesocarp) does not contain essential oil but has various coumarin derivatives and bitter flavone glycosides. It also contains small amounts of potash, sugar, and gum. Imitation lemon juice can be made by dissolving tartaric acid in water, then adding sulfuric acid and flavoring it with lemon oil. Lemon oil is dextrogyre and consists of 7 to 8% citral, an aldehyde that produces geraniol upon reduction, as well as small amounts of citronellal and pinene<sup>[18]</sup>.

**Parmacological activities:**

**1. Citrus lemon in Kidney stone treatment:** Citrus lemon, especially its juice, is high in citric acid, a natural substance that helps prevent kidney stone formation. Citric acid binds with calcium in the urine, decreasing the chances of calcium oxalate stones forming. Furthermore, drinking lemon juice boosts urinary citrate levels, providing additional protection against stone development.

- i. **Inhibition of calcium oxalate stones:** Citrate is a vital inhibitor that forms soluble complexes with calcium. It decreases the saturation of calcium phosphate and calcium oxalate, preventing crystallization and growth. This, in turn, reduces the formation of calcium-containing stones<sup>[19]</sup>.
- ii. **Alkalizing Effect:** Lemon juice can help alkalize the urine, making it less conducive to the formation of uric acid stones. This alkalization, combined with the increase in citrate levels, is an effective strategy for reducing the recurrence of kidney stones<sup>[20]</sup>.
- iii. **Reduction in stone size:** There's compelling evidence that lemon juice can shrink existing kidney stones, making them easier to pass and relieving discomfort more swiftly<sup>[21]</sup>.

**2. Antioxidant activity:** Citrus juices and fruits are key sources of antioxidants, including ascorbic acid, flavonoids, and phenolic compounds<sup>[22]</sup>. Citrus peels are rich in glycosides and phenolic compounds. The bioactive components, particularly phenolic acids, are responsible for their antioxidant properties and various other biological activities<sup>[23]</sup>. Citrus fruits exhibit the highest antioxidant activity, with ascorbic acid (vitamin C) playing a significant role in this effect. Additionally, other phytoconstituents, such as carotenoids, flavonoids, glutathione, and various enzyme systems, also contribute to their antioxidant properties<sup>[24]</sup>.

**3. Anti cancer activity:** Citrus limonene is rich in vitamin C, folate, dietary fiber, and other bioactive components like carotenoids and flavonoids, which are believed to play a role in preventing cancer and degenerative diseases. Citrus limonoids, found in the fruit's aqueous extract, exhibit anticancer properties by protecting cells from damage that can lead to cancer<sup>[25]</sup>.

**Medicinal uses:**

Citrus lemon is widely recognized for its numerous health benefits, particularly in the treatment of various ailments. It is often used in the management of Urinary Tract Infections (UTIs), where it can help flush out high levels of uric acid, contributing to relief from symptoms. Additionally, Citrus lemon is effective in preventing and treating kidney stones, making it a valuable natural remedy for these conditions. Beyond its therapeutic uses, Citrus lemon is beneficial for weight loss, as it boosts metabolism and promotes fat burning. Rich in vitamin C, it also plays a role in skincare by helping to lighten the skin and enhance its overall appearance. Furthermore, Citrus lemon is advantageous in managing chronic conditions like asthma and diabetes, as well as common issues such as throat

infections. It is also effective in controlling vomiting, nausea, and travel sickness, making it a versatile and essential part of natural medicine<sup>[26]</sup>.

### **WATER BARLEY**

Water barley is made by boiling barley grains in water and then straining the liquid to remove the grains<sup>[14]</sup>. The taxonomic classification is shown in table 3.

#### **Taxonomic classification of Grains<sup>[14]</sup>**

kingdom	Plantae
Family	Poaceae
Scientific Name	Hordeum vulgare Linn

**Table:3**

#### **Chemical constituents:**

Barley is rich in dietary fiber, particularly  $\beta$ -glucan, which may help reduce the risk of coronary heart disease<sup>[27]</sup>. Barley leaves are effective in preventing metabolic syndrome due to their strong antioxidant properties, primarily attributed to saponarin, a flavonoid with potent antioxidant activity found in young green barley leaves. Additionally, barley is an excellent source of magnesium, a mineral that serves as a co-factor for over 300 enzymes, including those involved in glucose metabolism and insulin secretion<sup>[28]</sup>.

#### **Pharmacological activities:**

**Diuretic properties:** Barley water acts as a natural diuretic, enhancing urine production. This increased urine flow aids in flushing out smaller stones and helps prevent the formation of new ones. A study by Badr and Abdallah (2015) demonstrated that consuming barley water significantly boosted urine output, thereby facilitating the passage of kidney stones. Beyond its diuretic effects, barley water is rich in essential vitamins and minerals that support overall kidney health, potentially lowering the risk of stone formation<sup>[29]</sup>.

#### **Antioxident activity:**

Barley water is rich in antioxidants like vitamins C and E, as well as phytonutrients, which help neutralize free radicals in the body. These antioxidants reduce oxidative stress, support the immune system, enhance skin health, and may help prevent chronic diseases such as heart disease and cancer<sup>[30]</sup>.

#### **Medicinal uses:**

The high fiber content in barley water aids in digestion and helps to prevent constipation. It can soothe the digestive system, reducing the risk of ulcers and gastritis. Barley water also promotes the growth of beneficial gut bacteria<sup>[31]</sup>. Regular intake of barley water may aid in lowering cholesterol levels, thanks to its beta-glucan content, a form of soluble fiber. This, in turn, can help reduce the risk of cardiovascular diseases<sup>[33]</sup>. Barley water has a low glycemic index, which helps regulate blood sugar levels, making it particularly beneficial for individuals with diabetes<sup>[35]</sup>. Barley water can also be applied topically or consumed for improving skin health. Barley water is low in calories and high in fiber so it is also useful in weight management<sup>[36]</sup>.

#### **Conclusion:**

In conclusion, the combined use of Citrus lemon and barley water represents a promising natural approach for both treating and preventing kidney stones. The high citric acid content in Citrus lemon plays a key role in preventing stone formation by inhibiting calcium crystallization and boosting urine volume, which helps to flush out smaller stones. Meanwhile, barley water, known for its rich antioxidant content and diuretic properties, supports the body's ability to cleanse the urinary tract and dissolve existing stones. Together, these natural remedies offer a complementary and effective strategy for kidney stone management, while also providing additional health benefits such as enhanced digestion and reduced oxidative stress. When incorporated into a healthy lifestyle, this combination could serve as a valuable alternative or supplement to conventional kidney stone treatments.

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