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Antiurolithiatic Potential of *Tridax procumbens* and *Phyllanthus niruri*: A Polyherbal Approach

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Abstract: *Medically referred to as urolithiasis, nephrolithiasis, or renal calculus disease, kidney stones are termed as such because "renal" translates to kidney in Latin, whereas "nephro" is its Greek counterpart, with both "calculus" and "lithiasts" signifying a stone. Classified as a crystallopathy, this condition arises when urinary mineral concentrations are excessively high relative to fluid levels. This imbalance triggers microscopic crystals to bind together, creating solid masses or stones within the upper urinary tract. Because these deposits typically originate in the kidneys, tiny ones can naturally flush out through urination without triggering any noticeable issues. Nevertheless, once a stone expands beyond 5 millimeters (0.2 inches), it can obstruct the ureter, inducing intense and severe lower back discomfort—known as renal colic—that frequently extends toward the groin.[1-3]*
Renal calculi develop from dietary minerals accumulating in the urine, and clinical medicine currently lacks an ideal pharmacological treatment for them. However, traditional knowledge indicates that the juice extracted from Tridax procumbens leaves exhibits anti-urolithiatic properties.[5]
On an annual basis, individuals seek medical attention nearly 3 million times, with over half a million visits directed to emergency departments specifically for kidney stone complications.[1]
Herbal remedies have sparked widespread interest due to their well-documented benefits, such as adaptogenic, immunomodulatory, and antimutagenic properties. Furthermore, the frequent side effects and adverse reactions linked to excessive synthetic medication usage have driven people back toward natural, safer healing alternatives.[4,9]

Keywords: Urolithiasis, Kidney Stones, Tridax Procubmens,Phyllanthus niruri, Polyheral syrup, Calcium Oxalate, heral formulation

I. INTRODUCTION

Urolithiasis is a common disease of the urinary system in which stones are form in the kidneys, ureters, urinary bladder, or other parts of the urinary tract. These stones, also called urinary calculi, develop when minerals and other substances present in urine form crystals that gradually grow and combine to form stones. Calcium oxalate is the most common component of urinary stones. Other types include calcium phosphate, uric acid, struvite, and cystine stones. The formation of urinary stones depends on various factors, such as urine composition, insufficient fluid intake, dietary habits, metabolic disorders, and genetic factors.[1-3]

Urinary stones can be managed by increased fluid intake, dietary changes, medications, and medical procedures such as extracorporeal shock-wave lithotripsy and endoscopic stone removal. The choice of treatment depends on the size and location of the stones and the patient's condition. However, some patients may experience recurrence of stones or complications related to treatment. Therefore, researchers continue to explore additional methods for the prevention and management of urolithiasis [1–5].

Medicinal plants have gained scientific attention because they contain natural compounds that may possess antioxidant, anti-inflammatory, and diuretic properties. Various plant extracts have been studied for their potential effects on calcium oxalate crystal formation, growth, and aggregation. However, the effectiveness and safety of each plant

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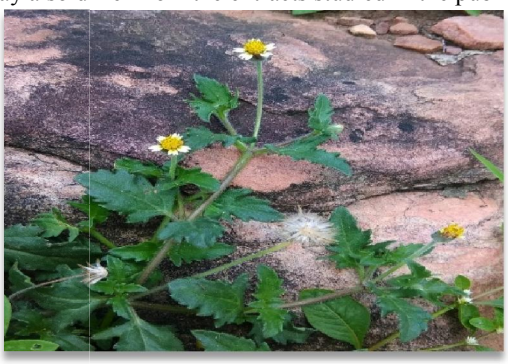
preparation must be confirmed through appropriate scientific studies. Traditional use alone cannot establish its therapeutic effectiveness.[4-6,9]

II. OVERVIEW OF THE SELECTED MEDICINAL PLANTS

2.1 Tridax procumbens:

Tridax procumbens is a plant in the family Asteraceae and is commonly known as coat buttons. Published phytochemical and pharmacological studies describe a range of plant constituents, including flavonoids and other secondary metabolites. The composition of an extract can vary with the plant part, geographical source, harvesting conditions and extraction method. For that reason, the identity of the plant material and the extraction procedure should be recorded carefully when comparing experimental findings.[5]

Ahmad and colleagues reported an in-vitro assessment of T. procumbens extracts using calcium oxalate and calcium phosphate stone models. The study compared extracts prepared using different solvents and included phytochemical screening. The authors reported potential stone-dissolving activity and proposed that the plant warranted further investigation [5]. These findings are relevant as preliminary laboratory evidence. However, results from an in-vitro model do not establish that an oral syrup will prevent stone formation or treat existing stones in humans. The extract used in the present formulation may also differ from the extracts studied in the published paper.[5]



2.2 Phyllanthus niruri

Phyllanthus niruri is a medicinal plant used in traditional systems of medicine and is often discussed in literature concerning urinary stones. Research has examined whether its extracts influence calcium oxalate crystallisation, crystal growth and aggregation. As with other botanical materials, the plant's chemical composition depends on identification, the plant material selected and the method used to prepare the extract. A project using P. niruri should therefore document botanical authentication and extraction conditions.[6-9]

Barros, Schor and Boim studied an aqueous extract of P. niruri in an in-vitro crystallisation model using urine samples from rats and humans. The extract did not prevent calcium oxalate precipitation under the study conditions, but the crystals were smaller and crystal aggregation was reduced. The authors suggested that the extract could influence early stages of stone formation [6]. This distinction is important: an extract may affect crystal size or aggregation without completely preventing crystallisation.[6]

Earlier experimental research also investigated P. niruri in relation to urinary factors associated with stone formation [7], and a later study examined its effect on crystal deposition in experimental urolithiasis [8]. More recently, Iregui-Parra and colleagues reviewed literature on P. niruri and nephrolithiasis. Their systematic review described encouraging findings in some settings but also emphasised that the evidence remains limited and needs to be interpreted according to study design, preparation and measured outcomes [9]. Consequently, P. niruri can be considered a candidate for further research, but its reported effects should not be treated as proof that every preparation will have the same activity.[7-9]

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III. HERBAL PREPARATIONS AND UROLITHIASIS: EVIDENCE FROM THE LITERATURE

Interest in herbal approaches to urinary stones is partly related to the complexity of crystal formation and the diversity of compounds present in medicinal plants. Laboratory investigations can assess specific outcomes such as crystal growth, aggregation or dissolution under controlled conditions. Animal studies may explore biological effects in a living system, while clinical studies are needed to determine whether a preparation provides meaningful benefit to patients. These evidence types answer different questions and should not be considered interchangeable.[4,6,9]

The systematic review by Monti et al. evaluated clinical evidence for phytotherapy in urinary stone disease. Sixteen studies met the review's eligibility criteria, but the authors identified substantial limitations in trial quality and risk of bias. Their analysis also found that citrate was more effective than phytotherapy for some outcomes involving stone size and urinary uric acid excretion. The authors cautioned that the overall quality of the evidence limited the strength and applicability of conclusions [4]. This review supports a cautious approach: herbal products may deserve study, but they should not be assumed to be equivalent to established treatment.[4]

The 2025 systematic review by Iregui-Parra et al. focused specifically on P. niruri in nephrolithiasis. It examined published studies addressing potential mechanisms and clinical or experimental outcomes, including its possible role alongside extracorporeal shock-wave lithotripsy. The authors noted that findings across the literature were mixed and that additional research is required [9]. Differences in plant preparations, dose, study populations and outcome measures make direct comparison difficult.[9]

For T. procumbens, the in-vitro study by Ahmad et al. provides a plant-specific starting point for investigation [5]. However, it does not by itself demonstrate clinical effectiveness, and its findings should be described as preliminary. In particular, evidence concerning an individual plant extract cannot be directly transferred to a combined formulation containing two extracts and a syrup base. Interactions between ingredients, extract concentration, stability and the final dosage form may influence the properties of the finished product.[5]

IV. RATIONALE FOR A POLYHERBAL SYRUP

A polyherbal formulation combines more than one plant-derived ingredient in a single dosage form. The rationale for combining T. procumbens and P. niruri in this project is to prepare a liquid formulation that can be evaluated for quality and potential anti-urolithiatic activity. The combination should be treated as a research hypothesis rather than evidence of a synergistic effect. Synergy can only be claimed if appropriate experiments compare the individual extracts with the combined preparation and demonstrate an effect that supports that conclusion.[5,6]

A syrup may be convenient to administer and can allow extracts to be incorporated into a liquid vehicle. At the same time, a formulation containing botanical extracts requires attention to taste, solubility, uniformity, microbial quality, preservation and storage. Sugar content may also be relevant for some users. It is not scientifically appropriate to claim

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that herbal syrups necessarily cause fewer side effects than synthetic medicines; safety depends on the ingredients, dose, quality, contaminants and available evidence.[4,9]

V. QUALITY EVALUATION OF THE FORMULATION

Formulation evaluation is important because a preparation cannot be considered suitable for further study merely because its ingredients are of plant origin. Basic physicochemical tests may include appearance, colour, odour, pH, density or specific gravity, viscosity where appropriate, and observations of physical stability during storage. The selected tests should match the final formulation and the facilities available in the laboratory. Methods, equipment, conditions and results should be recorded so that the work can be repeated.[1,4]

Botanical quality begins with correct identification and authentication of each plant. The plant part used, collection details, drying conditions, particle size and extraction solvent should be documented. If phytochemical screening is performed, the report should state which tests were used and describe the observations without treating a qualitative positive result as proof of therapeutic activity. Batch-to-batch variation is a recognised challenge in botanical products, so consistency of raw materials and extracts is important.[5,6]

Stability assessment should observe whether the formulation changes during the stated storage period. Changes in colour, odour, pH, precipitation or separation may indicate physical or chemical instability. If antimicrobial preservation or microbial quality is discussed, the relevant tests should actually be performed; they should not be claimed based only on the presence of preservatives. Similarly, anti-urolithiatic activity should only be reported if a suitable experimental method has been conducted and the results are available.[4,9]

VI. RESEARCH GAP AND FUTURE SCOPE

The literature provides a preliminary rationale for investigating both selected plants, but several gaps remain. First, the evidence for T. procumbens in urinary stone models is limited compared with the broader literature on P. niruri. Second, published results obtained using a single extract cannot establish the activity of a two-plant syrup. Third, differences in plant part, solvent, concentration and experimental model may affect results and limit comparison across studies. Finally, laboratory activity does not establish human efficacy or safety.[4-9]

Future work should begin with authenticated plant material and a clearly described extraction procedure. The formulation should then be prepared using a reproducible method and evaluated against predefined quality parameters. If the project includes an anti-urolithiatic assay, the experimental model, controls, reference standard, concentrations, replication and method of calculating results should be stated clearly. The individual extracts and combined formulation may be compared where feasible to explore whether the combination offers an advantage. Any limitations, including the absence of animal or clinical studies, should be acknowledged explicitly.[4-9]

VII. CONCLUSION

Published studies suggest that T. procumbens and P. niruri are worth further investigation in the context of urinary stone formation. In-vitro work on T. procumbens has reported activity in experimental stone models, while studies of P. niruri have described effects on calcium oxalate crystal size or aggregation under particular conditions. Systematic reviews nevertheless highlight limitations in the available clinical evidence. The present polyherbal syrup should therefore be viewed as a formulation for preliminary evaluation, not as a proven treatment for kidney stones. Reliable conclusions will depend on accurate botanical identification, reproducible preparation, appropriate quality testing and clearly reported experimental results.[4-9]

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