Review Article

Prevalence of urolithiasis in Saudi Arabia: A systematic literature review

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Abstract

Urolithiasis is a common urological disease that can have a negative impact on health and quality of life in people worldwide. Multiple studies have investigated the prevalence of urolithiasis worldwide. However, research on this disease in Saudi Arabia is very limited. This review was conducted to investigate the prevalence of urolithiasis and its associations in Saudi Arabia. A standardized, systematic search strategy was conducted to identify observational studies that reported the prevalence of urolithiasis in Saudi Arabia. The search included published studies between January 2000 and October 2023. A variation in prevalence between regions was found and was reported to range from 6% to 19%. A significant association between urolithiasis and two factors, increasing age and family history, was found. Studies on urolithiasis are limited in Saudi Arabia. Despite this, it is evident that the prevalence of urolithiasis is comparable in other parts of the world. Public awareness and lifestyle modification efforts may help reduce this disease's impact on our population.

Keywords: Prevalence, Saudi Arabia, urolithiasis

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INTRODUCTION

Urinary tract stones, referred to as urolithiasis, are a common urological disease that can negatively impact health and quality of life in people worldwide. They can result in significant morbidity, such as urinary tract infection, flank pain, hydronephrosis, decreased renal function, and other complications.[1] Renal colic caused by a stone is the most common reason for a visit to the emergency department, and it is a common task for the emergency physician and a significant burden on health-care systems.[2] Urolithiasis is a recurring multifactorial disorder caused by a combination of environmental and genetic factors.[3,4] Risk factors include age, gender, ethnicity, local climate, food habits, physical activity, and occupation and having co-occurring medical conditions such as diabetes, hypertension, and obesity.[5,6] There are various components of renal stones; however, calcium-based stones, such as calcium oxalate or calcium phosphate stones, are the most common.[7] Over the last few decades, the prevalence has risen across all age groups, genders, and races.[3,8] It has been reported that the prevalence of urolithiasis varies between countries. According to a previous study by Romero *et al.*, the rate in Western countries ranged from 0.1% to 14.8%.[3] It is well understood that urolithiasis epidemiology at the national level is critical for assessing disease burden and developing appropriate policies. The primary objective of this review

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was to investigate the prevalence of urolithiasis and its associations in Saudi Arabia.

METHODS

A search was conducted to find all articles addressing the primary objectives.

Search strategy

PubMed and Google Scholar were electronically searched by the three authors to identify studies published from January 2000 to October 2023. The search terms included "Urolithiasis or Nephrolithiasis or Kidney Stones or Ureteral stones" and "prevalence or incidence or epidemiology," and "Saudi Arabia." The search phrases were combined in several ways to find relevant literature, and the search strategies were customized to suit each database. Reference lists of eligible articles were also retrieved to find relevant studies.

Inclusion criteria

The clinical population, intervention, comparison question was as follows:

(1) Studies involving patients with urolithiasis in Saudi Arabia
(2) Studies recording data on the prevalence by sex, age, region, and year
(3) The type of study: random or cluster sampling.

Exclusion criteria

Studies conducted in special groups (e.g. pregnant women) and published before the year 2000 were excluded.

Data extraction

Two reviewers independently assessed each study's titles and abstracts against the inclusion and exclusion criteria. Articles that did not fit the inclusion requirements were removed. Further analysis was performed in cases of doubt during any screening stage, and issues were addressed through consensus discussion. The prevalence was defined as the number of existing cases in a population during each study. Articles in the full text were assessed for eligibility. The remaining studies were included in the systematic review. One investigator extracted data, which included (1) first author, (2) study year, (3) study design, (4) average age, (5) sex, (6) region, and (7) most common type of stone.

RESULTS

The database search yielded 3244 papers; after removing duplicates, (3100) publications were reviewed by titles/abstracts, and 3085 were eliminated. After that, 15 of these papers were reviewed by full text, and 2 were excluded, yielding 11 included publications [Figure 1].

Characteristics of studies

A total of 11 papers were included in the review [Table 1]. Six of them were cross-sectional (n = 6) studies.[10-15] Five studies were conducted as a retrospective records review.[5,6,8,9,16]

Prevalence

The prevalence of urolithiasis for each study is shown in Table 1. The central region showed a prevalence ranging from 14.8% to 19.1%.[8,15] Western region showed a prevalence ranging from 6% in 2019 to 17.4% in 2021.[12,13] The northern and southern regions also showed a prevalence of 13.7%–16.1%, respectively.[10,11] The overall prevalence in a nationwide study conducted by Safdar *et al.* in 2021 concluded a prevalence of 9%.[14]

Sex discrepancies

Five studies revealed a male predominance in the sample.[5,6,9,10,16] On the contrary, three studies showed a female predominance.[13-15]

Most common type of stone

Four studies conducted between 2015 and 2022 revealed calcium oxalate as the most common stone.[5,6,9,15,16]

Association with age

Five studies considered age as a variable and further analyzed it with urolithiasis [Table 2].[9,10,12-14] The studies revealed a significant relationship between urolithiasis and increasing age ($P < 0.05$).

DISCUSSION

In various regions of Saudi Arabia, the prevalence of urolithiasis differs from one region to another. The central area has the highest prevalence level, with a range of between 14.8% and 19.1%, due to factors such as climate change and diet intake.[17] On the other hand, regions such as the Western part of Saudi Arabia have a low prevalence level of urolithiasis ranging between 6% and 11.2%, a trend that aligns with the international trend (9% global prevalence rate) that shows various regions have different prevalence levels of urolithiasis due to diet, environmental, and genetic predisposition factors.[18] For instance, the high prevalence rate (19.1%) identified in the central region is because the region experiences related weather and climatic conditions, while the population adopts related dietary trends, high temperatures, and how environments increase the population level of dehydration, raising the risk of developing stones.[19] Dietary trends such as high intake of red meat, animal proteins, and salt increase the risk of developing stones, which is common in the south of Saudi Arabia and has a prevalence of 16.1%.[20] Genetic

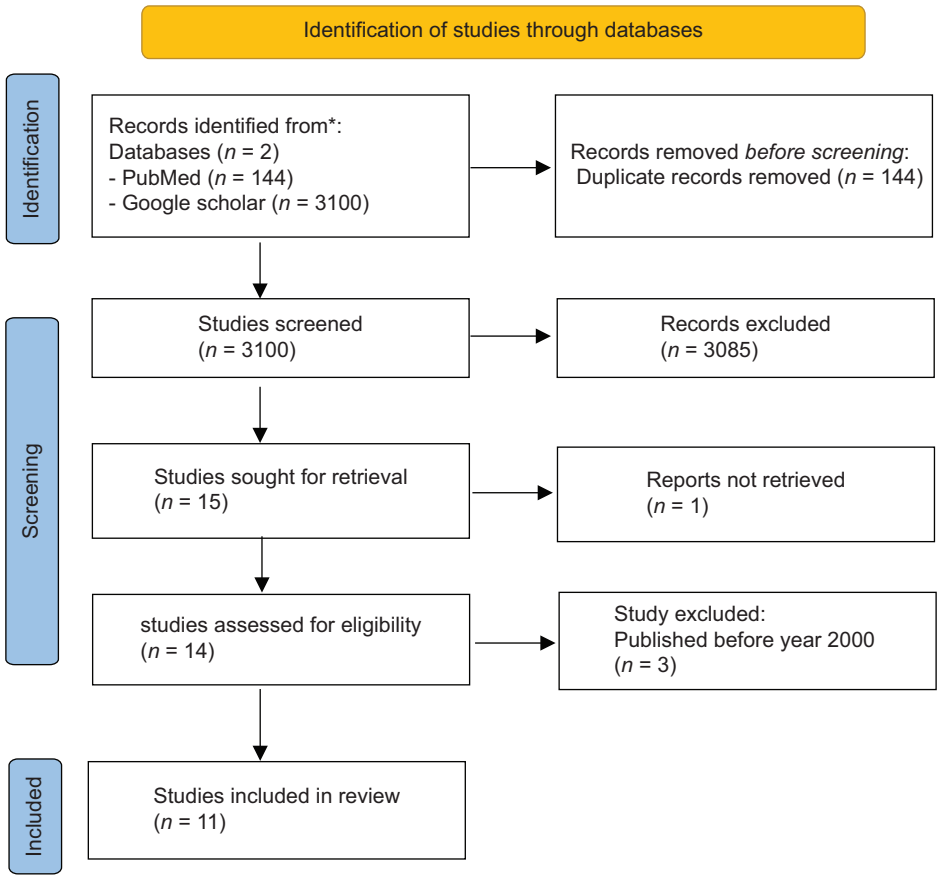

Figure 1: Search and screening flow chart

Table 1: Characteristics of studies included

Author	Year	Region (city)	Study design	Total participants	Sample size	Prevalence rate (%)	Males, *n* (%)	Females, *n* (%)	Mean age	Mean BMI
Alasker *et al*.[9]	2022	Eastern (Alahsa)	Retrospective	235	235	-	175 (74.5)	60 (25.5)	45.9±14.0	29.8±6.56
Bokhari *et al*.[10]	2022	North (Hail)	Cross-sectional	1150	158	13.70	101	57	Of 26.3±12.8	-
Bokhari *et al*.[11]	2023	South (Bisha)	Cross-sectional	1002	161	16.10	-	-	-	-
Nassir[12]	2019	Western (Makkah)	Cross-sectional	1506	93	6		-	-	-
Baatiah *et al*.[13]	2019	Western (Jeddah)	Cross-sectional	2173	246	11.20	105	139	-	-
Safdar *et al*.[14]	2021	All	Cross-sectional	580	64	9.10	31	33	36.91	-
Amir *et al*.[6]	2018	Eastern (Dhahran)	Retrospective	1747	1747	-	79	21	-	-
Ahmad *et al*.[8]	2015	Central (Riyadh)	Retrospective	5371	1029	19.10	-	-	-	-
Safdar *et al*.[15]	2021	Central and Western	Cross-sectional	1031	169	Jeddah (17.3) Riyadh (14.8)	69	100	-	26.75±5.67
Alkhunaizi[5]	2015	Eastern (Dhahran)	Retrospective	308,363	347	0.11	259	88	48.5	Female 32.01, male 29.87
Al-Nasser *et al*.[16]	2021	South (Najran)	Retrospective	433	433		316 (73)	117 (27)	-	-

BMI: Body mass index

factors such as having a family history of the condition increase the chances of developing urolithiasis, but the prevalence of such genetic differences differs according to the different regions in Saudi Arabia.[21] Since Saudi Arabia has an average prevalence of 9% of urolithiasis, which is within the current range of other developed regions such as the United States and Europe; it is evident that Saudi Arabia experiences similar issues and strains as other developed countries.[22]

Based on the results, Saudi Arabia does not have a specific sex discrepancy. For example, South Al Ahsa has 175 males and 60 females, while the number of males in Eastern Dhahran is 259 and 88 women, indicating that men are more prevalent in Saudi Arabia and have a higher risk of developing urolithiasis, which can be associated with factors such as dietary aspects like high intake of animal proteins and salt.[19,23] On the other hand, women are more prevalent in some regions, like Western (139), while males are (105),

Table 2: Associations in included studies

Author	Most common type of stone (%)	Association with age	Association with BMI	Association with family Hx
Alasker *et al*.[9]	Calcium oxalate (76)	0.004	0.386	-
Bokhari *et al*.[10]	-	OR=1.40; 95% CI=1.19–1.66	-	OR=1.99; 95% CI=1.39–2.85
Bokhari *et al*.[11]	-	-	-	0.049
Nassir[12]	-	r=0.87, P=0.01	r=0.68, P=0.03	-
Baatiah *et al*.[13]	-	P<0.001	P=0.3	P<0.0001
Safdar *et al*.[14]	-	P<0.0005		
Amir *et al*.[6]	Calcium oxalate	-	-	-
Ahmad *et al*.[8]	-	-	-	-
Safdar *et al*.[15]	-	-	0.109	-
Alkhunaizi[5]	Calcium oxalate		-	-
Al-Nasser *et al*.[16]	Calcium oxalate	-	-	-

OR: Odds ratio, CI: Confidence interval, BMI: Body mass index

indicating that women are more prevalent than men, which can be associated with factors such as hormonal imbalances, metabolic aspects, and dietary trends.[24] Nonetheless, this trend aligns with the global prevalence rates, where reports illustrate that when assessing the global rates of urolithiasis between males and females, there is a high discrepancy, and it cannot be concluded which gender is more likely to develop the condition.[23,25] Saudi Arabia's prevalence of urolithiasis by gender should be further researched to help in recommending the best mitigation measures.[12]

Calcium oxalate is the most prevalent type of stone in our review. This is in accordance to the global reports that rank calcium oxalate as the most common type of stone that occurs when urine has minimal levels of citrate and very high levels of calcium and uric acid or oxalate.[26] Thus, the most prevalent stone in Saudi Arabia, calcium oxalate, is similar to other developed countries such as the United States and Europe, which is associated with dietary trends of consuming foods rich in calcium and oxalate, low consumption of fluids, and some medical prescriptions that increase the risk.[16,23] Uric acid stones are found in 10% of all the urolithiasis cases involving renal stones, making them the most common type of stone after calcium oxalate due to risk factors such as crystallization and stone formation, which is <5.5 expected pH level.[27]

The study explores if there is any connection between the prevalence of urolithiasis and age in Saudi Arabia. A close connection was found between age and the risk of developing urolithiasis, where individuals above 40 years have a higher risk than younger people, as indicated in the global reports that maintain the high risk of urolithiasis among the elderly due to high levels of BMI.[16] Women have a higher body mass index, 32.01, compared to men, with 28.87, increasing the risk of older women above 48 years developing the condition compared to men. Older women have a higher risk of becoming obese, consuming foods high in salt and sugar, and developing diabetes, contributing to their high risk.[12,25] The risk of developing urolithiasis increases with age in Saudi Arabia because, as people get older, their lifestyle and body reactions change, which can alter the functionality of the kidney and increase the rate of urinary composition as age increases.[13] Further studies found that the high risk of urolithiasis can also be associated with an individual's psychological changes that interfere with renal functionality, changes in calcium metabolism, and low consumption of fluids, which increase the chances of stone formation.[28] Therefore, it is recommended that mitigation measures be customized to address the high risk of the elderly population in Saudi Arabia and globally.[25,29] Moreover, frequent medical checkups and screening for urolithiasis are recommended for early diagnosis and treatment to reduce the risk of more health complications.[29,30] These recommendations can be applied at the global level where the trend is similar; hence, the global urolithiasis interventions should be tailored to deal with risks associated with age to help manage the condition.[31]

CONCLUSION

Studies on urolithiasis are very limited in Saudi Arabia; a variation in prevalence between regions exists; however, the overall prevalence is comparable to the global prevalence. A significant association with increasing age and family history was observed. Public awareness events about the risk factors of stone formation are required. To assess the disease burden, nationwide research and the creation of a patient data registry are recommended.

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Conflicts of interest
There are no conflicts of interest.

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