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ASSESSMENT OF *IN-VITRO* ANTI-UROLITHIATIC ACTIVITY OF *SENEGALIA PENNATA* EXTRACT

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ABSTRACT

The development of urinary calculi (stones) in the urinary system, or urolithiasis, is a major global health problem. The plant Senegaliapennata, which is believed to have therapeutic characteristics, has attracted interest due to its possible anti-urolithiatic effects. This study used established procedures to evaluate Senegaliapennata extract's in-vitro anti-urolithiatic efficacy. Senegaliapennata was first used to make organic and aqueous extracts. The effectiveness of the extract in blocking important urolithiasis processes, such as nucleation and aggregation, was then assessed using a series of in-vitro experiments. significant inhibition of crystal formation and growth. Additionally, the extract exhibited notable antioxidant and anti-inflammatory properties, which are crucial in mitigating urolithiasis-associated tissue damage.This study underscores the potential of natural products, particularly plant-derived extracts, as alternative or adjunctive therapies for urolithiasis, offering novel avenues for drug discovery and development in this field.

Keywords: *kidney stone, Cystone, Anti-urolithiatic activity, Senegalia pennata*

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INTRODUCTION

Kidney stones, sometimes called nephrolithiasis, are solid mineral deposits that form in the kidneys or urinary tract. While struvite, calcium, uric acid, and cystine stones are the most common types, they can vary in composition and size. Dehydration, certain medical conditions, eating habits, and genetic susceptibility are among the factors that might lead to their creation. A urinalysis and imaging tests are usually required for diagnosis. Surgical intervention and pain management are among the treatment options available, contingent on the location and size of the stones. Medication to stop a recurrence of stones, dietary changes, and staying hydrated are examples of prevention techniques. To lower the danger, avoid complications, and alleviate symptoms, early identification and effective care are essential. Factors such as dehydration, dietary habits (including high intake of salt, protein, or oxalate-rich foods), metabolic disorders, and certain medical conditions like urinary tract infections or hyperparathyroidism.[1]

Causes of kidney stones

Dehydration

A concentrated urine can raise the chance of stone formation, thus it's important to drink adequate water.

Medical Conditions

Hypercalciuria

Excessive calcium excretion in the urine can lead to calcium stone formation.[2]

Urinary tract infections (UTIs)

Certain bacteria can produce substances that promote stone formation, leading to struvite stones.

Genetic Predisposition

Family history of kidney stones can increase an individual's risk of developing them.[3]

Underlying Medical Conditions

Due to their effects on urine composition and calcium metabolism, diseases such primary hyperparathyroidism, renal tubular acidosis, and inflammatory bowel disease might put people at risk for kidney stones. [4]

Urinary system and location of kidney stones

Once formed, kidney stones can remain in the kidneys or migrate through the urinary tract. If a stone becomes lodged in a ureter, it can obstruct urine flow, leading to intense pain, hematuria, and other symptoms. Understanding the urinary system's intricate processes and the factors contributing to kidney stone formation is crucial for developing prevention and treatment strategies to mitigate the risks and alleviate associated symptoms.[5]

PLANT PROFILE:

Figure No.1: SENAGALIA PENNATA (L.) MASLIN

Senegalia pennata (L.) Maslin, commonly known as climbing wattle, is a leguminous tree native to Southeast Asia, including countries like Thailand, Myanmar, Laos, Cambodia, Vietnam, and parts of India.[6] This plant is distinguished by its bipinnately compound leaves, which give it a feathery appearance, small creamy-yellow flowers arranged in cylindrical spikes, and elongated flat pods containing several seeds. Renowned for its young shoots and leaves, S. pennata is a staple in Southeast Asian cuisine, particularly in Thailand and Myanmar, where it is used in dishes such as omelets, soups, curries, and salads, imparting a unique flavor and aroma. Ecologically, as a member of the Fabaceae family, S. pennata aids in soil fertility through nitrogen fixation and provides habitat and food for various insects and animals. [7] Cultivation of S. pennata is relatively straightforward, requiring well-drained soil and full to partial sunlight, with propagation typically done from seeds or cuttings. While not currently endangered, sustainable harvesting is essential to prevent overexploitation. Senegalia pennata is thus a plant of significant cultural, nutritional, and ecological value, meriting continued study and conservation.[8]

Taxonomy:

The taxonomy of Senegalia pennata (L.) Maslin is as follows:

Kingdom: Plantae
Subkingdom: Viridiplantae
Infrakingdom: Streptophyta
Super division: Embryophyta
Division: Tracheophyta
Subdivision: Spermatophytina
Class: Magnoliopsida
Superorder: Rosanae
Order: Fabales
Family: Fabaceae
Subfamily: Mimosoideae
Genus Senegalia pennata [9]

Phytochemicals Constituents

Sr No.	Name	Source	Activity
1	Quercetin	*Senegalia pennata (L.) Maslin*	anti-inflammatory
2	Catechins	*Senegalia pennata (L.) Maslin*	Antiproliferative, anti-angiogenic
3.	Mimosine	*Senegalia pennata (L.) Maslin*	Anti-cancer, Anti-inflammation, Anti-fibrosis.
4.	Gallic acid	*Senegalia pennata (L.) Maslin*	anticarcinogenic, antimicrobial,
5.	Caffeic acid	*Senegalia pennata (L.) Maslin*	antioxidant

Table No.1: Isolated Compounds and reported activity from *Senegalia pennata (L.) Maslin*

Uses:

Urinary Disorders: Its diuretic properties are believed to aid in promoting urination and flushing out toxins from the urinary system.

Digestive Health: In traditional medicine, preparations of Senegalia pennata have been used to address digestive issues such as indigestion, diarrhea, and abdominal discomfort. It is believed to have mild astringent properties that may help in soothing gastrointestinal discomfort.[10]

Anti-inflammatory Effects: The plant is sometimes employed for its potential anti-inflammatory properties. It may be used topically or orally to alleviate inflammation associated with skin conditions, wounds, or minor injuries.[11]

4. Antimicrobial Activity: Certain preparations of Senegalia pennata, particularly extracts, are believed to possess antimicrobial properties. They may be applied externally to wounds or used internally to combat infections.

5. Antioxidant Support: Some constituents found in Senegalia pennata, such as flavonoids and phenolic compounds, exhibit antioxidant activity. Consumption of the plant or its extracts may contribute to scavenging free radicals and reducing oxidative stress in the body [12]

MATERIALS AND METHODOLOGY

Plant Collection and Authentication: The Senagalia Pennata (L.) Maslin leaves were harvested in March and then dried in the shade after being cleaned with tap water.[13]

The making a Herbal Extracts Senagalia Pennata (L.) Maslin: The fresh stem and leaves were ground into a coarse powder in a machine grinder, dried, and cleaned under running water.[14]

Making Extracts from Ethanol: The methods to prepare the extract were somewhat modified from those described in. The leaf sample was cleaned with regular water, dried, and then put into a blender to be powdered. For the Soxhlet extraction process, ethanol is utilized as a solvent in a variety of ratios. After the extract has been collected for 6 to 8 hours, filter it with a muslin cloth, transfer it to 50 ml tubes, and centrifuge them for 15 minutes at 4,000 rpm at 25 °C. The supernatant was saved for drying after being collected.[15]

EXPERIMENTAL WORK

Making calcium oxalate crystals using the homogenous precipitation method:

Fourteen grams of sodium oxalate and forty-one grams of calcium chloride dihydrate, each dissolved in two percent sulfuric acid, were put to different beakers. The mixture was then stirred to create calcium oxalate precipitate. By using distilled water and ammonia solution, respectively, excess sulfuric acid was cleaned away. Four hours were given for it to dry at 60°C. [16]

Using farm eggs to make semi-permeable membranes:

A whole egg's contents were extracted by puncturing the apex with a glass rod. After giving their empty egg shells a thorough wash with distilled water, the beaker containing 2M HCl was left overnight, and the egg shells were then submerged in an ammonia solution to neutralize any remaining acid residues while they were moist. Following a distilled water washing, they were refrigerated at a pH of 7.4–7.4.[17]

Figure No.2: Decalcification of Shell

Titrimetric analysis is used to assess anti-Urolithiatic activity

Five milligrams of calcium oxalate crystals, four distinct extract concentrations (10 mg, 20 mg, 30 mg, and 40 mg), and a standard (Positive control) were added to each semi-permeable membrane throughout the manufacturing process. Next, the membranes were carefully sutured. One sample with just calcium oxalate crystals in it served as the negative control sample. [18] To enable them to suspend, they were placed in individual conical flasks that each held 100 ml of 0.1M tris buffer solution. At 37°C, each conical flask was incubated for seven hours. Next, two milliliters of IN sulfuric acid were added to a test tube containing the contents of the semi-permeable membrane. After the mixture was created, it was titrated against the reference KMnO4 solution until a pale pink hue was seen. To achieve precise findings, the entire process was carried out three times [19]

RESULTS

Sr. No	Constituents in Ethanolic Extract	Observation
1	Saponins	+
2	Phenols	+
3	Tannins	+
4	Terpenoids	+
5	Flavonoids	+
6	Glycosides	-
7	Protein	-
8	Alkaloids	+

(-) indicates the absence of compound.
(+) indicates the presence of compound.

Table No. 2: Results of Preliminary Phytochemical Screening of Senegalia Pennata

The titrimetric approach yielded a purity percentage of 165.44%.

The antiurolithiatic efficacy of the ethanoic extract of Senegalia pennata is assessed in this study. The ethanolic extract showed the Hight rate of calcium oxalate “Ca Ox” dissolving 41.7%. Senegalia pennata ethanoic extract were discover to be more efficient at dissolving calcium oxalate.

Sr. No	Groups	Senegalia Pennata
1	Blank	0
2	Positive control	73
3	Ethanolic extract	41.7

Table No.3: % dissolution of calcium oxalate (Ca Ox) by Senegalia Pennata extracts

DISCUSSION

The effectiveness of the extract in blocking important urolithiasis processes, such as nucleation and aggregation, was then assessed using a series of in-vitro experiments. significant inhibition of crystal formation and growth. Additionally, the extract exhibited notable antioxidant and anti-inflammatory properties, which are crucial in mitigating urolithiasis-associated tissue damage.

This study underscores the potential of natural products, particularly plant-derived extracts, as alternative or adjunctive therapies for urolithiasis, offering novel avenues for drug discovery and development in this field.

CONCLUSION

According to study, Senegalia pennata has a bright future as an anti-Urolithiatic. Its constituents are effective in both preventing and facilitating the breakdown of urinary stones. To confirm these results and determine the ideal dose and modes of administration, more research is required, especially clinical trials. However, as a natural treatment for urolithiasis and associated disorders, Senegalia pennata shows potential.

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