AERVA LANATA: A PROMISING MEDICINE FOR UROLITHIASIS IN FUTURE

SIVAKUMAR, B.

Department of Pharmacognosy, Sanjo College of Pharmaceutical Studies, Kerala, India.
e-mail: sivapharm003[at]yahoo.co.in

(Received 23rd April 2025; revised 26th July 2025; accepted 15th August 2025)

Abstract. Urinary disorders are treated with Aerva lanata (Linn) in southern parts of india as a source of pashana Beda (Stone breaker). Most of the Ayuerveda and siddha practioner in south india used this plant towards urinary disorders like Ashmari (Urinari calculi) Moothra krichra (Dysuria), Mootravikara. The plant has been studied for its antiurolithiatic property from many years. The various part of this plant has been demonstrated for its antiurolithiatic activity in the form of various extracts in many scientific research. Many secondary metabolites has been reported in this plant such as alkaloids, tannins, flavonoids, and phenolic compounds. Preferably the aerial parts of the plant has enriched phytoconstituents. Among the various extract the aqueous extract of this plant was potent in dissolving kidney stones has been proved in many study. The plant has been reported to contain quercitin and betulin which has antiurolithiatic action associated by diuretic activity. Further the study has not been converted as medicine to be utilised by human by different dosage forms. If it is effectively subjected to formulation it will be a promising medicine for the treatment of kidney stone in near future wihout any complicated medication and surgery.
Keywords: *aerva lanata, pashana beda, ashmari, antiurolithiatic*

Introduction

Aerva lanata (L), also known as Pongal poo, belongs to the Amaranthaceae family and has many medicinal uses, including anti-urolithiasis and diuretics. The plant has diuretic properties and is used to treat stone disease. The roots have analgesic, diuretic, and anti-wetting effects. The plant is considered an antiseptic on the Malabar coast (Aasim et al., 2019; Jain and Jain, 2016). In Ceylon, it is useful for coughing and is also known as an anti-infant medicine. The Meena tribe in Sawai Madhopur district of Rajasthan uses the juice orally for patients with hepatitis, jaundice, excess bile, and indigestion. They also give herbal decoctions to treat pneumonia, typhoid, and other fevers (Kumar et al., 2003). The third kind of urinary tract infection is urinary tract stones. Urinary stones are quite common throughout the world, with over 80 percent cases of either calcium oxalate or a mixture of calcium oxalate and calcium phosphate identified in North India (Mitra et al., 1998). Hyperoxaluria is an important cause of calcium oxalate (CaOx) stones in people. One of the main causes of urine's crystallization is oxalate. It continues to heal cellular damage and cause premature stone formation (Kumar et al., 2002) Antiurolytics are used to reduce or dissolve kidney stones precipitates caused by drugs, crystalline and amorphous substances. These deposits may be caused by the accumulation of haemoglobin or foreign material in the urinary tract, which is involved in the formation of renal tract debris or kidney and urinary stone . The word stone is synonymous with uroliths, stones, or crystals, which is a urinary tract infection that begins with the precipitation of salts or crystals from the urine. Usually, urine contains chemicals that prevent crystallization. When urination is unable to keep water flowing through the urine, the amount of sediment increases, which can obstruct urination and cause urinary tract stones (Fauci et al., 2008).

Materials and Methods

The plant used in this study was collected from Trissur. The process of extraction involved mixing 50 grams of dry plant powder with 200 milliliters of water in a beaker. The mixture was allowed to stand for 24 hours, after which it was filtered through fine mesh or filter paper to separate the solids from the liquid. The resulting filtrate was then placed on a porcelain plate to evaporate, and the extract was collected for further analysis. Every manufactured extract underwent a quality examination to distinguish between various botanical components, ensuring that the integrity of the plant's active ingredients was preserved. This extract served as the foundation for the phytochemical analysis, where the focus was on identifying specific bioactive compounds within the plant's chemical makeup. This process of extraction and separation helped isolate the essential compounds for the subsequent biochemical testing, ensuring that only the most relevant components were retained for analysis. The first stage of the phytochemical analysis was the protein test, which involved using the biuret test to determine the presence of proteins in the plant extract. The biuret test consisted of adding two drops of a 1% copper sulfate solution and an equivalent amount of 10% sodium hydroxide solution to the test solution. A purple or crimson color that formed indicated the presence of proteins. Additionally, a yellow protein assay was performed by adding a few drops of concentrated nitrite solution to 2 milliliters of the plant extract. The development of a pale yellow color was a sign of an excess of protein, and further tests for free amino acids were carried out. The ninhydrin test, which uses a 0.2% ninhydrin solution, detected free amino acids by the formation of a red color upon heating. These tests allowed for a thorough analysis of the protein and amino acid content within the plant extract, providing important insight into the biochemical profile of the plant’s compounds.

Carbohydrate detection was another important aspect of the analysis, and this was carried out using the Molisch reagent test. To conduct this test, the Molisch reagent was added to the sample, followed by the careful introduction of concentrated sulfuric acid along the side of the test tube. The presence of carbohydrates was confirmed by the formation of a violet-colored ring at the interface of the two liquids. Furthermore, alkaloids, which are nitrogenous compounds that can have medicinal properties, were tested for using Dragendroff’s and Hager’s tests. In the Dragendroff’s test, a few drops of Dragendroff’s reagent were added to the plant extract, and the appearance of a red or reddish-brown precipitate confirmed the presence of alkaloids. Hager’s method also involved adding Hager’s reagent to the extract, and the formation of a yellow precipitate indicated the presence of alkaloids. These tests are essential for identifying bioactive alkaloids that might contribute to the plant’s medicinal potential. Other tests for saponins, glycosides, phenols, flavonoids, and steroids were also conducted. The saponin test involved stirring the plant extract with water for 15 minutes and observing the formation of stable froth, indicating the presence of saponins. However, the absence of stable froth suggested that saponins were not present in this extract. Glycosides were tested using Libermann’s method, where a mixture of flour, chloroform, and acetic acid was cooled with ice water and treated with concentrated sulfuric acid. A color change from purple to blue to greenish indicated the presence of glycosides, and the test revealed the presence of steroidal glycosides. The phenol test, using ferric chloride, was conducted by adding a few drops of ferric chloride solution to the extract. The appearance of a blue color indicated the presence of phenolic compounds, which are known for their antioxidant properties. Flavonoids were identified by mixing the plant

extract with sodium hydroxide, resulting in a pale yellow substance that turned colorless upon the addition of diluted acid. Finally, the steroid test using Libermann Burchard's method involved adding acetic anhydride and concentrated sulfuric acid to the plant juice, and the formation of a brown ring at the interface confirmed the presence of steroids. These tests collectively provided a comprehensive analysis of the plant's phytochemical constituents and their potential medicinal properties (Ali, 2024; Edwin et al., 2008; Gokhale and Kokate, 2008; Khandelwal, 2008; Divakar, 2002).

Step 1: Planning of exploratory kidney stones by homogenous precipitation

In the first step, a solution of sodium oxalate (AR) and calcium chloride (AR) is prepared to initiate the precipitation reaction that forms kidney stones in a controlled environment. Equimolar amounts of sodium oxalate and calcium chloride are combined with 10 ml of 2N H_2SO_4 (sulfuric acid) in a measuring utensil, ensuring both reactants are fully dissolved. Sodium oxalate, which is highly soluble in water, reacts with calcium chloride in an acidic medium to form calcium oxalate, which is the main compound for the formation of kidney stones. The solution is then allowed to react, with the process accelerated by the addition of calcium oxalate as a catalyst. The calcium oxalate acts as a seed for the formation of additional calcium oxalate crystals in the solution. In a separate container, an equimolar mixture of calcium chloride dehydrate (AR) and disodium hydrogen phosphate (AR) is prepared in a similar manner, adding adequate volumes of purified water and 10 ml of 2N H_2SO_4 to ensure complete dissolution. This mixture is also allowed to react, with calcium phosphate acting as the catalyst for the transition, further promoting the crystal formation. The reaction is carefully monitored, and once the reaction is complete, the product is treated with ammonium salts that are added in a manner that ensures rapid release from the sulfuric acid, which helps in precipitating the crystalline structure. Afterward, the solution is thoroughly cleaned with purified water to remove any impurities and residual acids. Finally, the calcium oxalate and calcium phosphate crystals are dried in a controlled environment at 60°C for four hours to ensure that all moisture is evaporated, leaving behind solid precipitates ready for further analysis.

Step 2: Arrangement of semipermeable film from the cultivated egg

The second step involves utilizing a semi-permeable membrane from a cultivated egg, which mimics the structure of biological membranes and acts as a model for examining the properties of kidney stone formation and permeation. The egg’s internal components, such as the yolk and egg whites, are separated from the external calcified shell by a semi-permeable membrane that allows for the passage of certain molecules. To isolate this membrane, the egg is first completely decalcified by immersing it in a 2M hydrochloric acid (HCl) solution overnight. This process removes the egg's calcium carbonate shell while preserving the delicate semi-permeable membrane. After decalcification, the egg is thoroughly rinsed with distilled water to neutralize the acid and wash away any remaining impurities. A small hole is then made at the top of the egg using a sharp pointer or needle, ensuring that the contents of the egg, including the yolk and whites, can be completely extracted without damaging the membrane. Once the egg is emptied, the semi-permeable film is carefully removed and cleaned again using distilled water to ensure that all traces of the egg’s interior have been eliminated. The membrane is then placed in an alkaline solution to facilitate the preservation of its

structure in a damp environment, preventing any degradation. After this treatment, the film is rinsed again with purified water to ensure it is free from contaminants. The final step in this process is refrigerating the semi-permeable film at a pH of 7.1–7.4 to maintain its integrity. This pH range ensures that the membrane remains in an optimal condition, preserving its functionality for subsequent experiments that mimic the interaction between biological tissues and kidney stone compounds.

Step 3: Determination of Calcium Oxalate by Titrimetry

The third step involves determining the concentration of calcium oxalate in the prepared sample using a titration method. A precise amount of calcium oxalate, typically around 1 mg, is measured and combined with 10 mg of the extract that has been encapsulated within the egg's semi-permeable membrane. The encapsulation process follows the suturing method, where the membrane is carefully sealed around the sample to prevent any leakage of the compound. This step ensures that the interaction between calcium oxalate and the other components of the extract is maintained in a controlled environment. The prepared sample is then suspended in a 100 ml buffer solution to create an environment that mimics the physiological conditions inside the human body, where kidney stones typically form. A control group containing only 1 mg of calcium oxalate is prepared without the extract to serve as the negative control, providing a baseline for comparison. All prepared groups, including the control and experimental groups, are placed in conical flasks and incubated at a constant temperature of 37°C for two hours to allow for the dissolution of calcium oxalate in the buffer solution. After the incubation period, the contents of the membrane are extracted into a test tube, and 2 ml of 1N sulfuric acid is added to facilitate the dissolution of any remaining calcium oxalate crystals. The titration process is then performed using a 0.0949N potassium permanganate ($KMnO_4$) solution as the titrant. The titration continues until a pale pink endpoint is achieved, which indicates that all the calcium oxalate has been dissolved. By subtracting the remaining undissolved amount from the initial quantity used in the experiment, the amount of calcium oxalate that was dissolved by the test material can be determined, providing valuable information about the effectiveness of the extract in dissolving kidney stone compounds. This titrimetric analysis serves as a crucial method for assessing the solubility and reactivity of calcium oxalate in the presence of various compounds, providing insight into the potential treatment of kidney stones.

Results and Discussion

The ash value of Aerva lanata is assessed through parameters such as total ash, water-soluble ash, and acid-soluble ash. A higher ash percentage reflects a greater presence of inorganic and siliceous matter, which serves as a potential indicator of the plant's harvesting quality (*Table 1*). Aerva lanata powder was extracted by maceration and the percentage yield was calculated (*Table 2*). Various qualitative chemical tests were conducted on the extract to identify the presence of secondary metabolites (*Table 3*). The extract was tested for its efficacy against calcium oxalate crystals to evaluate its antiurolithiatic potential. The results demonstrated that all tested extracts exhibited significant antiurolithiatic activity, with the specific parameters provided serving as evidence of their effectiveness (*Table 4*). 75.33% of the prepared decoction is mixed with five parts of simple syrup USP (1:5 ratio). Methyl paraben and peppermint oil is

added to the above mixture. The prepared syrup was evaluated to determine the quality (*Table 5*).

***Table 1**. Ash value determination.*

Ash type	Quantity (in percentage)
Acid insoluble ash	1.64%
Sulfated ash	9.12%
Water soluble ash	4.52%
Total ash	12.66%

***Table 2**. Percentage yield of extract.*

Name of drug	Weight of dried crude drug	weight of extract	% yield
Pashenbhed	50g	7.72g	15.44%

***Table 3**. Phytochemical analysis of aqueous extract of Aerva lanata.*

Category	Description
Alkaloid	+
Carbohydrate	+
Glycoside	+
Flavonoid	+
Saponin	+
Phenolic compound	+
Phytosterol & triterpenoids	+
Amino acid	+
Tannins	-
Steroid	-

Note: +=present' -=absent.

***Table 4**. Evaluation of antiurolithic activity by In vitro.*

Groups	Volume of KMnO4	Weight of Ca estimated	Weight of Ca reduced	% Dissolution
Negative	0.12	0.0227	0	-
Standard(Cystone)	0.02	0.0037	0.019	83.7%
AEOAL	0.03	0.0056	0.017	75.33%

***Table 5**. Basic evaluation of syrup.*

Parameter	Observation
Color	Light brown
Odour	Peppermint
Taste	Sweet

The syrup has no settling particle against black and white background (*Figure 1*). Digital pH meter was used to check the pH of the formulation, before the experiment the machine was calibrated by using buffer solution of pH 4.0. pH of sample was found to be 5.34 (*Figure 2*). Ostwald viscometer was used for finding the viscosity and the result was found to be 0.2630 poise (*Figure 3*). The specific gravity of the sample was found to be 1.181 w/w (*Figure 4*).

Figure 1. *Herbal syrup against black and white background.*

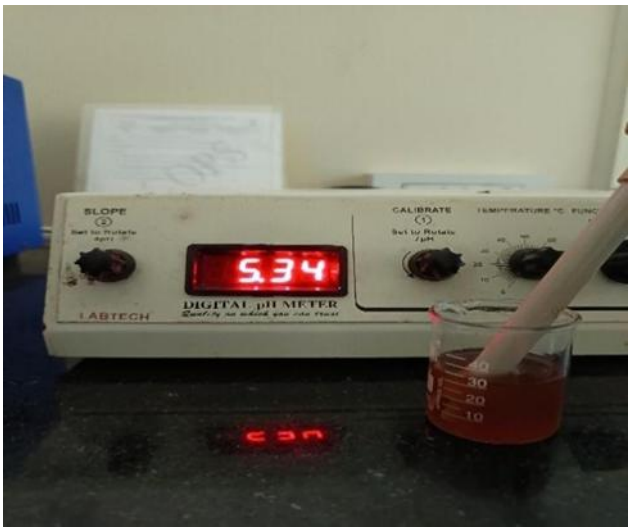

Figure 2. *pH determination of syrup.*

Figure 3. *Viscometer.*

Figure 4. *Specific gravity determination.*

The process of formulating the herbal syrup for antiurolithiasis comprises several critical stages. It begins with selecting Aerva lanata for its antiurolithiatic properties, identified through an extensive literature review. The active constituents are then efficiently extracted using the maceration method. Phytochemical screening is conducted to detect the chemical compounds present in the herb, revealing the presence of alkaloids, carbohydrates, glycosides, flavonoids, saponins, phenolic compounds, phytosterols, and amino acids. The plant extracts are evaluated in vitro against calcium oxalate crystals using an egg semipermeable membrane model. Cystone is used as a standard for comparison. The results demonstrate that Aerva lanata achieves a calcium oxalate dissolution rate of 75.33%, compared to 83.7% for cystone. Subsequently, herbal syrup is prepared as a potential treatment for kidney stones. This syrup undergoes various quality evaluation parameters and is confirmed to be within acceptable limits.

Conclusion

Aerva lanata, a widely recognized herb in traditional medicine, has shown significant promise as an antiurolithiatic agent, especially in the treatment of kidney stones. The plant's rich phytochemical profile, including alkaloids, flavonoids, tannins, saponins, and phenolic compounds, supports its medicinal value, particularly for urinary disorders such as Ashmari (urinary calculi) and Moothra Krichra (dysuria), which are prevalent in Southern India. The plant has long been used in Ayurveda and Siddha systems of medicine, primarily for its diuretic and stone-dissolving properties. However, the current study extends this traditional use by providing scientific validation for the antiurolithiatic potential of Aerva lanata, especially through its aqueous extracts. The experimental results highlight that the plant's extracts, particularly when formulated into a syrup, exhibit notable efficacy in dissolving calcium oxalate crystals, the primary constituent of most kidney stones, showcasing a dissolution rate of 75.33%, which is only slightly less than the standard treatment (Cystone, 83.7%). The extraction process and subsequent phytochemical analysis revealed a well-rounded composition of bioactive compounds, such as alkaloids, flavonoids, and phenolic compounds, which could account for the plant's therapeutic action. Aerva lanata's bioactive components, particularly quercetin and betulin, are known for their diuretic and antiurolithiatic properties, contributing to the effective dissolution of kidney stones without the need for complex surgeries or pharmaceutical interventions. The quality control measures conducted during the formulation of the herbal syrup ensured that the product's physical

characteristics, such as pH, viscosity, and specific gravity, aligned with standard expectations for medicinal products, supporting the product's feasibility for clinical use. This study's findings pave the way for further research to optimize the extraction process and explore different dosage forms, potentially transforming Aerva lanata from a traditional remedy to a standardized pharmaceutical product. Despite promising results, more extensive clinical trials and toxicological studies are needed to fully ascertain the safety and efficacy of the herbal formulation for human use. The plant's low-cost, non-invasive nature makes it an appealing alternative to conventional treatments for kidney stones, particularly for individuals seeking a natural remedy with minimal side effects. In conclusion, Aerva lanata offers a promising future in urolithiasis treatment, with its demonstrated ability to dissolve kidney stones and its rich medicinal properties, making it a viable candidate for formulation into an effective, accessible, and sustainable treatment option. Continued research and development could solidify its place as an alternative to current urolithiasis therapies, providing a safe, affordable, and efficient solution for patients suffering from this common condition.

Acknowledgement

The author sincierly thanks to Principal and management of sanjo college of pharmaceutical studies for their support and encouragement to make this study possible.

Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

REFERENCES

[1] Aasim, M., Khawar, K.M., Ahmed, S.I., Karataş, M. (2019): Multiple uses of some important aquatic and semiaquatic medicinal plants. – In Plant and Human Health, Volume 2: Phytochemistry and Molecular Aspects, Cham: Springer International Publishing 36p.
[2] Ali, M. (2024): Textbook of Pharmacognosy. – CBS Publishers and Distributors Pvt Ltd 505p.
[3] Divakar, M.C. (2002): Plant drug evaluation. – CD Remedies Publication 4p.
[4] Edwin, S., Joshi, S.B., Jain, D.C. (2008): Comparative pharmacognostic studies on root powder of Plumbago zeylanica and Plumbago rosea. – Indian Journal of Natural Products 24(2): 27-29.
[5] Fauci, A.S., Braunwald, E., Kasper, D.L., Hauser, S.L., Longo, D.L., Jameson, J.L., Loscalzo, J. (2008): Harrison's principles of internal medicine. – In Harrison's Principles of Internal Medicine 2800p.
[6] Gokhale, M.S., Kokate, C.K. (2008): Practical pharmacognosy. – Editora Record 120p.
[7] Jain, A., Jain, S.K. (2016): Indian Ethnobotany: Bibliography of 21st Century (2001-2015). – Scientific Publishers 164p.
[8] Khandelwal, K. (2008): Practical pharmacognosy. – Pragati Books Pvt. Ltd. 187p.
[9] Kumar, R., Mukherjee, M., Bhandari, M., Kumar, A., Sidhu, H., Mittal, R.D. (2002): Role of Oxalobacter formigenes in calcium oxalate stone disease: a study from North India. – European Urology 41(3): 318-322.

[10] Kumar, S., Goyal, S., Parveen, F. (2003): Ethno-medico-botany of household remedies of Kolayat tehsil in Bikaner district, Rajasthan. – Indian J Traditional Knowledge 2(4): 357-365.

[11] Mitra, S.K., Gopumadhavan, S., Venkataranganna, M.V., Sundaram, R. (1998): Effect of cystone, a herbal formulation, on glycolic acid-induced urolithiasis in rats. – Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives 12(5): 372-374.