

Risk factors of urolithiasis: A hospital-based retrospective study

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ABSTRACT

Aim: Urolithiasis is the most prevalent urinary tract disease, posing a global public health concern. The escalating prevalence and recurrence rates of urolithiasis are attributed to lifestyle modifications, such as reduced physical activity and dietary habits. This retrospective study aims to explore the risk factors associated with urolithiasis among individuals diagnosed with this condition. **Method:** A retrospective hospital-based study involving 60 participants meeting the inclusion criteria was conducted. The participants were selected through convenience sampling from the urology, nephrology, and medical wards at Saveetha Medical College and Hospital. Demographic variables were collected, and the risk factors were assessed using a checklist on one-to-one interviews. **Results:** The study unveiled that most participants (68%) were male. Eighty percent of participants had the risk factor of decreased water intake, 74% consumed excess tomatoes, 56% had a history of recurrent urinary tract infections, 64% consumed an excessive amount of salt daily, 72% experienced a decreased urine output, 53% had a habit of alcohol consumption, and 45% included milk and milk products in their daily diet. A small percentage (5%) had a family history of urolithiasis. Additionally, 6% were undergoing Siddha treatment. **Conclusion:** The findings from this study underscore the significant factors contributing to urolithiasis. They can inform public health campaigns to raise awareness about lifestyle modifications, dietary changes, and hydration protocols contributing to kidney stone formation.

Keywords: Renal calculi, retrospective study, risk factors, stone formation, urolithiasis

Introduction

Urolithiasis is the most common disease of the urinary tract. It refers to the formation of urinary stones, also known as lithiasis, within the urinary tract^[1] which lodged in the kidney(s).^[2] These stones can develop in various parts of the genitourinary system, including the kidneys, ureters, bladder, and urethra. Urinary stones arise within the urinary tract when urine becomes overly

saturated with minerals such as calcium, phosphate, and oxalate, leading to crystal formation. These crystals may increase in size, causing obstruction and retention within the kidneys.^[3] Worldwide, around 80% of kidney stones consist of a combination of calcium oxalate and calcium phosphate. Conversely, uric acid, struvite, and cystine stones are also prevalent, constituting roughly 9%, 10%, and 1% of stones, respectively.^[4] Globally, there is a rising trend in the prevalence and recurrence rates of kidney stone disease,^[5] accompanied by a scarcity of effective pharmaceutical options. Approximately 12% of the global population experiences urolithiasis at some stage in their lives.^[6] The likelihood of developing stones differs from nation to nation; nonetheless, it remains a global public health issue.^[7] Within the Indian population, approximately 12% are anticipated to develop urinary stones, with around 50% of those cases potentially resulting in kidney function

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impairment.^[8] This upward trajectory is thought to be linked to shifts in lifestyle patterns, including reduced physical activity and dietary habits,^[9-11] as well as the impact of global warming.^[12] Individuals who develop stones are at the risk of hypertension^[13,14] and chronic kidney and end-stage renal disease.^[15-18] Recurrent stone formation poses a common challenge across all types of stones and is thus a significant aspect of medical care.^[19] Understanding the precipitating factors associated with urolithiasis is imperative for developing targeted preventive strategies and personalized treatment approaches. This retrospective study aims to investigate the risk factors associated with urolithiasis among patients who have been diagnosed with this condition. This study aims to shed light on the specific factors that may increase the likelihood of stone formation. Such insights can guide healthcare professionals, especially primary care physicians, in early detection, screening for kidney stones based on risk factors, educating about lifestyle modifications, referring for further evaluation, and implementing proactive measures to mitigate the risk of urolithiasis, thereby improving the overall quality of care for affected individuals or those at risk of developing urolithiasis.

Materials and Methods

A retrospective study utilizing a quantitative approach was conducted to assess the risk factors of urolithiasis among patients admitted to urology, nephrology, and medical wards at Saveetha Medical College and Hospital. Ethical approval was granted by the Institutional Scientific Review Board of Saveetha College of Nursing, Saveetha Institute of Medical and Technical Sciences (789/2022/ISRB/SCON dated December 16, 2022). The investigator obtained prior permission from the hospital authority to conduct the study. The sample size was calculated by Sigma Plot 13 (Systat Software Inc., USA) based on the prevalence of urolithiasis.^[20] Seventy patients were initially screened for eligibility, and 10 were excluded from the study. Thirty participants meeting the inclusion criteria were selected using convenience sampling. The inclusion criteria encompassed both male and female patients aged over 21, medically diagnosed with calculi, with a past history of urolithiasis, conscious, oriented, able to answer the questionnaire, and willing to participate.

The study's purpose was explained to patients in their native language, addressing any questions or concerns. Consent was obtained from each participant, ensuring confidentiality and their understanding of the information provided. Data collection employed a tool encompassing demographic and clinical variables, along with a checklist assessing risk factors. The checklist, developed after an extensive literature review, expert discussions, and investigator experience, covered factors such as daily water consumption, tomato consumption, history of recurrent UTIs, family history of urolithiasis, chronic and hereditary diseases, excessive salt intake, past urolithiasis history, drug consumption, sunlight exposure at work, alcohol consumption, daily urine output, previous urinary infections, prolonged bed rest, milk and dairy product consumption, AYUSH treatment history, congenital renal abnormalities, and drinking fluoridated tap water. The

reliability of the tool was checked, and it yielded a value of 0.87. Demographic and clinical variables were assessed first, followed by the checklist using an interview method. Confidentiality was maintained throughout the procedure, and the collected data were expressed in terms of frequency and percentage.

Results

Table 1 shows that most of the patients with urolithiasis, 22 (36.7%) were aged between 31 and 40 years, 40 (66.7%) were male, 42 (70%) were residing in urban areas, 34 (56.6%) had completed till secondary education, 36 (60%) were private employees, 32 (53.3%) had uric acid stones, 40 (66.7%) had stone at the calyceal site, 21 (70%) had <6 mm size of stones, and 36 (60%) were undergoing surgical treatment.

Table 2 shows the percentage of risk factors among patients with urolithiasis. Eighty percent had the risk factor of consuming a decreased intake of water, 74% had the risk of consuming excess tomatoes, 56% had a history of recurrent urinary tract infection,

Table 1: Background information on participants

Demographic variables	Frequency	Percentage
Age in years		
21–30	12	20.0
31–40	22	36.7
41–50	18	30.0
>51	8	13.3
Gender		
Male	40	66.7
Female	20	33.3
Type of residence		
Urban	42	70.0
Rural	18	30.0
Education		
Illiterate	4	6.7
Primary education	10	16.7
Secondary education	34	56.6
Graduate and above	12	20.0
Occupation		
Government employee	16	26.7
Private employee	36	60.0
Unemployed	8	13.3
Type of kidney stones		
Calcium oxalate stones	18	30.0
Uric acid stones	32	53.3
Cystine stones	10	16.7
Stones at site		
Calyceal stones	40	66.7
Renal pelvic stone	8	13.3
Upper water stone	12	20.0
Size of the stone		
<6 mm	42	70.0
>6 mm	18	30.0
Mode of treatment		
Medical	24	40.0
Surgical	36	60.0

Table 2: Percentage of risk factors of urolithiasis

Risk factors	Percentage
Consumption of decreased intake of water	80%
Consumption of excess tomatoes	74%
History of recurrent UTI	56%
Family history of urolithiasis	5%
Consumption of excessive amount of salt	64%
Consuming of any drugs – Calcium-based drugs	27%
Working under sunlight	18%
Consumption of alcohol	53%
Frequency of passing urine per day	72%
Prolonged bedrest	26%
Consumption of milk and milk products	45%
On AYUSH treatment	6%
Congenital renal abnormalities	-
Drinking fluoridated tap water	15%

64% consumed an excessive amount of salt per day, 72% had a decrease in passing urine per day, 53% had the habit of alcohol consumption, 45% consumed milk and milk products in their day-to-day life, and a very few (5%) had a family history of urolithiasis. Additionally, 6% were undergoing Siddha treatment.

Discussion

Recent research indicates a rising occurrence of urolithiasis over the last few decades in both developed and developing nations. The development of kidney stones involves a multifaceted process influenced by intrinsic factors like age, sex, and heredity and extrinsic factors such as geography, climate, diet, mineral composition, and water intake.^[12,21] While urolithiasis can affect individuals of all ages, genders, and races, it tends to be more prevalent in males aged 20–49 years.^[22] Various risk factors, including age, gender, ethnicity, local climate, dietary patterns, physical activity, and occupation, can contribute to the development of urolithiasis.^[20] In this study, a retrospective analysis of urolithiasis risk factors revealed that a majority of the participants were male, aged 31–40 years. Major contributors to its formation include low water consumption, increased intake of tomatoes and sodium-containing diets, and the consumption of milk and milk products. Additionally, some individuals with urolithiasis habits included alcohol and smoking and worked in hot sun conditions. These findings align well with the results of previous studies by other authors. Comorbid medical conditions such as diabetes, hypertension, and obesity also emerged as significant contributing factors.^[23] In the current study, it was found that some individuals developed hypertension after the occurrence of urolithiasis, while others had it before the onset of urolithiasis. Exposure to high temperatures is identified as one of the most significant determinants that increase the likelihood of acquiring stones, particularly in men aged between 30 and 60.^[24] This was also observed in the current study. Taylor *et al.*^[25] noted a significant association between the body mass index and urinary supersaturation of uric acid, which could increase the risk of uric acid stone formation. In this present study, weight and body mass index were not measured. Metabolic

disorders such as hypercalciuria, hyperoxaluria, hyperuricosuria, hypocitraturia, and a history of gout pose potential risks for developing urolithiasis.^[26-28] Stone formation can also be associated with primary hyperparathyroidism and other disturbances in calcium metabolism.^[29] The current study is limited to assessing metabolic disorders related to the formation of stones in the urinary tract. Instead, it focused on evaluating the consumption of tomatoes and calcium-based drugs, among which excessive tomato consumption emerged as the second major contributing factor for stone development in this study. Thirty percentage of the participants had calcium oxalate stone. Low urine volume, resulting from inadequate water intake and dehydration,^[30] can contribute to the formation of calculi. This is similar to our study, which observed that decreased water consumption stood at a high percentage among the risk factors. Additionally, the use of lithogenic group of drugs, such as sulfonamides, uricosuric agents, and indinavir, can facilitate the formation of stones due to their low solubility.^[31] Very recently, Zhu *et al.*^[32] found that a higher body mass index, waist circumference, adiponectin, triglycerides, and alcohol intake increased the risk of urolithiasis. Another study indicated that factors such as gender, diabetes, obesity, hypertension, and personal habits such as cigarette smoking, alcohol consumption, and opium use contribute significantly to the development of kidney stones.^[33] In this current study, it was found that more than 50% of male participants had the habit of consuming alcohol. Based on the comparison of the present study with existing studies regarding the risk factors of urolithiasis, which strongly supported the risk factors found in the present study, it is recommended that research be conducted on a larger scale to generalize the findings. Additionally, a comparative retrospective analysis of each type of stone and its risk factors could be conducted. These findings could assist primary care practitioners or family practitioners in screening for kidney stones at an earlier stage, providing education on lifestyle modifications for prevention, and designing management strategies accordingly.

Conclusion

The findings of the current study suggest that crucial factors contributing to urolithiasis encompass gender, water and fruit intake, consumption of milk and milk products, frequency of urination, family history of urolithiasis, and occupation. These results establish a foundation for informing individuals about the potential risk of developing urolithiasis based on their demographic data and medical history. Nevertheless, it is imperative to champion and endorse awareness campaigns targeting the key risk factors associated with urolithiasis.

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Conflicts of interest

There are no conflicts of interest.

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