IJMPR 2023, 7(5), 31-37

International Journal of Modern Pharmaceutical Research

www.ijmpronline.com

ISSN: 2319-5878
IJMPR
Review Article

SJIF Impact Factor: 5.273

A REVIEW ON HERBS USED IN THE TREATMENT OF UROLITHIASIS

Jenanee Velayuthem V.*[1], Amudha P.[2], Muralidharam P.[3]

Post Graduate[1], Asst Professor[2], Professor Head of pharmacology[3]
C.L Baid Metha College of Pharmacy, No.2/304, Rajiv Gandhi Salai, Jyothi Nagae, Thoraipakkam, Chennai-600097.

Received on: 08/03/2023
Revised on: 28/03/2023
Accepted on: 18/04/2023

***Corresponding Author**
Jenanee Velayuthem V.
Post Graduate C.L Baid Metha College of Pharmacy, No.2/304, Rajiv Gandhi Salai, Jyothi Nagae, Thoraipakkam, Chennai-600097.

ABSTRACT

Urolithiasis, which affects up to 12% of the world's population, is the third most common and painful ailment among urinary diseases. Among the most common varieties of kidney stones are those made of calcium oxalate, calcium phosphate, uric acid, struvite, and cysteine. Although there are several ways to lessen diabetes' negative effects and its subsequent complications, herbal formulations are favoured since they have fewer side effects and are less expensive. This review's main objective is to give readers a fundamental grasp of urolithiasis and the numerous plants that can be used to cure kidney stones since they have anti-urolithiatic properties.

KEYWORDS: Urolithiasis, calcium oxalate, herbal plants.

INTRODUCTION

Urolithiasis is the third common condition that affects the urinary system and causes people to experience excruciating discomfort. In industrialized nations, 10-12% of the population suffers from urinary stones. Although the mechanisms of urolithiasis have not been fully explored, it is thought that the risk of urinary calculi may be directly tied to many elements, including heredity, gender, age, occupation, metabolic disease, drug use, food, infection, and urinary tract blockage.[1] A sufficient fluid intake and dietary changes may successfully stop the recurrence of stones. Recent therapeutic options include surgical removal, percutaneous methods, and extracorporeal shock wave lithotripsies (ESWL) are too expensive for the average person to afford. Recurrence is also extremely common with these operations, and the patient must undergo thorough follow-up for a number of years. As a result, it's essential to adopt alternate therapies or create new antilithiatic medications with milder adverse effects.[2] Due to their effectiveness, low toxicity, and lack of side effects, herbal medications are gaining more and more attention. Except for a few composite herbal drugs and plants, the majority of remedies used in traditional medical systems were derived from plants, and they were demonstrated to be effective despite the lack of a well-established rationale for their use through systematic pharmacological and clinical studies.[3]

Symptoms

The symptoms of a kidney stone vary depending on whether it is in the kidney, ureter, or urinary bladder. A kidney stone does not usually produce symptoms until it moves about within the kidney or enters one of the ureters. The tubes that link the kidneys and bladder are known as ureters. If a kidney stone becomes caught in the ureters, it can cause the kidney to enlarge and the ureter to spasm, both of which can be quite painful. These are some examples of stone disease indicators and symptoms.[4]

- Significant lower back ache on either side
- More nebulous pain or a persistent stomachache
- Urine with blood in it
- Foul smell in urine

Mechanism of Stone Formation

The process of stone formation involves the nucleation of the crystals that make up the stone, their growth or aggregation to a size that can interact with an intra renal structure, their retention within the kidney or renal collecting system, and then additional aggregation and/or secondary nucleation to create the renal stone.[5]

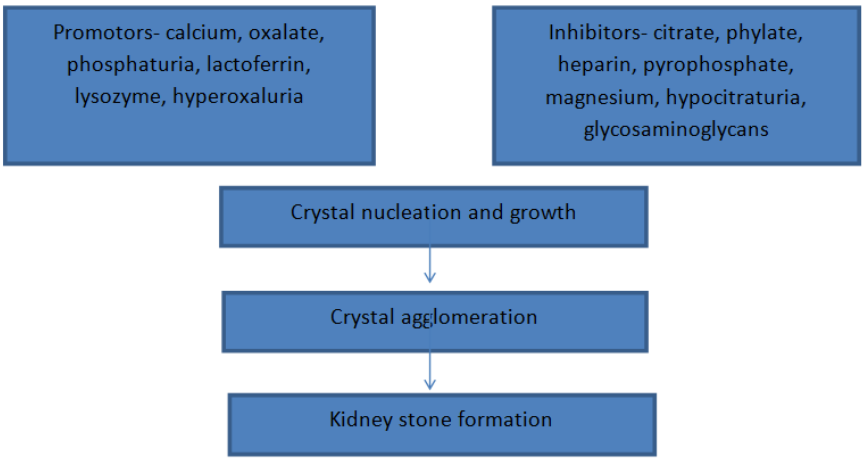

Figure 1: Schematic representation of formation of kidney stones.

TYPES OF RENAL STONES

Calcium oxalate stones

The most prevalent kidney stone kind is calcium oxalate. When there is a lack of fluids and a high concentration of calcium, oxalate, cystine, or phosphate, solid lumps called kidney stones develop in the kidney. Calcium oxalate, either by itself or, far more frequently, in combination with calcium phosphate or calcium urate, makes up calcium stones[6] .Calcium stones can form as a result of hypercalciuria, poor urine volume, and hypocitraturia.Diseases like hyperparathyroidism, cancer, sarcoidosis, and excess vitamin D that are associated with hypercalcemia and hypercalciuria frequently co-occur with these conditions.

Uric acid stone

Patients with hyperuricosuria frequently develop uric acid stones, but aciduria is generally the most prevalent underlying cause. Diet-dependent and diet-independent factors, including metabolic syndrome, which tends to produce a net acid load, are thought to be the causes of aciduria. Due to the high purine content of animal protein, which results in the production of uric acid during catabolism, a diet heavy in animal protein may increase the risk of uric acid stone development. At a low urinary pH (5.5 or less), uric acid is significantly less soluble, whereas solubility significantly rises at a higher urinary pH.[7]

Struvite stones

These stones, which are often composed of magnesium ammonium phosphate stones, develop in response to urinary tract infections. Urease, a bacterial enzyme that breaks down bacteria into ammonia and carbon dioxide and makes urine alkaline, favours the formation of struvite stones[8]. Typically, women are more likely than men to develop this sort of stone.[9]

Cystine stones

Cystine kidney stones are caused by cystinuria, an inherited (genetic) disease in the transport of the amino acid cystine, which causes an excess of cystine in the urine and the development of cystine kidney stones.[10]

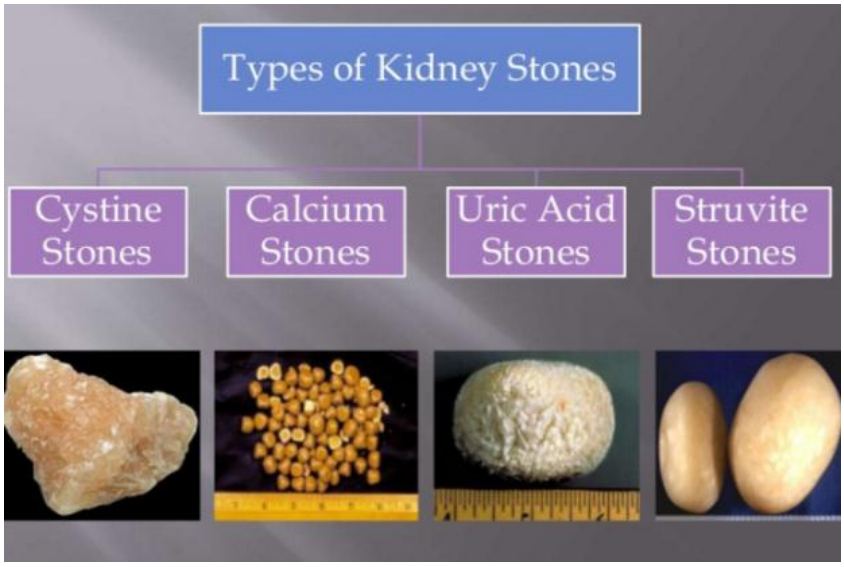

Figure 2: types of kidney stones.

Table 1: Herbal plants having urolithiatic activity.

Sr.No	Plant name	Family	Part used	Inducer	Outcome	Reference
01	Abelmoschus moschatus	malvaceae	seed	Zinc disc implantation in urinary bladder of rats	Increased creatinine clearance rate Diuretic effect	[11]
02	Alcea rosea	malvaceae	root	Ethylene glycol induced urolithiasis	Prevented calcium oxalate deposition in kidney Reduced urinary oxalate level	[12]
03	Angelica sinensis	Apiaceae	Roots	Ethylene glycol induced urolithiasis	Inhibited urinary oxalate – stone forming constituent	[13]
04	Berberis trifoliata	Berberidaceae	Leaves	Zinc disc implantation of urinary bladder	decrease in the weight of calculi in the urinary bladder	[14]
05	Biophytum sensitivum	Oxalidaceae	Whole plant	Surgical implantation of zinc disc in urinary bladder of rats	Increased GFR	[15]
06	Bryophyllum pinnatum	Crassulaceae	Leaves	sodium oxalate induced urolithiasis	Prevented accumulation and retention of calcium oxalate crystals in renal tubules	[16]
07	Camellia sinensis	Theaceae	Leaves	Ethylene glycol induced urolithiasis in rats	Increased sodium oxate dismutase Decreaed growth rate of calculus	[17]
08	Cinchorium intybus	asteraceae	leaves	Ethylene glycol induced urolithiasis	Decreased serum levels of calcium, uric acid Increased urine output	[18]
09	Cucumis trigomus	Curcurbitaceae	fruits	Ethylene glycol induced urolithiasis	Restored antioxidant in homogenates of kidney	[19]
10	Crocus sativus	Iridaceae	Stigma	Ethylene glycol induced urolithiasis	Reduced number of crystal deposition	[20]
11	Daucus carota	Apiaceae	roots	Ethylene glycol and ammonium chloride induced urolithiasis	Inhibited renal tissue damage and inflammation Inhibited serum creatinine and uric acid level	[21]
12	Dolichos biflorus	Fabaceae	seeds	Experimentally prepared kidney stone- calcium oxalate	Increased dissolution of calcium oxalate	[22]
13	Euphorbia hirta	Euphorbiaceae	Leaves	Nucleation and aggregation assay	Inhibition of calcium oxalate kidney stone	[23]
14	Eryngium campestre	Apiaceae	Aerial parts	Ethylene glycol induced urolithiasis	Reduced inflammation Inhibited calcium oxalate deposition in kidney	[24]
15	Ficus tikova	moraceae	stem	Ethylene glycol induced urolithiasis in SD rats	Inhibition of inflammatory process Decrease in level of oxalate in inorganic urine sediment	[25]
16	Gomphocarpus fruitcosus	Apocynaeceae	leaves	Ethylene glycol and ammonium chloride induced urolithiasis	Elevated the levels of magnesium, citrate Increased urine output	[26]
17	Holorrhena antidysenterica		seeds	Hyperoxaluric rat model of CaOx	Decreased the size of crystals	[27]
18	Hygrophila spinosia	Acanthaceae	Whole plant	Ethylene glycol induced urolithiasis	Lowered level of calcium and oxalate	[28]

					Increased glomerular filtration rate	
19	Ipomea ericarpa	Convolvulaceae	Leaves	Ethylene glycol induced urolithiasis	Inhibited serum level of calcium, urea,creatinine	[29]
20	Lagenaria siceraria		Fruit powder	Sodium oxalate induced urolithiasis in rats	Decreased calcium oxalate excreation and prevented crystal deposition in urinary tubules	[30]
21	Launea procumbens	asteraceae	leaves	Ethylene glycol induced urolithiasis	Decreased number and size of calcium oxalate crystals sediment in renal tubules	[31]
22	Lea macrophylla	Vitaceae	Whole plant	Ethylene glycol induced urolithiasis	Increased urinary excreation of calcium phosphorus and oxalate	[32]
23	Macrotyloma uniflorum	Fabaceae	seeds	Ethylene glycol induced urolithiasis	Showed anti urolithiatic activity by promoting inhibitors- magnesium, citrate and supressed promotors- calcium, oxalate, phosphate in serum, urine kidney tissue	[33]
24	Mallotus philippinensis	Euphorbiaceae	leaves	Ethylene glycol induced urolithiasis in wistar rats	Inhibition of formation of calcium oxalate and phosphate	[34]
25	Melia azearach	Meliaceae	Leaves	Ethylene glycol induced urolithiasis in rats	Decreased the elevated serum levels of creatinine, blood urea nitrogen and uric acid	[35]
26	Mentha piperita	Lamiaceae	Aerial parts	Urolithiasis induced by giving 1% ammonium chloride and 0.75% ethylene glycol in drinking water	Inhibited calcium oxalate deposition	[36]
27	Mimusops elengi	sapotaceae	bark	Ethylene glycol induced urolithiasis	Lowered the levels of oxalate and calcium in urine Increased urinary phosphate excreation	[37]
28	Musa acuminate	Musaceae	stem	Nucleation and aggregation assay	Inhibited the growth of calcium oxalate crystals	[38]
29	Pedalium murex	Pedaliaceae	Whole plant	Ethyl acetate induced urolithiasis model in rats	Inhibited enzyme urease Inhibited urinary pH Through this crystal formation inhibited	[39]
30	Pedalium murex	Pedaliaceae	fruit	Ethylene glycol induced urolithiasis	Lowered LDH level (oxalate synthesizing enzyme)	[40]
31	Piper cubeba	piperaceae	fruit	Ethylene glycol and ammonium choride induced urolithiasis	Elevated glomerular filration rate Decreased renal oxidative stress	[41]
32	Pyrrosia petiolosa	polypodiaceae	Whole plant	Ethylene glycol induced urolithiasis	Decreased oxidative stress and inflammatory response Activated TGF-β	[42]

					pathway	
33	Rubia tinctorum	Rubiaceae	Root	0.75% ethylene glycol and 2% ammonium chloride induced urolithiasis	Reduced the presence of calcium oxalate in urine	[43]
34	Salvia hispanica	lamiaceae	seeds	Ethylene glycol induced urolithiasis	Reduced inflammation Inhibited levels of urinary oxalate, calcium and serum uric acid	[44]
35	Solanum xanthocarpum	Solanaeceae	Fruits	Ethylene glycol induced urolithiasis	Increased urinary output Decreased deposits of calcium oxalate crystal	[45]
36	Vernonia cinerea	asteraceae	Whole plant	Ethylene glycol induced urolithiasis	Decreased oxalate levels Maintained phosphate levels	[46]

CONCLUSION

A detailed description has been made about various medical plans having antiurolithiatic effect, along with their underlying mechanism for progression, however more researchers are required in order to isolate the active constituent of herbal drugs and molecular interaction of their active combination of evaluation their therapeutic activity.

ACKNOWLEDGEMENT

We wish to ackhnowledge the help and support rendered by the management of C.L.Baid Metha College of Pharmacy, Chennai, Tamilnadu.

REFERENCE

1. López M, Hoppe B. History, epidemiology and regional diversities of urolithiasis. Pediatric nephrology, 2010 Jan; 25: 49-59.
2. Yasui T, Okada A, Hamamoto S, Ando R, Taguchi K, Tozawa K, Kohri K. Pathophysiology-based treatment of urolithiasis. International Journal of Urology, 2017 Jan; 24(1): 32-8.
3. Kant R, Singh TG, Singh S. Mechanistic approach to herbal formulations used for urolithiasis treatment. Obesity Medicine, 2020 Sep 1; 19: 100266.
4. Fisang C, Anding R, Müller SC, Latz S, Laube N. Urolithiasis—an interdisciplinary diagnostic, therapeutic and secondary preventive challenge. Deutsches Ärzteblatt International, 2015 Feb; 112(6): 83.
5. Khan A. Prevalence, pathophysiological mechanisms and factors affecting urolithiasis. International urology and nephrology, 2018 May; 50(5): 799-806.
6. Han H, Segal AM, Seifter JL, Dwyer JT. Nutritional management of kidney stones (nephrolithiasis). Clinical nutrition research, 2015 Jul 1; 4(3): 137-52.
7. Alelign T, Petros B. Kidney stone disease: an update on current concepts. Advances in urology, 2018 Feb 4; 2018.
8. Xu H, Zisman AL, Coe FL, Worcester EM. Kidney stones: an update on current pharmacological management and future directions. Expert opinion on pharmacotherapy, 2013 Mar 1; 14(4): 435-47.
9. Flannigan R, Choy WH, Chew B, Lange D. Renal struvite stones—pathogenesis, microbiology, and management strategies. Nature reviews Urology. 2014 Jun; 11(6): 333-41.
10. Spivacow FR, Del Valle EE, Lores E, Rey PG. Kidney stones: Composition, frequency and relation to metabolic diagnosis. Medicina (Buenos Aires), 2016 Dec; 76(6): 343-8.
11. Pawar AT, Vyawahare NS. Antiurolithiatic activity of Abelmoschus moschatus seed extracts against zinc disc implantation-induced urolithiasis in rats. Journal of basic and clinical pharmacy, 2016 Mar; 7(2): 32.
12. Ahmadi M, Rad AK, Rajaei Z, Mohammadian N, Tabasi NS. Alcea rosea root extract as a preventive and curative agent in ethylene glycol-induced urolithiasis in rats. Indian Journal of Pharmacology, 2012 May; 44(3): 304.
13. Wang S, Li X, Bao J, Chen S. Protective potential of Angelica sinensis polysaccharide extract against ethylene glycol-induced calcium oxalate urolithiasis. Renal Failure, 2018 Oct 15; 40(1): 618-27.
14. Pérez-Hernández RA, Treviño-Moreno SG, Arévalo-Martínez G, Sánchez-García E, Leos-Rivas C, Rivas-Morales C. Antiurolithic activity of Berberis trifoliate extract on induced urolithiasis in rats by zinc disc implantation. African Journal of Traditional, Complementary and Alternative Medicines, 2018 Feb 19; 15(1): 168-73.
15. Pawar AT, Vyawahare NS. Anti-urolithiatic activity of standardized extract of Biophytum sensitivum against zinc disc implantation induced urolithiasis in rats. Journal of advanced pharmaceutical technology & research, 2015 Oct; 6(4): 176.

16. Yadav M, Gulkari VD, Wanjari MM. Bryophyllum pinnatum leaf extracts prevent formation of renal calculi in lithiatic rats. Ancient science of life, 2016 Oct; 36(2): 90.
17. Jeong, B.C.; Kim, B.S.; Kim, J.I.; Kim, H.H. Effects of green tea on urinary stone formationn in vivo and in vitro study. *J. Endourol*, 2006; *20*: 356–361.
18. Emamiyan MZ, Vaezi G, Tehranipour M, Shahrohkabadi K, Shiravi A. Preventive effects of the aqueous extract of Cichorium intybus L. flower on ethylene glycol-induced renal calculi in rats. Avicenna Journal of Phytomedicine, 2018 Mar; 8(2): 170.
19. Balakrishnan A, Kokilavani R, Gurusamy K, Teepa KA, Sathya M. Effect of ethanolic fruit extract of Cucumis trigonus Roxb on antioxidants and lipid peroxidation in urolithiasis induced wistar albino rats. Ancient Science of Life, 2011 Jul; 31(1): 10.
20. Amin B, Feriz HM, Hariri AT, Meybodi NT, Hosseinzadeh H. Protective effects of the aqueous extract of Crocus sativus against ethylene glycol induced nephrolithiasis in rats. EXCLI journal, 2015; 14: 411.
21. Bawari S, Sah AN, Tewari D. Anticalcifying effect of Daucus carota in experimental urolithiasis in Wistar rats. Journal of Ayurveda and integrative medicine, 2020 Jul 1; 11(3): 308-15.
22. Atodariya U, Barad R, Upadhyay S, Upadhyay U. Anti-urolithiatic activity of Dolichos biflorus seeds. Journal of Pharmacognosy and Phytochemistry, 2013 Jul 1; 2(2).
23. Kain D, Kumar S, Suryavanshi A, Arya A. In –vitro antiurolithiatic potential of leaves of Euphorbia hirta against calcium oxalate kidney stones. IJPSR, 2021; 12(2): 991-994.
24. Safari H, Esmaeili S, Naghizadeh MS, Falahpour M, Malekaneh M, Sarab GA. The effects of aqueous extract of Eryngium campestre on Ethylene Glycol-Induced calcium oxalate kidney stone in Rats. Urology Journal, 2019 Dec 24; 16(06): 519-24.
25. Bervinova AV, Palikov VA, Mikhailov ES, Palikova YA, Borozdina NA, Kazakov VA, Rudenko PA, Tukhovskaya EA, Dyachenko IA, Slashcheva GA, Goryacheva NA, Sadovnikova ES, Kravchenko IN, Kalabina EA, Shinelev MV, Wu P, Murashev AN. Efficacy of *Ficus tikoua* Bur. extract in ethylene glycol-induced urolithiasis model in SD rats. Front Pharmacol, 2022 Aug 29; 13: 974947.
26. Alelign T, Tessema TS, Debella A, Petros B. Evaluations of the curative efficacy of G. fruticosus solvent extracts in experimentally induced nephrolithiatic Wistar male rats. BMC Complementary Medicine and Therapies. 2021 Dec; 21(1): 1-4.
27. Khan A, Khan SR, Gilani AH. Studies on the in vitro and in vivo antiurolithic activity of Holarrhena antidysenterica. Urological research, 2012 Dec; 40(6): 671-81.
28. Ingale KG, Thakurdesai PA, Vyawahare NS. Effect of Hygrophila spinosa in ethylene glycol induced nephrolithiasis in rats. Indian journal of pharmacology, 2012 Sep; 44(5): 639.
29. Das M, Malipeddi H. Antiurolithiatic activity of ethanol leaf extract of Ipomoea eriocarpa against ethylene glycol-induced urolithiasis in male Wistar rats. Indian journal of pharmacology, 2016 May; 48(3): 270.
30. Takawale RV, Mali VR, Kapase CU, Bodhankar SL. Effect of Lagenaria siceraria fruit powder on sodium oxalate induced urolithiasis in Wistar rats. Journal of Ayurveda and integrative medicine, 2012 Apr; 3(2): 75.
31. Makasana A, Ranpariya V, Desai D, Mendpara J, Parekh V. Evaluation for the anti-urolithiatic activity of Launaea procumbens against ethylene glycol-induced renal calculi in rats. Toxicology reports, 2014 Jan 1; 1: 46-52.
32. Nizami AN, Rahman MA, Ahmed NU, Islam MS. Whole Leea macrophylla ethanolic extract normalizes kidney deposits and recovers renal impairments in an ethylene glycol–induced urolithiasis model of rats. Asian Pacific Journal of Tropical Medicine, 2012 Jul 1; 5(7): 533-8.
33. Patel VB, Acharya N. Effect of Macrotyloma uniflorum in ethylene glycol induced urolithiasis in rats. Heliyon, 2020 Jun 1; 6(6): e04253.
34. Patel TB, Golwala DK, Vaidya SK. Antiurolithiatic Activity of Alcoholic Leaf Extract of Mallotus Philippinensis Lam. against Ethylene Glycol Induced Urolithiasis in Rats. Indian J. Pharmacol, 2016; 48: 270-4.
35. Dharmalingam SR, Madhappan R, Chidambaram K, Ramamurthy S, Gopal K, Swetha P, Kumar KS. Anti-urolithiatic activity of Melia azedarach Linn leaf extract in ethylene glycol-induced urolithiasis in male albino rats. Tropical Journal of Pharmaceutical Research, 2014; 13(3): 391-7.
36. Jamshed A, Jabeen Q. Pharmacological Evaluation of Mentha piperita Against Urolithiasis: An In Vitro and In Vivo Study. Dose-Response, 2022 Jan 10; 20(1): 15593258211073087.
37. Ashok P, Koti BC, Vishwanathswamy AH. Antiurolithiatic and antioxidant activity of Mimusops elengi on ethylene glycol-induced urolithiasis in rats. Indian journal of pharmacology, 2010 Nov 1; 42(6): 380.
38. Abu Zarin M, Tan JS, Murugan P, Ahmad R. Investigation of potential anti-urolithiatic activity from different types of Musa pseudo-stem extracts in inhibition of calcium oxalate crystallization. BMC complementary medicine and therapies, 2020 Dec; 20(1): 1-2.
39. Kaleeswaran B, Ramadevi S, Murugesan R, Srigopalram S, Suman T, Balasubramanian T. Evaluation of anti-urolithiatic potential of ethyl acetate extract of Pedalium murex L. on struvite crystal (kidney stone). Journal of traditional and complementary medicine, 2019 Jan 1; 9(1): 24-37.
40. Teepa KA, Kokilavani R, Balakrishnan A, Gurusamy K. Effect of ethanolic fruit extract of

Pedalium murex linn. in ethylene glycol induced urolithiasis in male wistar albino rats. Ancient science of life, 2010 Apr; 29(4): 29.
41. Bano H, Jahan N, Makbul SA, Kumar BN, Husain S, Sayed A. Effect of Piper cubeba L. fruit on ethylene glycol and ammonium chloride induced urolithiasis in male Sprague Dawley rats. Integrative Medicine Research, 2018 Dec 1; 7(4): 358-65.
42. Zhou F, Wang X. Pyrrosia petiolosa Extract Ameliorates Ethylene Glycol-Induced Urolithiasis in Rats by Inhibiting Oxidative Stress and Inflammatory Response. Disease Markers, 2022 Aug 5; 2022.
43. Marhoume FZ, Aboufatima R, Zaid Y, Limami Y, Duval RE, Laadraoui J, Belbachir A, Chait A, Bagri A. Antioxidant and polyphenol-Rich ethanolic Extract of Rubia tinctorum L. Prevents Urolithiasis in an ethylene glycol Experimental Model in Rats. Molecules, 2021 Feb 14; 26(4): 100
44. Saleem U, Ahmad N, Shah MA, Anwar F, Ahmad B. Anti-urolithiatic activity of Salvia hispanica L. seeds in ethylene glycol induced urolithiasis rat's model. Anais da Academia Brasileira de Ciências, 2020 Nov 16; 92.
45. Patel PK, Patel MA, Vyas BA, Shah DR, Gandhi TR. Antiurolithiatic activity of saponin rich fraction from the fruits of Solanum xanthocarpum Schrad. & Wendl.(Solanaceae) against ethylene glycol induced urolithiasis in rats. Journal of ethnopharmacology, 2012 Oct 31; 144(1): 160-70.
46. Hiremath RD, Jalalpure SS. Effect of hydro-alcoholic extract of Vernonia cinerea Less against ethylene glycol-induced urolithiasis in rats. Indian Journal of Pharmacology, 2016 Jul; 48(4): 434.