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A Survey of Ethnomedicinal Plants used for Urinary Tract Infection (UTI) and Kidney Stone in the Nalbari, Sonitpur and Tinsukia Districts of Assam, India

Research Article

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Abstract

Natural products derived from plants have essential biological parts in contradiction of many pathogenic organisms and are considered a principal source of modern synthetic drugs. A thorough field survey of ethnomedicinal plants was conducted between the months of July, 2022 to December, 2022 in three districts of Assam, namely Nalbari, Sonitpur and Tinsukia. Indigenous knowledge of the traditional medicines used for Urinary Tract Infection (UTI), Urinary Tract stones or kidney stones were gathered based on personal interviews and questionnaires. Medicinal plants with their family, local names, parts used and target diseases were documented. A total of 51 species were documented; of which, amaranthaceae family showed the highest number of species (6), followed by malvaceae (4), fabaceae (3), euphorbiaceae (3), asteraceae (3) etc. This survey revealed several effective medicinal plants that have significant pharmacogenetic properties, especially for UTI and kidney diseases.

Keywords: Therapeutics, Urolithiasis, Nephrolithiasis, Hyperoxaluria, Indigenous.

Introduction

Globally, kidney stones and urinary tract infections are amongst the most common disorders that affect both male and female. Wessen et al. (2003) have reported that 20-25% of residents of Middle East followed by 10-15% in USA, 5-9% in Europe and 1-5% population of Asian countries are prone to either chronic kidney diseases or urinary tract infections, (UTI) (1). Nearly 12% people of India are prone to kidney and urinary stones (2). While UTIs occur due to infections of bacteria, viz. *Escherichia coli* (3), *Klebsiella pneumoniae (4)*, *Pseudomonas aeruginosa* etc. (5, 6), kidney and urinary tract stones primarily occur due to accumulation of calcium, phosphate or oxalates (7). These stones might continue to grow indefinitely, creating secondary issues that could seriously harm the patient's life. Kidney stones are also referred to as urinary calculi, urinary tract stone disease, renal calculi, nephrolithiasis, ureterolithiasis, and urolithiasis, depending on where they occur in the body. Kidney failure and other serious problems can be prevented with prompt and appropriate treatment for kidney stones. Since urine is a chemical solution and contains a variety of chemical components, stones in the urinary system are a frequent problem. These compounds readily crystallize, expand in size, and eventually crystallize into stones. The introduction of non-invasive stone disruption techniques has changed the treatment of urinary tract and kidney stones, although patients usually wish to avoid surgery. The recurrence rate is roughly 50–80% and it also bears issues like high cost, availability, side effects, etc. Since there is no effective medical treatment for these stone ailments, it is crucial to look for new or lesser-known medicinal plants that may contain novel bioactive chemicals with therapeutic potential.

Plants have long served as a source of precursors and products utilized in various sectors, including medicines, food, cosmetics, and agrochemicals. Researchers have been looking to the natural world for prospective pharmaceuticals as the quest for novel medications continues. According to the World Health Organization (WHO, 2003) 65% of Indian populations are from the rural area and a total of 80% world's population are reliant on traditional medicine for primary health needs (8,9,10). On the other hand, traditional medicines are becoming more and more popular due to their little or complete lack of residual toxicity. Initially, the primary component of traditional medication is plants. Traditional medicines gradually paved the way for the development of traditional medical practices like Ayurveda in India. It is vital to express interest in traditional herbal remedies and indigenous medical practices, which are said to be fairly safe and free of side effects. These remedies should also be reasonably priced, widely accessible, and accessible to everyone.

The lives of individuals in rural and tribal areas are significantly influenced by ethno-medicinal plants.

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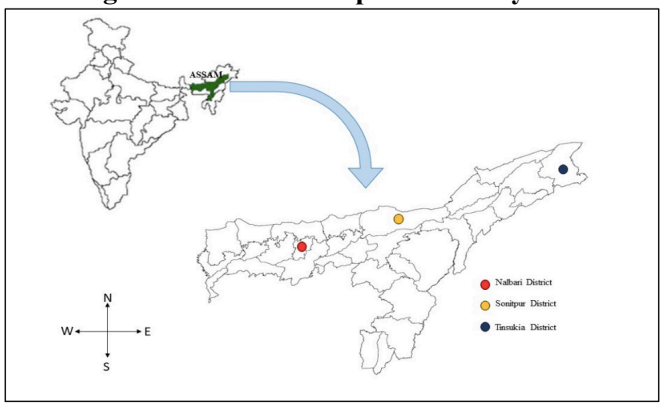
Northeast region of India that includes the states Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Sikkim and Tripura is an ethnic repository of thousands of unexplored medicinal plants. Many plant biologists have identified thousands of medicinal plants in different districts of Assam and neighbour states (11). Whereas only a few plants have been studied extensively for clinical trials as phytomedicine, most of them are still unexplored. Some of which are rare and endemic to this region. Since residents in deep and very distant rural locations have extensive knowledge of the therapeutic potential of native flora and indigenous folk treatments have been used for generations by locals of this region to treat urolithiasis, we aimed to identify and document the potent wild medicinal plants used by the natives for kidney stone and UTIs treatment in the Nalbari, Sonitpur and Tinsukia district of Assam.

Materials and Methodology

Study site and work plan

We selected three districts (Figure 1) from three different locations of Assam, *viz.* Nalbari (Lower Assam), Sonitpur (middle Assam) and Tinsukia (Upper Assam). Nalbari located at 26.3653ºN, 91.4048ºE; Sonitpur at 26.6770ºN, 92.6984ºE and Tinsukia at 27.5291ºN, 95.6458ºE. A total of 300 native informants, 100 informants from each studied district, were interviewed with standard structured questionnaires (12). A thorough review of existing literature on medicinal plant surveys and related questionnaires was done before framing the questionnaire. The questionnaire was reviewed for face validity which involves evaluating whether the questions appear to measure what they are intended to measure. It was ensured that the questions were clear, concise and appropriate for the target population. The questions were also consulted with experts working in the field of medicinal plants and pharmacologists to assess the content validity of the questionnaire. A pilot study was conducted with a small group of individuals in the villages from all the study areas who have knowledge or experience with medicinal plants. The pilot test helps identify any potential issues with the questionnaire, such as ambiguous or confusing questions or sections that may be redundant or irrelevant. Responses from the pilot study are reviewed to identify any problematic items and removed from the questionnaire. The informants were mostly farmers, traditional healers, villagers, and knowledgeable persons. Names, roles, and plant parts used for each medicinal plants were identified and documented. During the field visits, the plants were collected based on the information provided by the tribe in their own language. The collected medicinal plants were locally identified to know the vernacular name. The study was preceded with a collection of important medicinal plants and the identification of the specimens that were collected. Sometimes many informants have mentioned similar treatments for various conditions, however, sometimes contradictory responses were also received for the same plant as well. In those cases results were validated by performing a literature review and the functional characterization of each ethnomedicinal plant was considered. The limitation of the study is that most of the informants are above 60 years since younger generations are not interested to participate in the survey because of their limited knowledge on the subject matter. The statistical analysis was performed using Microsoft Excel 2010.

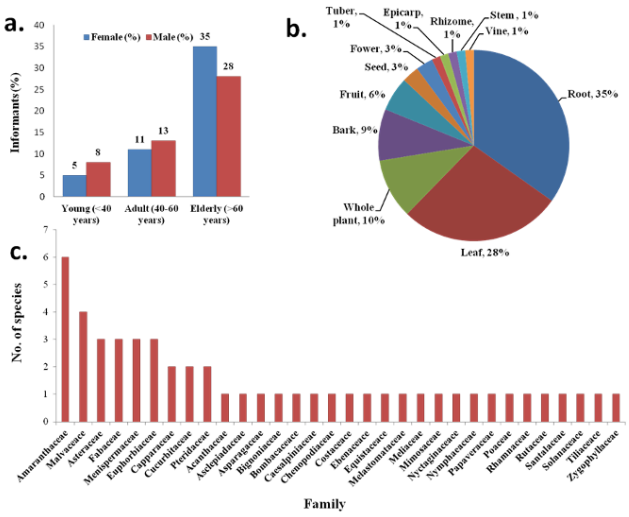
Figure 1: Location map of the study area



Results and Discussion

The present survey on ethnomedicinal plants in Nalbari, Sonitpur and Tinsukia districts revealed the use of several wild and cultivated plant species by native people for UTI and Kidney stones specific disorders. The interviewed informants included traditional healers, herbalists and villagers who were classified into three categories based on their age: young (<40 years), adult (40–60 years) and elderly (>60 years) informants. Amongst these, 63% of informants belonged to the elderly category, 23% were adults and 13% were young (Figure 2). The total number of female informants (51%) was found to be comparatively higher than that of male (49%).

Figure 2: a. Classification of informants (%) based on age and gender; b. Ethnomedicinal plant parts used against UTI and Kidney stones; c. Family-wise number of ethnomedicinal plants



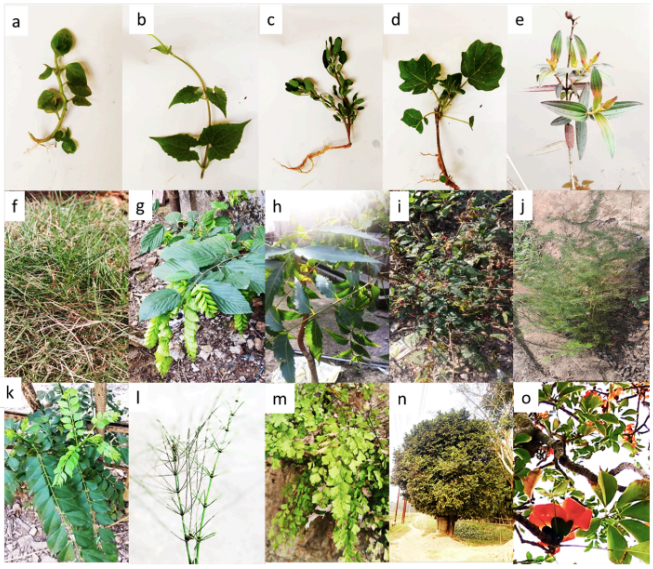
A total of 51 species belonging to 32 family were identified as commonly used medicinal plants for UTI and kidney stones (Figure 2). During the survey, some villagers informed that the healing process for kidney stones takes several months. On the other hand, some were reported to be healed within 5-7 weeks. However, according to them, UTI symptoms disappeared within 1-3 weeks. The ethnomedicinal data collected from the survey between the months of July 2022 to December 2022 are given in table 1.

Table 1:

Family	Scientific name	Vernacular Name	Parts used	Disorder/disease
Acanthaceae	*Andrographis paniculata* (Burm.f.)	Sirata	Whole plant	Kidney stone, UTI
Amaranthaceace	*Aerva lanata* (L.)	Astama-boidya	Leaves	Kidney stone
	Amaranthus caudatus (L.)	Moricha sak	Leaves	Kidney stone
	Amaranthus spinosus (L.)	Kata-khutura	Root	UTI
	Amaranthus viridis (L.)	Khutura Sak	All parts	Kidney stone
	Beta vulgaris (L.)	Beet root	Rhizome	Kidney stone
	Gomphrena globosa (L.)	Bixolyakarani	Whole plant	Kidney stone
Asclepiadaceae	*Hemidesmus indicus* (L.)	Anantamul	Leaves	Urinary tract infections
Asparagaceae	*Asparagus racemosus* (Wild.)	Xotamul	Roots	Urinary problems
Asteraceace	*Ageratum conyzoides* (L.)	Gendali-bon	Leaves, roots	UTI
	Elephantopus scaber (L.)	Bon dhopat	Roots	Difficulty in urination
	Mikania mikrantha (Kunth)	Japani Lota	Leaves	Kidney stone
Bignoniaceae	*Oroxylum indicum* (L.)	Bhat ghila	Bark, fruit	Difficulty in urination, burning sensation, polyuria
Bombacaceace	*Bombex ceiba* (L.)	Himolu	Stem and bark	Urinary troubles
Caesalpiniaceae	*Caesalpinia crista* (L.)	Leta guti	Plant juice, roots, fruit	UTI
Capparaceae	*Crateva unilocularis* (Buch.-Ham)	Barun	Leaves	UTI, Kidney diseases
	Crateva nurvel (Buch.-Ham)	Barn	Bark	UTI
Chenopodiaceae	*Chenopodium album* (L.)	Bhotua-sak	Leaves	UTI
Costaceace	*Costus speciosus* (J. Konig)	Jam lakhuti	Tubers	Urinary problems
Cucurbitaceae	*Cucumis melo* (L.)	Bangi	Epicarp	UTI, Kidney stone
	Cucumis sativus (L.)	Tiyoh	Seed	UTI
Ebenaceace	*Diospyros melaoxylon* (Roxb.)	Kendu tree	Fruit and flower bark	UTI
Equistaceace	*Equisetum debile* (Roxb.)	Sosma Bon	All parts	UTI
Euphorbiaceace	*Euphorbia ligularia* (Roxb.)	Xiju	Whole plant	Blood in urine
	Phyllanthus urinaria (L.)	Hazar moni	Whole plant	Urinary trouble
	Ricinus communis (L.)	Era gos	Root	UTI
Fabaceae	*Acacia ferruginea* (DC.)	Babul chim	Roots	UTI, oliguria and polyuria
	Clitoria ternatea (L.)	Aparajita	Leaves	Urinary tract problems
	Flemingia chappar (Benth.)	Makhiyoti	Root	Painful urination
Malvaceace	*Abutilon indicum* (L.)	Jopa bondha	Seed and leaf	Kidney stone, UTI
	Malva verticillata (L.)	Lofa	Root	Urinary tract infection
	Urena lobata (L.)	Bar- Xonborial	Roots, leaves, bark, flowers	Urinary trouble
	Sida rhombifolia (L.)	Xonborial	Whole plant	UTI
Melastomataceae	*Melastoma malabathricum* (L.)	Phutuki	Roots, leaves	Burning sensations in the urinary tract, painful urination.
Meliaceae	*Azadirachta indica* (A. Juss)	Mohaneem	Leaves	Urinary troubles
Menispermaceae	*Cissampelos pareira* (L.)	Tubul kilata	Roots, leaves	Urinary tract infection
	Tinospora sinensis (Lour.)	Gulancha	Whole plant	Urinary troubles
	Stephania japonica (Thunb.)	Tubuki lota	Vines	UTI
Mimosaceae	*Mimosa pudica* (L.)	Lajuki lota	Root, leaf	Urinary infection
Nyctaginaceace	*Boerhavia diffusa* (L.)	Purna nava	Root	Kidney stone
Nymphaeaceae	*Nymphaea nouchali* (Burm.f.)	Bhet	Root tops	Urinary ailments
Papaveraceae	*Argemone mexicana* (L.)	Kuhumkait	Root	Urinary trouble
Poaceae	*Cyanodon dactylon* (L.)	Dubori bon	Root	Urolithiasis
Pteridaceae	*Adiantum lunulatum* (Burm.)	Dhekia	Root	Blood in urine
	Acrostichum capillus-veneris (L.)	Dhekia	Leaves	UTI
Rhamnaceae	*Zizyphus oenoplia* (L.)	Bogori	Root	Urinary disorders
Rutaceae	*Clausena excavate* (Burm.f.)	Aamphis	Root	Urinary infection
Santalaceae	*Santalum album* (L.)	Chandan	Tender twig	UTI
Solanaceace	*Solanum surattense* (Burm. f.)	Bhot bengena	Root powder	Urolithiasis
Tiliaceace	*Grewia hirsute* (Vahl.)	Sukta-pata	Root powder and decoction of roots	Bleeding from urinary tract
Zygophyllaceae	*Tribulus terrestris* (L.)	Gokshur	Leaves, Root, fruit	Kidney stone

As shown in figure 2, Amaranthaceae family was found to be utilized most often with the highest number of species (6). This was followed by Malvaceace (4), Asteraceae (3), Fabaceae (3), Menispermaceae (3), Euphorbiaceae (3) and so on. Root (35%) followed by leaves (28%) were the most commonly used plant parts and administered orally in the form of paste. However, in some plants both leaves and roots or whole plants were used as ethnomedicine. Amongst the documented plant species, *Amaranthus lanata, A. cadatus, A. spinosus* and *Beta vulgaris* were most common plants used for kidney stones, whereas *Urena lobata, Asparagus racemosus, Oroxylum indicum*, *Caesalpinia nuga* etc. were commonly used for UTIs. *Cucumis melo* and *Caesalpinia nuga* were used for both UTI and kidney stones. While root extracts of *Adiantum lunulatum* were prescribed for Blood discharge in urine, *Acrostichum aureum* was used for unclear urine in women. The utilization of these plants as ethnomedicine for UTI and kidney disorders was also reported by Prachi et al. (2008), DiPasquale, (2008) and Shahhen et al. (2019) (13,14,15).

Figure 3: Picture showing collected ethonomecinal plants used for UTI and kidney stones: a. *Borhaavia diffusa*; b. *Mikania mikrantha;* c. *Chenopodium album*; d. *Solanum surattense*; e. *Melastoma malabathricum* ; f. *Cynodon dactylon*; g. *Flemingia chappar;* h. *Azadirachta indica* ; i. *Mimosa pudica* ; j. *Asparagus racemosus* ; k. *Murraya koeniggi;* l. *Equisetum edule*; m. *Adiantum lunulatum* ; n. *Diospyros melaoxylon*; o. *Bombex ceiba*



Most of the species documented in the present study have been identified to be abundant in secondary metabolites and possess a wide range of pharmacological activities. For example, *Andrographis paniculata* has several medicinal properties such as hepatorenal protective activity, antimicrobial, anti-protozoan, anti-inflammatory, antioxidant, immunostimulant, anti-infective etc. Two compounds, *viz*., Andrograholides and arabinogalactan isolated from *A. paniculata* were found to have strong renal protectivity against ethanol-induced toxicity in mice (16). Moreover, the action of *Hemidesmus indicus* against urolithiasis and hyperoxaluria was examined in various studies in rats (17,18). The antioxidant effect of *A. racemosus* can prevent the formation of kidney stones by preventing hyperoxaluria-induced peroxidative damage to the renal tubular membrane surface (19). Further, the antiurolithiatic property of *A. racemosus* can decrease the serum levels of waste products such as urea, creatinine, and uric acid etc., which gets accumulated as a result of difficulty in glomerular filtration caused by urolithiasis (20,21). Phytochemicals like Tyrosol, Pyrogallol, saponins and Flavonoids extracted from *Clitoria ternatea* are responsible for antilithiatic activity of the plant. Treatment of hydroalcoholic extract of *Clitoria ternatea* in rats possibly prevents calcium oxalate crystal deposition in the kidney by preventing hyperoxaluria induced peroxidative damage to the renal tubular membrane surface (22). Again, investigations on *T. terrestris* treated hyperoxaluria induced male wistar rats exhibited significantly decreased excretion of oxalate, calcium, and phosphate and reduced levels of blood urea nitrogen, uric acid and creatinine in serum. Furthermore, RT-PCR analysis revealed alteration in transcriptional levels of different antioxidant enzymes in *T. terrestris* treated hyperoxaluria induced rats. Therefore, several literatures supported the medicinal properties of most of the plants documented in this study and are found to be highly effective against diseases like urinary tract infections and kidney stones etc.

Conclusion

The present study is evident that nature has the best remedy for many diseases. Traditional practices of medicinal plants play a crucial role in the treatment of diseases like kidney stones and urinary tract diseases. The tremendous outcomes of herbal medicines fascinate the attention of scientists towards the use of natural products for the discovery of new drugs. Proper documentation and validation of exact plant products are necessary to strengthen the acceptability and awareness among the people. The healthcare system is gradually becoming more expensive for people living in rural areas. Therefore, it is the need of the hour to advance the knowledge and trust towards the safer indigenous herbal therapeutic system. Validation of herbal therapeutics will surely reinforce the use of natural products in treatment for various health implications. In future, natural products will be able to compete with modern medicines for their additional advantages of low side effects and lower costs.

References

1. Wesson J.A., Johnson R.J., Mazzali M., Beshensky A.M., Stietz S., Giachelli C., Liaw L., Alpers C.E., Couser W.G., Kleinman J.G., Hughes J. Osteopontin is a critical inhibitor of calcium oxalate crystal formation and retention in renal tubules. J Am Soc Nephrol. 2013;14(1):139.

2. Guha M., Banerjee H, Mitra P., Das M. The demographic diversity of food intake and prevalence of kidney stone diseases in the Indian continent. Foods. 2019;8(1):37.
3. Lee D.S., Lee S.J., Choe H.S. Community-Acquired Urinary Tract Infection by *Escherichia coli* in the Era of Antibiotic Resistance. Biomed Res Int. 2018;1:765.
4. Cristea O.M., Avrămescu C.S., Bălăşoiu M., Popescu F.D., Popescu F., Amzoiu M.O. Urinary tract infection with *Klebsiella pneumoniae* in Patients with Chronic Kidney Disease. Curr Health Sci J. 2017;43(2):137.
5. Mittal R., Aggarwal S., Sharma S., Chhibber S., Harjai K. Urinary tract infections caused by *Pseudomonas aeruginosa*: A minireview. J Infect Public Health. 2009;2(3):101.
6. Narten M., Rosin N., Schobert M., Tielen P. Susceptibility of *Pseudomonas aeruginosa* urinary tract isolates and influence of urinary tract conditions on antibiotic tolerance. Curr Microbiol. 2012;64(1):1-7.
7. Chandrajith R., Weerasingha A., Premaratne K.M., Gamage D., Abeygunasekera A.M., Joachimski M.M., Senaratne A. Mineralogical, compositional and isotope characterization of human kidney stones (urolithiasis) in a Sri Lankan population. Environ Geochem Health. 2019;41(5):1881-1896.
8. World Health Organization. Guidelines on Safety Monitoring of Herbal Medicines in Pharmacovigilance Systems. Geneva, Switzerland: World Health Organization; 2004.
9. Bodeker C., Bodeker G., Ong C.K., Grundy C.K., Burford G., Shein K. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. Geneva, Switzerland: World Health Organization; 2005.
10. Bandaranayake W.M. Quality control, screening, toxicity, and regulation of herbal drugs. In: Ahmad I, Aqil F, Owais M, editors. Modern Phytomedicine. Weinheim: Wiley-VCH GmbH & Co. KGaA; 2006. p. 25.
11. Mazumder T.Z. Phytochemical study of some traditional medicinal plants of northeast India. Agric Ecosyst Environ. 2021;2(11):59-64.
12. Martin G.J. Ethnobotany: A Methods Manual. World Wide Fund for Nature (International); 1995.
13. Prachi N.C., Kumar D., Kasana M.S. Medicinal plants of Muzzafarnagar district used in the treatment of urinary tract and kidney stones. Indian J Tradit Knowl. 2009;8(2):191-199.
14. Dipasquale R. Effective Use of Herbal Medicine in Urinary Tract Infections. J Dietary Suppl. 2008;5(3):219-226.
15. Shaheen G., Akram M., Jabeen F., Ali Shah S.M., Munir N., Daniyal M., Riaz M., Tahir I.M., Ghauri A.O., Sultana S., Zainab R. Therapeutic potential of medicinal plants for the management of urinary tract infection: A systematic review. Clin Exp Pharmacol Physiol. 2019;46(7):613-623.
16. Okhuarobo A., Falodun J.E., Erharuyi O., Imieje V., Falodun A., Langer P. Harnessing the medicinal properties of *Andrographis paniculata* for diseases and beyond: a review of its phytochemistry and pharmacology. Asian Pac J Trop Dis. Jun, 2014;4(3):213-222.
17. Patel P.K., Patel M.A., Saralai M.G., Gandhi T.R. Antiurolithiatic effects of *Solanum xanthocarpum* fruit extract on ethylene-glycol-induced nephrolithiasis in rats. J Young Pharm. 2012;4(3):164-169.
18. Gadge N.B., Jalalpure S.S. Curative treatment with extracts of *Bombax ceiba* fruit reduces the risk of calcium oxalate urolithiasis in rats. Pharm Biol. 2012;50(3):310-315.
19. Jagannath N., Chikkannasetty S.S., Govindadas D., Devasankaraiah G. Study of antiurolithiatic activity of *Asparagus racemosus* on albino rats. Indian J Pharmacol. 2012;44(5):576-580.
20. Singh PP, Pendse AK. Urolithiasis in Southern Rajasthan (Western Region of India). In: Urological Research. New York, USA: Springer; 1984. p. 60.
21. Visavadiya N.P., Narasimhacharya A.R. Hypolipidemic and antioxidant activities of *Asparagus racemosus* in hypercholesteremic rats. Indian J Pharmacol. 2005;37(6):376-380.
22. Kalaivanan S. Anti-Urolithiatic Activity of Hydroalcoholic Extract of *Clitoria ternatea* Linn against Ethylene Glycol Induced Urolithiasis in Rats. [Doctoral dissertation]. Madurai: KM College of Pharmacy; 2020.

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