



Herbal Solutions for Urolithiasis in Ruminants: A Concise Overview of Natural Remedies

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Urolithiasis, commonly known as kidney stones, is a prevalent and often painful medical condition characterized by the formation of solid crystals within the urinary system. These crystals, which are composed of various substances like calcium, oxalate, phosphate, and uric acid, can aggregate and develop into stones of varying sizes within the kidneys, ureters, bladder, or urethra. Urolithiasis poses a significant health concern worldwide, impacting individuals of all ages and demographics. The formation of kidney stones is a complex process influenced by multiple factors, including genetics, dietary habits, fluid intake, and environmental conditions. The prevalence of urolithiasis varies across regions, with certain geographic areas and climates contributing to a higher incidence of stone formation.

Pathophysiology

The complex procedure of calculus development involves urine's biological components that promote crystal nucleation, aggregation, and maybe adhesion (Samantha *et. al*, 2021). Furthermore, persistently low urine pH (the primary cause), hypovolemia and low urine levels, and hyperuricosuria (defined as daily urinary uric acid surpassing 750 mg/d in females and 800 mg/d in males) are among the urinary abnormalities that impact the development of uric acid calculi (Abou Elela 2017).

Symptoms of urolithiasis often manifest when stones obstruct the flow of urine, leading to intense pain, hematuria (blood in urine), and urinary tract infections. The size and location of the stones play a crucial role in determining the severity of symptoms. Larger stones can cause agonizing pain and may need to be removed by medical intervention, whereas smaller stones may pass through the urinary tract without causing any difficulty. (Khan *et. al*, 2016).

Diagnosis typically involves a combination of imaging studies, such as ultrasound or CT scans, along with a detailed medical history, and physical examination. Treatment strategies for urolithiasis range from conservative measures, such as increased fluid intake and dietary modifications, to more invasive interventions like lithotripsy (shock wave therapy) or surgical removal, depending on the size and location of the stones.

Worldwide Prevalence:

- Urolithiasis is a common urological condition globally.
- The prevalence varies across different regions and populations.
- According to estimates, the global prevalence of renal stones is around 7-13%, with higher rates reported in certain regions (Sorokin, *et. al*, 2017).

Prevalence in India:

- Urolithiasis is widespread in India, and the prevalence has been reported to be relatively high.
- Several factors contribute to the high prevalence, including dietary habits, climate, and genetic predisposition.
- The incidence appears to be increasing in urban areas, possibly due to changes in lifestyle and dietary patterns.

Factors Contributing to Urolithiasis (Khan *et. al.*, 2018).

1. Geography and Climate: Regions with hot and arid climates may have a higher incidence of renal stones due to increased dehydration.
2. Dietary Habits: Diets rich in certain substances like oxalate, calcium, and purines can contribute to stone formation. In India, dietary practices that include a high intake of oxalate-rich foods, such as certain leafy vegetables, and low fluid intake may play a role.
3. Genetics: There is evidence to suggest a genetic predisposition to kidney stone formation.
4. Demographics: Urolithiasis is often more common in certain age groups, and there may be gender differences in prevalence.

Urolithiasis in ruminants

Urolithiasis in ruminants is a serious condition that can lead to significant health problems and economic losses in livestock farming. Here are some key points related to urolithiasis in ruminants. The most common types of urinary calculi in ruminants are composed of minerals like magnesium ammonium phosphate or calcium carbonate. The specific type of calculi may vary depending on factors such as feed diet, water quality, and the physiological characteristics of the species. Dietary factors play a crucial role in the development of urinary calculi in ruminants. Diets high in certain minerals, such as phosphorus, calcium, and magnesium, can contribute to stone formation. Insufficient water intake is a significant risk factor. Inadequate water consumption can lead to the concentration of minerals in the urine, facilitating stone formation. Male ruminants are more commonly affected than females, and castrated males are particularly prone to urolithiasis. Urolithiasis can have a significant economic impact on livestock operations. It can lead to reduced productivity, increased veterinary costs, and in severe cases, the loss of affected animals (Makhdoomi *et. al.*, 2013).

Natural Agents to Prevent Urolithiasis

Natural anti-urolithiatic agents refer to substances derived from plants or natural sources that have demonstrated potential in preventing or treating urolithiasis, the formation of urinary and kidney stones. These agents may act through various mechanisms, such as inhibiting crystal formation, promoting stone dissolution, or reducing the risk factors associated with stone development (Shukla *et. al.*, 2017). It's important to note that while some natural substances show promise in laboratory studies, clinical efficacy and safety should be further investigated (Alok *et. al.*, 2013).

Citrate: Citrate, which is found in citrus fruits, binds with calcium in the urine to prevent the development of calcium oxalate stones. One proposed dietary intervention is lemonade. (Ruiz-Agudo *et. al.*, 2017).

Phyllanthus niruri (Chanca Piedra): This herb is traditionally used in Ayurvedic medicine and has been studied for its potential to prevent and treat kidney stones. It may work by inhibiting crystal aggregation and promoting the expulsion of stones.

Basil (Tulsi): Basil has been studied for its potential anti-urolithiatic properties. It may help inhibit the formation of calcium oxalate crystals.

Pomegranate Juice: Pomegranate juice has antioxidant properties and has been investigated for its potential in preventing kidney stone formation.

Magnesium: Adequate magnesium intake has been associated with a reduced risk of kidney stone formation, as it may inhibit the crystallization of calcium oxalate.

Dandelion Root: Dandelion root has been explored for its potential diuretic effects, which may help in flushing out kidney stones.

Apple Cider Vinegar: Some studies suggest that apple cider vinegar may help dissolve certain types of stones and prevent the formation of new ones.

Buchu (*Agathosma betulina*): This herb has been traditionally used in South Africa for urinary conditions and may have anti-inflammatory and diuretic effects.

Aloe Vera: Aloe vera has been investigated for its potential to prevent the formation of kidney stones, possibly by reducing calcium oxalate crystallization.

Turmeric (Curcumin): Curcumin, the active compound in turmeric, has antioxidant and anti-inflammatory properties. Some studies suggest it may have a role in preventing calcium oxalate crystal formation.

Phyllanthus niruri, commonly known as Chanca Piedra, has been traditionally used in various cultures for its potential medicinal properties, particularly in the context of kidney stones. While research on its effectiveness is ongoing, some studies and anecdotal evidence suggest that *Phyllanthus niruri* may have certain beneficial effects on kidney stones (Kaur, et. a., 2017).

Stone Expulsion: One of the primary reported effects of *Phyllanthus niruri* is its ability to promote the expulsion of kidney stones. Some studies suggest that it may help relax the smooth muscles in the urinary tract, facilitating the passage of stones.

Inhibition of Crystal Aggregation: *Phyllanthus niruri* may have properties that inhibit the aggregation of crystals involved in stone formation, particularly calcium oxalate crystals. This action could potentially interfere with the early stages of stone development.

Reduction in Oxidative Stress: The herb is known for its antioxidant properties, which may help reduce oxidative stress in the kidneys. Oxidative stress can contribute to inflammation and damage, which are factors in kidney stone formation.

Anti-Inflammatory Effects: *Phyllanthus niruri* may possess anti-inflammatory properties that could be beneficial in the context of kidney stones. Inflammation plays a role in the formation and progression of stones.

References

1. Abou-Elela, A. (2017). Epidemiology, pathophysiology, and management of uric acid urolithiasis: A narrative review. *Journal of advanced research*, 8(5), 513-527.
2. Alok, S., Jain, S. K., Verma, A., Kumar, M., & Sabharwal, M. (2013). Pathophysiology of kidney, gallbladder and urinary stones treatment with herbal and allopathic medicine: A review. *Asian Pacific Journal of Tropical Disease*, 3(6), 496-504.
3. Kaur, N., Kaur, B., & Sirhindi, G. (2017). Phytochemistry and pharmacology of *Phyllanthus niruri* L.: a review. *Phytotherapy research*, 31(7), 980-1004.
4. Khan, A. (2018). Prevalence, pathophysiological mechanisms and factors affecting urolithiasis. *International urology and nephrology*, 50(5), 799-806.
5. Khan, S. R., Pearle, M. S., Robertson, W. G., Gambaro, G., Canales, B. K., Doizi, S., ... & Tiselius, H. G. (2016). Kidney stones. *Nature reviews Disease primers*, 2(1), 1-23.
6. Makhdoomi, D. M., & Gazi, M. A. (2013). Obstructive urolithiasis in ruminants-A review. *Veterinary World*, 6(4).
7. Ruiz-Agudo, E., Burgos-Cara, A., Ruiz-Agudo, C., Ibañez-Velasco, A., Cölfen, H., & Rodríguez-Navarro, C. (2017). A non-classical view on calcium oxalate precipitation and the role of citrate. *Nature communications*, 8(1), 768.

8. Samantha, C., Avani, S., Kumar, E., & Prasobh, G. (2021). A review on urinary calculi-types, causes, its mechanism, diagnosis, prevention and medical expulsion therapy of calculi. *World Journal of Pharmaceutical Research*, 9(10), 473-86.
9. Shukla, A. K., Shukla, S., Garg, A., & Garg, S. (2017). A review on anti-urolithiatic activity of herbal folk plants. *Asian Journal of Biomaterial Research*, 3(2), 1-11.
10. Sorokin, I., Mamoulakis, C., Miyazawa, K., Rodgers, A., Talati, J., & Lotan, Y. (2017). Epidemiology of stone disease across the world. *World journal of urology*, 35, 1301-1320.