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Original Research Article

Frequency of Factors Leading to the Development of Urolithiasis at SIUT, Karachi

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Abstract: *Urolithiasis is a common urological condition worldwide and a significant cause of morbidity, especially in regions with hot climates and dietary variations such as Pakistan. Understanding the contributing factors is essential for prevention and management.* ***Objective:*** *To determine the frequency of factors leading to the development of urolithiasis at SIUT, Karachi.* ***Methodology:*** *We conducted this study on 385 participants aged 20-70 years presenting with acute renal colic and a confirmed ultrasonographic diagnosis of urolithiasis. Data on predefined demographic and risk factors were collected.* ***Results:*** *The mean age of the 385 participants was 49.49 ± 14.09 years. A majority were male (62.3%), and the most prevalent modifiable risk factor was low water intake (65.7%), which was followed by obesity (51.9%) and aerated beverage consumption (56.4%). Comorbid risk conditions were highly prevalent, including hypertension (37.9%), anemia (48.8%), and diabetes mellitus (28.3%). A strong family history of urolithiasis was reported in 47.5% of the cohort. Other significant factors included an age greater than 50 years (53.8%) and smoking (24.9%).* ***Conclusion:*** *The risk factors leading to the development of urolithiasis were the high frequency of male sex and increasing age, with modifiable risks such as low water intake and comorbid metabolic conditions.*
Keywords: Urolithiasis, Risk Factors, Dehydration, Obesity

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Introduction

Urolithiasis is a prevalent condition, as urinary calculi are globally distributed. There exist four different kinds of calculi. Approximately 75% of stones are made up primarily of calcium, mainly in the form of calcium oxalate combined with calcium phosphate. Approximately 15% of stones are classified as triple phosphate stones, which consist of magnesium ammonium phosphate. Around 6% are uric acid stones, while cystine stones constitute 2% of the total. In recent years, the prevalence of urinary stone disease has been changing as social conditions have improved, especially in urban areas of more affluent developing nations (1-4). The development of renal stones is attributed to both high concentrations of stone constituents and favorable physicochemical conditions. Excessive urinary excretory products are a significant factor resulting from highly concentrated urine, which may be due to environmental conditions (5). Hypercalciuria can arise from numerous causes, including excessive oxalate or uric acid production, with hereditary cystinuria being a major cause. The factors that promote the formation of crystalloid may be equally significant. An alkaline pH encourages the formation of calcium phosphate stones (6). The development of renal stones and the chemical composition of the most common types are affected by gender and age (7). Nephrolithiasis, once thought of solely as a renal disorder, is now supported by significant proof as a systemic disorder. Recent studies have established important connections between nephrolithiasis and several prevalent conditions. Greater body size, as measured by weight, BMI, or waist circumference, is associated with a higher likelihood of stone formation, regardless of other risk factors (8, 9). Type 2 diabetes and hypertension are linked to nephrolithiasis; specifically, diabetes may contribute to the formation of uric acid stones. Insulin resistance, a hallmark of metabolic syndrome and type 2 diabetes, leads to a lower urine pH due to impaired renal ammoniagenesis, which promotes the development of uric acid stones (10).

Despite significant advancements in the development of novel therapies for urinary stone management, the global incidence of urolithiasis continues to rise. The mechanisms underlying renal stone formation are not fully understood. The factors contributing to the development of urolithiasis vary by geographical region, including prevalence, incidence, age and sex distribution, stone composition, and stone location. Moreover, alterations in socio-economic conditions have led to variations in the prevalence, incidence, and distribution of lithiasis concerning age, sex, and type, as well as the location and chemical-physical composition of the calculi. This study aims to present a current perspective on patients with urolithiasis to elucidate emerging trends and inform the formulation of an effective prevention strategy.

Methodology

The study employed a cross-sectional design and was conducted from 15 August 2022 to 15 February 2023 at the Department of Urology, SIUT, Karachi, after obtaining ethical approval from the hospital. A sample size of 385 participants was determined using WHO software, based on an anticipated prevalence of diabetes mellitus of 20%11 among urolithiasis patients, with a 4% margin of error and a 95% confidence level. Consecutive non-probability sampling was used to enroll patients presenting with acute renal colic lasting at least 12 hours and diagnosed with urolithiasis via trans-abdominal ultrasonography, as indicated by the presence of echogenic foci with acoustic shadowing.
Participants between the ages of 20 and 70 years were included, while those with a history of hyperthyroidism, hyperparathyroidism, dialysis, malignancy, pregnancy, stroke, chronic liver disease, chronic renal failure, chronic obstructive pulmonary disease, congestive cardiac failure, or myocardial infarction were excluded. Consent was secured from all participants. Data were collected using a structured pro forma to record demographic details, clinical history, and specific risk factors as defined

operationally. We examined the risk factors for urolithiasis in these patients such as increased age which was defined as patients aged > 50 years, male sex, low water intake (drinking less than 1 liter per day), smoking defined as patients who smoked at least 10 cigarettes a day for last two years, alcohol consumption (> 20 units per week for more than six months, aerated beverage consumption defined as patients who consumed such beverages more than 3 per week for more than six months, diabetes mellitus (HbA1c ≤ 7 taking anti-diabetic for at least six months), hypertension (taking anti-hypertensive medicines for at least six months with SBP ≤ 130 mmHg and DBP ≤ 90 mmHg), anemia was defined as patients with a hemoglobin level below 12 g/dL for males or below 11 g/dL for females and obesity was defined as patients with BMI of 30 kg/m² or higher.

Data was analyzed with SPSS 26. Age was calculated using the mean and standard deviation. Demographics and risk factors were evaluated using frequency and percentages.

Results

The study cohort comprised 385 participants with a mean age of 49.49 ± 14.09 years, ranging from 20 to 70 years. A slight majority of participants were literate (205, 53.2%), resided in urban areas (215, 55.8%), and were employed (200, 51.9%) (Table 1).

Analysis of potential risk factors revealed a male predominance in the sample (240, 62.3%). The majority of participants (207, 53.8%) were over 50 years of age. 96 (24.9%) individuals reported a history of smoking, while alcohol consumption was reported by 75 (19.5%). Consumption of aerated beverages was notably common, reported by 217 (56.4%) participants. Several medical comorbidities were prevalent among the study population. Hypertension was present in 146 (37.9%) individuals, diabetes mellitus in 109 (28.3%), and obesity in 200 (51.9%). Nearly half of the participants, 188 (48.8%), had a Diagnosis of anemia. A family history of urolithiasis was reported by a significant proportion of the cohort 183, 47.5%). The most frequently identified modifiable risk factor was low water intake, reported by 253 (65.7%) participants (Table 2).

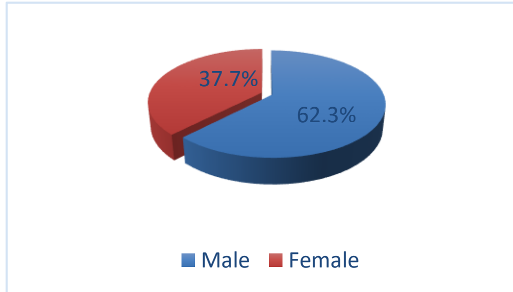

Figure 1: Gender distribution.

Table 1: Demographics

Demographics		**n**	**%**
Education	Literate	205	53.2%
	Illiterate	180	46.8%
Residence	Urban	215	55.8%
	Rural	170	44.2%
Occupation status	Employed	200	51.9%
	Unemployed	185	48.1%
Socioeconomic status	Lower class	97	25.2%
	Middle class	200	51.9%
	Upper class	88	22.9%

Table 2: Risk factors of urolithiasis

Risk factors		**n**	**%**
Male gender	Yes	240	62.3%
	No	145	37.7%
Age groups (Years)	20 to 35	80	20.8%
	36 to 50	98	25.5%
	> 50	207	53.8%
Smoking	Yes	96	24.9%
	No	289	75.1%
Alcohol	Yes	75	19.5%
	No	310	80.5%
Aerated beverage consumption	Yes	217	56.4%
	No	168	43.6%
Diabetes	Yes	109	28.3%
	No	276	71.7%
Hypertension	Yes	146	37.9%
	No	239	62.1%
Anemia	Yes	188	48.8%
	No	197	51.2%
Obesity	Yes	200	51.9%
	No	185	48.1%
Family history of urolithiasis	Yes	183	47.5%
	No	202	52.5%
Low Water Intake	Yes	253	65.7%
	No	132	34.3%

Discussion

The findings of the present study provide a detailed epidemiological profile of risk factors for urolithiasis in a cohort of 385 patients. The mean age of 49.49 ± 14.09 years aligns with global trends, indicating that kidney stone incidence peaks in middle age. This observation is consistent with the review by Wróbel et al., who noted that while urolithiasis can affect all ages, its prevalence increases with age (12). The male predominance of 62.3% in our sample is a well-documented demographic pattern in urolithiasis research. For instance, the study from Bisha, Saudi Arabia, reported that 55% of their cohort was male, while a hospital-based study in India found an even higher male prevalence of 66.7% (13, 14). This consistent gender disparity is often attributed to hormonal influences, specifically the protective role of estrogen in pre-menopausal women, which promotes citrate excretion and inhibits crystal formation (12).

The high prevalence of low water intake among 65.7% of our participants is the most significant modifiable risk factor. Multiple studies powerfully corroborate this finding. The hospital-based retrospective study in India identified decreased water intake as a factor in 80% of their patients (14). Similarly, chronic dehydration, often resulting from high ambient temperatures or occupational heat exposure, is a primary driver of urine supersaturation and subsequent stone formation, as documented by Wrobel et al. (12). This is particularly relevant given that many occupations that lead to sweat loss and inadequate fluid replacement are common across various populations. The high consumption of aerated beverages (56.4%) in our cohort is another critical dietary concern. These beverages are often high in fructose and phosphoric acid, which can increase urinary calcium and oxalate excretion, thereby elevating the lithogenic risk.

The burden of comorbid conditions in our population is substantial and mirrors the findings from other studies. The prevalence of hypertension (37.9%) and diabetes (28.3%) in our patients is significant. This aligns with the results from the Hail Saudi Arabia study, which found these comorbidities to be strong predictors of urolithiasis, with hypertensive participants showing a 56% greater likelihood of stones.[15] The pathophysiological link may involve abnormalities in renal calcium handling in hypertension and the effects of insulin resistance on urinary pH and calcium excretion in diabetes. Furthermore, the high rate of obesity (51.9%) in our cohort is a major concern. Taylor et al. demonstrated that a larger body size is associated with increased urinary excretion of calcium oxalate and uric acid, thereby promoting stone formation (16).

A notably high proportion of our participants (48.8%) were anemic. While not a traditional risk factor highlighted in the literature, this finding warrants further investigation. It is plausible that chronic hematuria, a common symptom of urolithiasis, could contribute to anemia in a subset of patients. Alternatively, shared nutritional deficiencies or other underlying inflammatory processes could link the two conditions. The strong family history of urolithiasis (47.5%) observed in our study underscores the important role of genetic predisposition. This finding is consistent with a report showing that 41.9% of participants had a family history, and another study that also highlighted familial patterns and even consanguinity as risk factor (13, 17). This reinforces the concept that heredity can influence the metabolism of stone-forming compounds, such as calcium oxalate and citrate.

Based on these findings, a multi-faceted approach is recommended. Public health campaigns should prioritize educating high-risk populations about the importance of achieving a high daily urine volume by increasing water intake. Dietary counseling should specifically target reducing aerated beverages and sodium-rich foods while promoting a balanced diet to manage weight and associated metabolic conditions such as diabetes and hypertension. Screening for urolithiasis should be considered in patients with these comorbidities, especially those with a positive family history. Finally, further research is needed to explore the curious link between anemia and urolithiasis observed in this population and determine whether it is a consequence of the disease or a marker of a shared underlying etiology.

Conclusion

The risk factors leading to the development of urolithiasis in our study were the high frequency of male gender and increasing age, along with modifiable risks such as low water intake and comorbid metabolic conditions, which underscores the critical need for targeted public health strategies focused on dietary and fluid intake education to mitigate the substantial burden of urolithiasis in the population.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRB)
Consent for publication
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Not applicable

Conflict of interest

The authors declared no conflicts of interest.

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Critical input, and final approval of draft.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Moe OW. Kidney stones: pathophysiology and medical management. *Lancet.* 2006;367(9507):333–44. https://doi.org/10.1016/S0140-6736(06)68071-9
2. Khan AS, Rai ME, Gandapur, Pervaiz A, Shah AH, Hussain AA, et al. Epidemiological risk factors and composition of urinary stones in Riyadh, Saudi Arabia. *J Ayub Med Coll Abbottabad.* 2004;16(3):56–8.
3. Trinchieri A. Epidemiology of urolithiasis: an update. *Clin Cases Miner Bone Metab.* 2008;5(2):101–6.
4. Prezioso D, Strazzullo P, Lotti T, Bianchi G, Borghi L, Caione P, et al. Dietary treatment of urinary risk factors for renal stone formation: a review of CLU Working Group. *Arch Ital Urol Androl.* 2015;87(2):105–20. https://doi.org/10.4081/aiua.2015.2.105
5. Aggarwal KP, Narula S, Kakkar M, Tandon C. Nephrolithiasis: molecular mechanism of renal stone formation and the critical role played

by modulators. *Biomed Res Int.* 2013;2013:292953. https://doi.org/10.1155/2013/292953
6. Cunningham P, Noble H, Al-Modhefer AK, Walsh I. Kidney stones: pathophysiology, Diagnosis and management. *Br J Nurs.* 2016;25(20):1112–6. https://doi.org/10.12968/bjon.2016.25.20.1112
7. Curhan GC. Epidemiology of stone disease. *Urol Clin North Am.* 2007;34(3):287–93. https://doi.org/10.1016/j.ucl.2007.04.003
8. Strope SA, Wolf JS Jr, Hollenbeck BK. Changes in the gender distribution of urinary stone disease. *Urology.* 2010;75(3):543–6. https://doi.org/10.1016/j.urology.2009.08.007
9. Trinchieri A, Croppi E, Montanari E. Obesity and urolithiasis: evidence of regional influences. *Urolithiasis.* 2017;45(3):271–8. https://doi.org/10.1007/s00240-016-0908-3
10. Daudon M, Traxer O, Conort P, Lacour B, Jungers P. Type 2 diabetes increases the risk for uric acid stones. *J Am Soc Nephrol.* 2006;17(7):2026–33. https://doi.org/10.1681/ASN.2006030262
11. Kannan S, Kumar BV, Sharmilla SS, Sreelekah B. Assess the risk factors of urolithiasis among patients attending OPD at Sri Ramachandra Hospital, South India, Chennai. *Int J Curr Res.* 2019;11(6):4429–32. https://doi.org/10.24941/ijcr.35303.06.2019
12. Wróbel G, Kuder T. The role of selected environmental factors and the type of work performed on the development of urolithiasis: a review paper. *Int J Occup Med Environ Health.* 2019;32(6):761–75. https://doi.org/10.13075/ijomeh.1896.01491
13. Bokhari A, Alghamdi AAM, Khushayl AMA, Alaklabi SNA, Albarrak SKA, Aldarwish HA. Prevalence and risk factors for renal stones among the Bisha population in Saudi Arabia. *Cureus.* 2023;15(6):e40090. https://doi.org/10.7759/cureus.40090
14. Paluchamy T, Rani ND, Bhuvaneswari G, Tamilselvi S. Risk factors of urolithiasis: a hospital-based retrospective study. *J Family Med Prim Care.* 2024;13(9):3902–5. https://doi.org/10.4103/jfmpc.jfmpc_353_24
15. Bokhari AA, Aldarwish HA, Alsanea SA, Al-Tufair MA, Alghasian SA, Alghasab AA, et al. Prevalence and risk factors of urolithiasis among the population of Hail, Saudi Arabia. *Cureus.* 2022;14(7):e26983. https://doi.org/10.7759/cureus.26983
16. Taylor EN, Stampfer MJ, Curhan GC. Obesity, weight gain, and the risk of kidney stones. *JAMA.* 2005;293(4):455–62. https://doi.org/10.1001/jama.293.4.455