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Evaluating the level of awareness about urolithiasis among the general population of Hail, Saudi Arabia

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ABSTRACT

Background: Urolithiasis is one of the most prevalent urinary tract disorders. It concerns stones that form in the urinary tract, usually in the kidneys or ureters. People with renal stone may experience dysuria, fever and flank pain. The risk factors of nephrolithiasis include hypertension, obesity and dehydration. *Methodology:* A cross sectional study conducted in 2022, over duration of four months. The study was undertaken to Evaluating the level of awareness about urolithiasis among the population of the Hail region in Saudi Arabia. The questionnaire contains 27 questions. All data was analyzed using SPSS 22. *Results:* The study included a total of 1,150 participants, who ranged from the age of 18 to 68 years the mean age is 26.3 ± 12.8 years old. 585 (50.9%) participants were males and 1,100 (95.7%) were Saudi. 683 (59.4%) were found to have a low level of awareness regarding urolithiasis, 448 (39%) were moderately knowledgeable, while only 19 (1.7%) had a high awareness level. Increased age was associated with 12% more likelihood of higher awareness. Female participants also had 36% more likelihood of higher awareness than males. HCWs had doubled the probability of a good awareness level than did the other participants. Moreover, participants with a history of urolithiasis had nearly doubled the probability of a good awareness level than did those without such a history. *Conclusion:* Study participants have shown low awareness of urolithiasis, especially among non-medical professionals. There was a significant association between age, gender, history of urolithiasis and participants' level of awareness.

Keywords*: Urolithiasis, Calculi, Nephrolithiasis, Awareness, Saudi Arabia

1. INTRODUCTION

Urolithiasis is one of the most common diseases of the urinary tract. It is caused by stones that form in the urinary tract and involves the formation of calcifications in the urinary system, usually in the kidneys or ureters, but which may also affect the bladder or urethra (Sowtali et al., 2021). These forms

when the urine becomes super saturated with a mineral and it contains crystalline and organic components the main component of most stones is Calcium oxalate Randall's plaques are calcium oxalate stones which form on a base of calcium phosphate (Khan et al., 2016). Renal papilla 1 sub epithelial calcification, which is less than 2 mm at their greatest dimension, is called Randall plaques. They have high affinity to calcium oxalate crystals and they are a predisposing factor for urolithiasis formation (Baba and Goel, 2013).

In the United States of America, the prevalence of urolithiasis is 8.8% (Scales et al., 2012). In Saudi Arabia, the prevalence in the western region, among the population between 18 to 65 years, was found to be 6.2% (Nassir et al., 2019). Patients suffering from urolithiasis usually present with dysuria, frequency, fever, chills, hematuria and flank pain (Frassetto and Kohlstadt, 2011). There are several risk factors of urolithiasis, which may increase the prevalence of the disease. One of these is metabolic syndrome, such as hypertension and obesity (Obligado and Goldfarb, 2008). Moreover, a lack of water intake and dehydration can cause urolithiasis (Alelign and Petros, 2018). Besides inadequate water intake, there are other factors that increase the risk of urolithiasis, such as hot climate (Safdar et al., 2021), excessive intake of animal protein and salt deficiency of chelating agents (Knoll et al., 2010) along with a family history of renal calculi (Giannossi and Summa, 2012).

Most cases of urolithiasis are resolved spontaneously by passing through the urine. These can therefore be managed with conservative treatment approaches. However, some cases may need minimal surgical intervention like endourological techniques and shock wave lithotripsy (SWL). Recurrence of urolithiasis after surgical intervention also remains a major problem for some patients (Almuhanna et al., 2018). Meanwhile, the burden of urolithiasis for health care facilities includes the cost of treatment and investigation. A significant economic burden is in fact associated with urolithiasis, with annual estimates exceeding $5 billion (Pearle et al., 2005).

Overall, urolithiasis is a common and painful condition, which can be prevented in many patients by avoiding the risk factors that contribute to it. There is however limited data and literature concerning the level of awareness regarding urolithiasis, particularly in a Saudi Arabian setting. Therefore, this study aims to evaluating the awareness levels regarding urolithiasis among the general population in Hail, Saudi Arabia, as well as risk factors associated with it.

2. MATERIALS AND METHODS

Research design and setting
This is a community based cross sectional study. It was accepted by the Research Ethics Committee at the University of Hail, Saudi Arabia. The study was conducted to evaluating the level of awareness about urolithiasis among participants between February and May 2022, using an electronic questionnaire which was written in Arabic and distributed through multiple social media applications. Information was kept confidential in accordance with Google's privacy policy. The study was performed in accordance with the principle outlined in the Declaration of the Helsinki regarding studies involving human participants.

Sample size
The sample size was calculated by The World Health Organization's (WHO) prevalence rate calculation, via a ss = $(Z2 \times p \times q)/d2$ formula, where ss = sample size, Z = 1.96, p = 0.5, q = (1-p) = 0.5, and d = 3% sampling error. According to this equation, the optimal sample size for performing this study was 1,066, which achieves ± 3% accuracy with a 95% confidence interval (CI). However, 1,150 participants included. Inclusion criteria included participants not less than 18 years old, who live in Hail region and were willing to participate in this study. Respondents under the age of 18 and/or living outside the Hail area were excluded, as were incomplete submissions.

Development and application of the questionnaire
The questionnaire was designed by the research team to assess the community's awareness of urolithiasis. The questionnaire had a total of twenty-seven questions, which were sub divided into three categories. The first category collected demographic data on participants, through seven questions. The second category was related to past medical history and had four questions. The last category had sixteen questions, which assessed the level of awareness about urolithiasis (Table 1). Participant consent was secured before undertaking the questionnaire.

Statistical analysis
After data was extracted, it was revised, coded and fed into statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). Two tailed tests were performed in all statistical analysis. P values below 0.05 were statistically significant. For knowledge and

awareness items, each correct answer scored one point. The different items' total summation of the discrete scores of awareness was calculated. Participants with a score of 24 or above were considered to have a high level of awareness. Scores between 13 and 23 were considered an intermediate level of awareness, while scores of 12 or less signified a low level of awareness.

Descriptive analyzes based on frequency and percentage distributions were performed for all variables including participant personal information, level of education and medical history. Participants' awareness levels regarding urolithiasis were also graphed. Cross tabulation was used to assess the distribution of participants' awareness of urolithiasis relative to their personal information and medical history. Relations were tested using an exact probability test and Pearson chi square test for small frequency distributions. We used adjusted binary logistic regression that included all factors associated with urolithiasis awareness.

A forced input model was used. The model tested all independent variables in the block to assess association while controlling for the influence of other variables in the model. Multicollinearity was checked by performing collinearity with multiple linear logistic regressions. This was measured with and a variance inflation factor (VIF) > 10 and < 0.10 tolerances. The level of statistical significance was set at $p < 0.05$ adjusted powers of odds ratios (OR) or the adjusted exponentiation of the B coefficient Exp (B) value and 95% confidence intervals (CI) were displayed for each variable included.

3. RESULTS

A total of 1,150 participants completed the survey questionnaire. Participants' ages ranged from 18 to 68, 26.3±12.8 was the mean age. 565 (49.1%) were female and 50 (4.3%) were non-Saudi. 302 (26.3%) had a secondary education degree and 833 (72.4%) had a college or higher education degree. only 268 (23.3%) study participants were health care workers (HCW). Of the participants, 379 (33%) were overweight and 307 (26.7%) were obese while, 464 (40.3%) were of normal weight. (Table 2, Table 3) shows the medical history of the study participants. 183 (15.9%) of study participants were smokers, 121 (10.5%) had hypertension, 124 (10.8%) had diabetes, 28 (2.4%) had gout and 29 (2.5%) complained with hypothyroidism. A total of 507 (44.1%) had a family history of renal stones and 158 (13.7%) had a history of urolithiasis

Figure 1 shows the overall public awareness level regarding urolithiasis. 683 (59.4%) participants had a low level of awareness regarding urolithiasis, 448 (39%) were moderately knowledgeable regarding the disease while only 19 (1.7%) had a high awareness level. The awareness score ranged from 2-29 out of 33, with mean score of 13.0 ± 3.9 points. Table 4 shows the distribution of public awareness levels regarding urolithiasis by reference to the bio demographic data provided by participants. Poor awareness was significantly higher among male participants than females (62.2% vs. 56.5%, respectively; P = 0.049). 43.7% of HCWs had a poor awareness level versus 64.2% of the other participants, with a recorded statistical significance (P = 0.001). Moreover, 64.2% of obese persons had a poor awareness level compared with 53.9% of those who had a normal body weight (P = 0.034) .

Table 5 shows the distribution of public awareness levels regarding urolithiasis by reference to participants' medical history. Low awareness levels regarding urolithiasis were significantly higher among participants who were not diagnosed with urolithiasis previously than those who were (61.1% and 48.7, respectively; P = 0.001). Other medical history related data were insignificantly associated with participants' awareness level. Table 6 provides multiple logistic regressions for predictors of public awareness levels regarding urolithiasis. Among all included factors, the following showed significant relation with awareness levels. First, increased age was associated with 12% more likelihood of higher awareness levels (OR = 1.12; 95% CI: 1.01-1.39) when keeping all other factors constant. Female participants also had 36% more likelihood of higher awareness than males (OR = 1.36; 95% CI: 1.03-1.78). HCWs showed double the probability of a good awareness level relative to the other participants (OR = 2.33; 95% CI: 1.72-3.14). Additionally, participants with a history of urolithiasis had nearly doubled the probability of good awareness than those who did not (OR = 1.91; 95% CI: 1.33-2.73).

Table 1 Questionnaire used to evaluate the level of awareness about renal stones and its weighted score

Questions	Weighted score
What do you think are the risk factors for kidney stones?	8
In your opinion, which of the dietary ingredients may contribute in the development of renal stone?	7
In your opinion, which of the	3

following are considered symptoms of renal stone diseases	
What should I do if your urine is dark?	3
Which of the following stone sizes will cause the most pain?	1
What do you think is the minimum amount of fluid to be taken each day for reducing renal stones formation rate?	1
What do you think about protein intake in patients who suffer from renal stones disease?	1
Please use the scale below to describe the pain that renal stone patient can experience	1
Do you think holding urine (for several time) will cause renal stone disease?	1
Do you think weather influences renal stones?	1
Do you think your diet influences stone formation?	1
Do you think there is other treatment for renal stones rather than surgery?	1
Do you think restricting calcium intake is beneficial in preventing renal stones disease?	1
Do you think increase potassium intake (banana, dates, and prunes) can prevent renal stones formation?	1
Do you think high consumption of sodium will increase the risk of renal stones formation?	1
Do you think citrus fruits or juices (orange, lemon, grapefruit, and berries) protect against renal stones?	1

Table 2 Bio-demographic data of study participants, Hail, Saudi Arabia

Bio demographicdata	No	%
Age		
18-25	487	42.3%
26-35	212	18.4%
36-50	317	27.6%
51-60	106	9.2%

> 60	28	2.4%
Gender		
Male	585	50.9%
Female	565	49.1%
Nationality		
Saudi	1100	95.7%
Non-Saudi	50	4.3%
Education		
Primary / below	15	1.3%
Middle / secondary	302	26.3%
University / above	833	72.4%
Job title		
HCW	268	23.3%
Others	882	76.7%
BMI		
Normal	464	40.3%
Overweight	379	33.0%
Obese	307	26.7%

Table 3 Medical history of study participants, Hail, Saudi Arabia

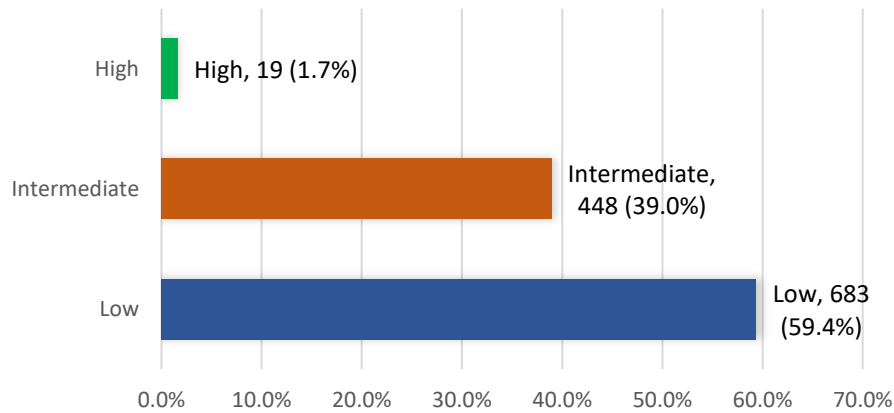| Medical history	No	%
Smoker		
Yes	183	15.9%
No	967	84.1%
Chronic diseases		
None	829	72.1%
DM	124	10.8%
HTN	121	10.5%
Hyperthyroidism	28	2.4%
Intestinal disease	33	2.9%
Chronic kidney disease	8	0.7%
Gout	28	2.4%
Hypothyroidism	29	2.5%
Others	42	3.7%
Had renal stones		
Yes	158	13.7%
No	992	86.3%
Family history of renal stones		
Yes	507	44.1%
No	643	55.9%

Figure 1 Overall public awareness level regarding renal stones, Hail, Saudi Arabia

Table 4 Distribution of public awareness level regarding renal stones by their bio-demographic data, Hail, Saudi Arabia

Bio demographic data	Awareness level						P Value
	Low		Intermediate		High		
	No	%	No	%	No	%	
Age							
18-25	270	55.4%	208	42.7%	9	1.8%	
26-35	127	59.9%	80	37.7%	5	2.4%	
36-50	195	61.5%	118	37.2%	4	1.3%	0.217$
51-60	72	67.9%	34	32.1%	0	0.0%	
> 60	19	67.9%	8	28.6%	1	3.6%	
Gender							
Male	364	62.2%	213	36.4%	8	1.4%	0.049*
Female	319	56.5%	235	41.6%	11	1.9%	
Nationality							
Saudi	657	59.7%	425	38.6%	18	1.6%	0.553$
Non-Saudi	26	52.0%	23	46.0%	1	2.0%	
Education							
Primary / below	7	46.7%	8	53.3%	0	0.0%	
Middle / secondary	191	63.2%	106	35.1%	5	1.7%	0.429$
University / above	485	58.2%	334	40.1%	14	1.7%	
Job title							
HCW	117	43.7%	141	52.6%	10	3.7%	0.001*
Others	566	64.2%	307	34.8%	9	1.0%	
BMI							
Normal	250	53.9%	204	44.0%	10	2.2%	
Overweight	236	62.3%	138	36.4%	5	1.3%	0.034*
Obese	197	64.2%	106	34.5%	4	1.3%	

P: Pearson X^2 test $: Exact probability test* $P < 0.05$ (significant)

Table 5 Distribution of public awareness level regarding renal stones by their medical history, Hail, Saudi Arabia

Medical history	Awareness level						p-value
	Low		Intermediate		High		
	No	%	No	%	No	%	
Smoker							0.810
Yes	109	59.6%	72	39.3%	2	1.1%	
No	574	59.4%	376	38.9%	17	1.8%	
Chronic diseases							0.622
Yes	495	60.2%	313	38.1%	14	1.7%	
No	188	57.3%	135	41.2%	5	1.5%	
Had renal stones							0.001*
Yes	77	48.7%	73	46.2%	8	5.1%	
No	606	61.1%	375	37.8%	11	1.1%	
Family history of renal stones							0.661
Yes	296	58.4%	201	39.6%	10	2.0%	
No	387	60.2%	247	38.4%	9	1.4%	

P: Pearson X^2 test $: Exact probability test $P < 0.05$ (significant)*

Table 6 Multiple logistic regressions for predictors of public awareness level regarding renal stones, Hail, Saudi Arabia

Factors	P value	OR $_a$	95% CI	
			Lower	Upper
Age	0.048*	1.12	1.01	1.39
Female	0.021*	1.36	1.03	1.78
HCWs	0.001*	2.33	1.72	3.14
Smoker	0.469	1.14	0.80	1.64
Had chronic disease	0.078	0.77	0.58	1.03
History of renal stones	0.001*	1.91	1.33	2.73
FH of renal stones	0.908	1.01	0.79	1.30

OR $_a$: Adjusted Odds Ratio CI: Confidence interval $P < 0.05$ (significant)*

4. DISCUSSION

Urolithiasis is a multi factorial problem that can be affected by age, gender, diet, weather and body mass index (Lieske et al., 2014; Sharma and Filler, 2010; Bokhari et al., 2022). This study assessed the level of awareness about urolithiasis among the Hail population in Saudi Arabia. The study shows that, out of 1,150 participants, 19 (1.7%) had a high level of awareness, with a mean score of 39.4% ± 11.8% (13.0 ± 3.9 points). This is slightly higher compared to a study conducted in Jeddah, which shows a mean awareness score of 37.7% ± 10.9% (Baatiah et al., 2020). Furthermore, Aldaher et al., (2021) found a high level of awareness, with a mean score of 56.4%.

Data analysis identified several factors that showed significant association to awareness levels. These were: Age, gender, health care professionals and history of urolithiasis. On the other hand, the level of education and family history of renal stones were found to have no relationship with the level of awareness. The present study thus showed that the older the age, the higher level of awareness. Our results accord with another study conducted by (Almosaieed et al., 2020). Moreover, the level of awareness about urolithiasis was studied in Abha with it found that females had higher levels of awareness than males (Alghamdi et al., 2018). These results are also like our study, which found females to have a 36% higher level of awareness. Other studies have also found this (Baatiah et al., 2020; Sowtali et al., 2021). However, in contrast to the assumption that females have a higher level of awareness, Al Otipi et al., (2020) found that males displayed greater knowledge than females.

A complete understanding of the role of human error factors in healthcare to improve patient safety is paramount (Green et al., 2017). This study found that HCWs have double the probability of better awareness levels than did the other participants. Other previous studies also support our findings (Binsaleh et al., 2015; Bos et al., 2014; Akter Halim et al., 2019). Not surprisingly, those participants who had a previous history of urolithiasis show a nearly 50% higher level of awareness than those without. This finding was also observed by (Almuhanna et al., 2018). In the analysis, we noticed that there is no relationship between the level of education and knowledge about urolithiasis. This is in accordance with (Scales et al., 2016). Interestingly, our study suggested that there is no association between a family history of urolithiasis and level of awareness. On the other hand, another study supports such an association (AlOtipi et al., 2020).

It is worth investigating in detail how the community is embracing actions to prevent urolithiasis. However, the low level of awareness demonstrated in this study raises the need for public health interventions aimed at disseminating awareness and knowledge of this disease and how to prevent it. The limitations of this study are that it is a cross sectional study and that the survey was distributed online, which could result in sampling bias. Moreover, we did not explore the role of occupation in the population. The sample size does not therefore reflect the actual population of the area.

5. CONCLUSION
The participants of the study show a low level of awareness about urolithiasis, especially among non-health care workers. There was a significant relationship found between age, gender, history of urolithiasis and level of awareness. Awareness campaigns should be organized to improve community knowledge about urolithiasis. Moreover, further studies should be conducted to assess the relationship between the level of awareness about urolithiasis risk factors and its prevalence among the Hail community.

Author Contributions
Conceptualization: AB and HA. Methodology: BA, SA, AA, SA. Formal Analysis: AB, HA. Investigation: AB, HA, BA, SA, AA, SA. All authors reviewed the manuscript draft writing.

Ethical approval
Ethical approval was granted by the Research Ethics Committee of University of Hail, Saudi Arabia (NO: H-2022-164).

Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

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