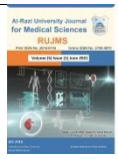
Original Research Al-Razi Univ J Med Sci 2023; 7 (2):16-26

RUJMS

Al-Razi University Journal of

Medical Sciences



Risk Factors of Urinary Tract Stones Formation: A Case – Control Study in Ibn Sina Hospital Sana'a city, Yemen

Maged Ali Yahya AL-Ghashmi[1*]; Fawz Mohammed Abol–Gaith[1]

[1]Department of Department of Community Health and Nutrition, Faculty of Medicine and Health Sciences, Al-Razi University, Yemen.

Abstract:

Background: Renal stone is a distressing chronic condition that is becoming common across the world. However, apparently, the main risk factors responsible for the occurrence of renal stones in Yemen have not been investigated yet. **Objective**: To find out the main risk factors responsible for the occurrence of renal stones in Ibn Sina hospital patients in Sana'a City Yemen. **Method**: A case-control study was conducted among 181 (63 cases and 126 controls) individuals attending the outpatient departments of Ibn Sina Hospital in Sana'a City Yemen during the period of December 2020 and August 2021. **Results**: The age mean of cases was 41.98 ±10.5 years, while the age mean of controls was 36.4±10 years. The current study found associations of occurrence of renal stone with genetic predisposition (odd ratio (OR): 11.9, 95% confidence interval (CI); 5.66-25.17), walking < 1 hr/day (OR: 5.8, 95% CI; 1.87-18.47), water consumption < one bottle/day and one bottle/ day (OR: 7.7 and 4, 95% CI; 1.72-34.44 and 1.02-15.76 respectively), drinking mineral water (OR: 0.2, 95% CI; 0.066-0.59), daily dairy consumption (OR: 15.5, 95% CI; 4.122-58.7), weekly cattle meat consumption (OR: 2.7, 95% CI; 1.34-5.38), both daily and weekly consumption of fresh fruits (OR: 0.02 and 0.004, 95% CI; 0.001-0.37 and 0.000-.095 respectively), and both weekly consumption of other vegetables and legumes (OR: 0.3 and 0.2, 95% CI; 0.100-0.95 and 0.074-0.57 respectively). **Conclusions**: The current study recommended that greater attention to renal stone classification, approaches to assessing the risk of recurrence and individualized prevention strategies may improve the clinical care of stone formers. Lifestyle changes help to reduce renal stone disease formation.

Keywords: Urinary Tract Stones Formation, Risk Factors, A Case – Control Study, Yemen

Article Info:

Received: 9 August 2023; **Revised:** 25 August 2023; **Accepted:** 27 August 2023; **Available online:** 29 August 2023

Cite this article:-

AL-Ghashmi MAY and Abol-Gaith FM. Risk Factors of Urinary Tract Stones Formation: A Case – Control Study in Ibn Sina Hospital Sana'a city, Yemen. Al-Razi Univ J Med Sci. 2023; 7(2):16-26.

DOI 10.51610/rujms7.2.2023.174

Address for Correspondence:

Dr.Maged Ali Yahya AL-Ghashmi: 1Department of Department of Community Health and Nutrition, Faculty of Medicine and Health Sciences, Al-Razi University, Yemen., **Tel**- +967-774327936; ***E-mail***: majidghashmi2003@gmail.com.

Introduction

Renal stone disease is a common disease that affects a large number of people and it has been classified as one of the illnesses that can cause much pain to human beings. In addition, renal stone disease can be one of the major causes of chronic kidney disease and chronic kidney failure[1]**.** The etiology of this disorder is multifactorial and is related to genetics, diet, and low activity[2]**.** Furthermore, renal stones rank third among the diseases of the urinary tract and are one of the most important urological diseases for which many studies have been done to prevent and treat[3], and they are an important health problem that has a significant role in performing extensive surgical operations and kidney failure and can also be prevented by changing behavioral habits, such as diet habits[4,5]**.** On the other hand, it was reported, however, that the prevalence of renal stone disease varies in different countries across the world. A previous study by *Romero et al*[6] reported that the rate in Western countries ranged from 0.1% to 14.8%. However, in Asia, Taiwan was likely to have 9.6% of the population at risk of developing upper renal stone[7]. Moreover, according to previous studies, the incidence of renal stone disease has been reported to be increasing globally[6], even having appeared to nearly double in the last 15 years (1988–1994: 6.3%; 2007–2010: 10.3%) among men in the US[8]. The increased prevalence of the disease is due to lifestyle changes such as lower dietary intake of vegetables or fruit, higher consumption of animal proteins, salt, sweetened beverages, and inadequate fluid intake[9]**.** Calcium stones are the most common type of renal stones and can be associated with hyperoxaluria or hyperuricosuria[10]**.**

Renal stone disease is a common and a major cause of morbidity worldwide including Yemen[11]. Also, it is an increasingly prevalent condition with remarkable clinical heterogeneity, with regards to stone composition, age of manifestation, rate of recurrence, and impairment of kidney function. Calcium-based renal stones account for the vast majority of cases, but their etiology is poorly understood, notably their genetic drivers. As recent studies indicate, hereditary conditions are most likely underestimated in prevalence, and socio-demographic, life style, and dietary habits are constantly being identified. As a consequence, there is an urgent need of a more efficient to increase understanding of risk factors of renal stone disease in Sana'a, Yemen. Furthermore, current study was aimed to help closing the vast knowledge gap on renal stone disease, especially because the lack of research done in this field in Yemen. In this context, there is an urgent need to study risk factors of renal stone formation for several reasons: first, delineating better renal stone sociodemographic associations will allow more precise patient stratification in future clinical research studies. Second, identifying life style, and dietary habits will further improve understanding of recurrence prevention in severely affected people, and third, in order to stimulate further researches in the future. With a lifetime prevalence of up to 10%, renal stone disease is therefore a major health burden. Renal stone disease is associated with significant morbidity and progression to chronic kidney disease due to recurrence, repetitive surgical/ endoscopic intervention, and concomitant inflammation. Hence from all of the above, the current study was planned to determine the risk factors of urinary tract stones formation in Sana'a City, Yemen and understanding of prevalence risk factors of renal stones, and to correlate the renal stone with demographic data.

Research Methodology

Study Design

The current study was a hospital-based unmatched case-control study and was conducted on those who are attending the outpatient department (OPD) of Ibn Sina hospital in Sana'a city Yemen, during the period of December 2020 and August 2021. Therefore, the unmatched case-control study allowed current study on multiple risk factors.

Study Population and Sampling size determination

The study population was all people who were visiting the outpatient department of Ibn Sina

hospital for recruiting medical services during study period.

The sample size for the current study has been calculated, considering odds ratio = 2.47 for renal stone as obtained from *Dongre et al.,*[12] study; with power at 80%, 95% confidence interval and case-control ratio 1:2. Two controls per case were selected for better power and statistical confidence in interpretations. The percentage of exposure among control was assumed to be 50%. The number of cases required for the current study was 63 and the number of controls was 126. The sample size was calculated using Epi Info Program, version 7.2.3.1 (StatCalc for sample size and power for unmatched case-control study) software package. During a period of December 2020-August 2021, the sample was selected from Ibn Sina hospital OPD patients using convenience sampling method till the required sample size was arrived.

Selection of cases and controls

Patients of both genders in the age group of 20-70 years, who were recently diagnosed (last three months) with renal stone. Cases were recruited from the Urology OPD of Ibn Sina hospital in Sana'a city Yemen. The cases were selected during the morning and afternoon OPD shifts. Initial 63 consecutive cases coming to Urology OPD during the period of December 2020 and August 2021 were selected. All cases were uniformly selected by following current study criteria till the desired number of 63 was achieved.

To be enrolled in the study, controls had never been diagnosed with urinary tract stone at any time in the past. These patients should not have a specific diet. Furthermore, controls were selected from the same study base that gave rise to the cases. For each case, two hospital-based controls were selected. First two patients waiting in waiting room of OPDs who met current study's definition for control were invited to participate. The controls were also selected during the morning and afternoon OPD hours, till the desired number of 126 was achieved. All the controls who gave consent to join the study were interviewed by qualified nurses.

Data collection technique and tools

This case-control study has been carried out on patients admitted to the Ibn Sina hospital with urinary tract stones. According to diagnostic criteria, all cases were confirmed as urinary tract stone patients by means of ultrasound and radiographic evaluation. Totally, 63 cases and 126 controls aged 20-70 years were included in the study. Patients with urinary tract stones have been picked as the cases group and 126 patients without urinary tract stones referred to the OPDs have been selected randomly as controls.

First, to ensure that healthy controls had no urinary tract stones, ultrasonography of their UTS was performed. After obtaining informed consent, trained nurses collected the data by using a predefined and structured questionnaire. This questionnaire was adopted from similar four studies in other countries. In the following, the sociodemographic questionnaire was completed by asking the participants (both cases and controls). Sociodemographic questionnaire included age (in years), gender (male and female), occupation, region of residence, marital status (married and unmarried), and educational level (illiterate, basic, secondary, university and postgraduate).

Second, the exposure information on cases and controls was collected by interview. Investigator was instructed to ensure to the same degree of accuracy in measurement of exposure in cases and controls. The structured questionnaire also covered information on their physical activity, family history of urinary tract stone, and dietary habits. Considering local culture, researcher himself worked out the list of food item under various food groups such as vegetables, milk, and milk products, meat products, poultry products, and fruits routinely consumed. Each respondent was asked the frequency of consumption of each of these items under the enlisted food groups on the scale of daily, weekly, monthly and never. In addition, information on tobacco smoking, and khat chewing were obtained. Respondents were asked about the source of drinking water and frequency of drinking water. The scheme employed to

categories the frequency of drinking water was as follows: <1 bottle, 1 bottle, 2 bottles, 3 bottles and ≥ 4 bottles (one bottle of water contains 750 milliliter)

Statistical analysis

The questionnaires were pre-coded before being administered and the same codes were used in data entry. Open-ended questions were post coded and the master coding sheets securely stored. Pearson's Chi-square and fisher exact test were used to assess the differences between case and control groups. Kolmogorov–Smirnov test confirmed that all continuous variables were normally distributed. Therefore, quantitative data were presented as means ± standard deviation. The descriptive statistics on background characteristics of cases and controls were presented as percentages. The association between a dependent variable and each independent variable was measured as Odds Ratio (OR) with 95% Confidence Intervals (CI).

Ethical consideration

The study protocol was approved by the Ethics Committee at AL-Razi University. After the purpose and benefits of the current study were explained to the participants, written informed consent was obtained from each participant with a commitment to confidentiality, anonymous, coded, and right to withdraw at any point of the research process. Moreover, this study was conducted in accordance with the Declaration of Helsinki.

Results

Heredity factors and Risk of urinary tract Stone Formation

As shown in table 1, positive family history was significantly higher in the case group (p-value= 0.000). However, there was no significant association in relative degree between the case group and the control group (p-value= 0.474).

Socio-Demographic characteristics and Risk of urinary tract Stone Formation

General characteristics of study participants are presented in table 2 on the next page. Mean age of cases was 41.98 ±10.5 years, while mean age of controls was 36.4± 10 years. The cases and controls were similar with respect to gender, marital status, occupation, and governorate. Significantly there were associations between the two groups in relation to age group, educational level and weather (P-value < 0.05).

Table 1: Family history among study participants by cases and controls.

Variables		Cases (N = 63) Frequency, F Percentage (%)	Controls (N = 118) Frequency, F Percentage (%)	P-value
FH	Yes	40 (63.5)	15 (12.7)	**0.000***
	No	9 (14.3)	81 (68.6)	
	I don't Know	14 (22.2)	22 (18.6)	
Relative degree	Father	20 (50)	6 (40)	0.474
	Mother	7 (17.7)	4 (26.7)	
	Bro/Sis	11 (27.5)	4 (26.7)	
	Son/Daughter	1 (2.5)	0 (0)	
	Grand Fa/Moth	1 (2.5)	1 (2.5)	

* indicates significant result.

Table 2: Socio-Demographic characteristics of the participants by cases and controls.

Characteristics		Cases (N = 63) F (%)	Controls (N = 118) F (%)	P-value
Age (years)	≤ 29	11 (17.5)	38 (32.2)	**0.012***
	30-39	18 (28.6)	39 (33.1)	
	41-50	18 (28.6)	30 (25.4)	
	> 50	16 (25.4)	11 (9.3)	
	Cases' mean age = 41.98 ±10.5 years Controls' mean age = 36.4± 10 years			
Gender	Female	18 (28.6)	31 (26.3)	0.740
	Male	45 (71.4)	87 (73.7)	
Marital Status	Married	53 (84.1)	87 (73.7)	0.111
	Unmarried	10 (15.9)	31 (26.3)	
Educational Level	Illiterate	5 (7.9)	2 (1.7)	**0.000***
	Basic	14 (22.2)	5 (4.2)	
	Secondary	17 (27)	36 (30.5)	
	University	25 (39.7)	73 (61.9)	
	Postgraduate	2 (3.2)	2 (1.7)	

Occupation	Housework	8 (12.7)	14 (11.9)	0.191
	Agricultural work	4 (6.3)	2 (1.7)	
	Laborer	3 (4.8)	16 (13.6)	
	Employee	33 (52.4)	61 (51.7)	
	Not working	15 (23.8)	25 (21.2)	
Governorate	Sana'a	11 (17.5)	35 (29.7)	0.075
	Thamar	9 (14.3)	9 (7.6)	
	Ibb	8 (12.7)	11 (9.3)	
	Amraan	7 (11.1)	7 (5.9)	
	Taiz	9 (14.5)	14 (11.9)	
	Hajja	7 (11.1)	6 (5.1)	
	Al Dhale	1 (1.6)	5 (4.2)	
	Saadah	5 (7.9)	3 (2.5)	
	Aden	0 (0)	4 (3.4)	
	Al-Baydha	2 (3.2)	4 (3.4)	
	Hodeidah	1 (1.6)	12 (10.2)	
	Raymah	1 (1.6)	3 (2.5)	
	Ma'areb	1 (1.6)	3 (2.5)	
	Al-Jaoof	1 (1.6)	2 (1.7)	
Weather	Mostly Hot	21 (17.8)	5 (7.9)	**0.000***
	Mostly Fair	80 (67.8)	27 (42.9)	
	Mostly Cold	17 (14.4)	31 (49.2)	

* indicates significant result.

Recurrent urinary tract stone formers

As shown in figure 1, recurrent urinary tract stone formers were found in 30 (47.6%).

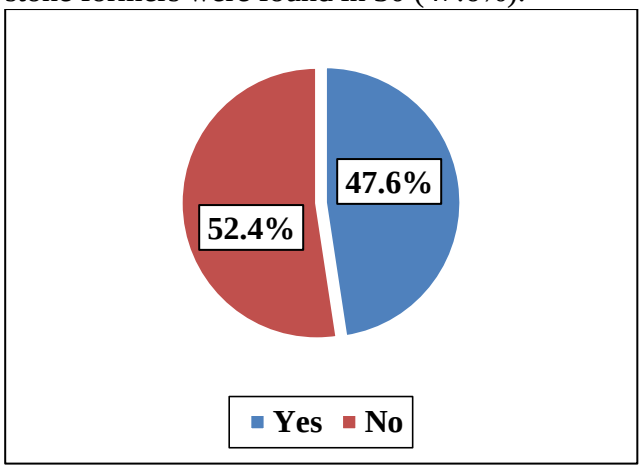


Figure 1: Recurrent urinary tract stone formers

Personal Habits and Risk of urinary tract Stone Formation

There were no statistically significant associations between the two groups in both smoking and chewing Khat (p-values = 0.765 and 0.559 respectively), but patient group had significantly higher hours/day of physical activities, whether towards walking hours per day (p-value = 0.000), or regular exercises (p-value = 0.036). Table 3.

Table 3: Personal habits among study participants by cases and controls.

Personal habits		**Cases (N = 63)**	**Controls (N = 118)**	**P-value**
		F (%)	**F (%)**	
Smoking	Yes	26 (41.3)	46 (39)	0.765
	No	37 (58.7)	72 (61)	
Chewing khat	Yes	45 (71.4)	89 (75.4)	0.559
	No	18 (28.6)	29 (24.6)	
Physical Activities	**1. Walking per day**			
	< 1 hour/day	43 (68.3)	42 (35.6)	**0.000***
	1-2 hours/ day	16 (25.4)	53 (44.9)	
	> 2 hours/day	4 (6.3)	23 (19.5)	
	2. Regular exercises			
	Yes	3 (4.8)	18 (15.3)	**0.036***
	No	60 (95.2)	100 (84.7)	

* indicates significant result.

Water intake and Risk of urinary tract Stone Formation

As shown in table 4, there were statistically significant associations between the two groups in intakes of water. Patient group showed significantly lower in water quantity (p-value= 0.000). There were significant associations between the two groups in water source (p-value = 0.009).

Co-morbidities and Risk of urinary tract Stone Formation

In respect to relationship between co-morbidities and urinary tract stone formation, there were statistically significant associations between two groups in both hypertension and parathyroid disorders. Table 5.

Table 4: Water intake among study participants by cases and controls.

Water intake	Cases (N = 63) F (%)	Controls (N = 118) F (%)	P-value
Water Quantity			
≤ one bottle/day	16 (25.4)	9 (7.6)	**0.000***
one bottle/ day	25 (39.7)	27 (22.9)	
2 bottles	14 (22.2)	39 (33.1)	
3 bottles	5 (7.9)	30 (25.4)	
≥ 4 bottles	3 (4.8)	13 (11)	
Water source			
Home water network	4 (6.3)	8 (6.8)	**0.009***
Rain water	1 (1.6)	0 (0)	
Treated water (caustic water, household dropper)	38 (60.3)	58 (49.2)	
Mineral water	7 (11.1)	38 (32.2)	
Both treated and mineral	13 (20.6)	14 (11.9)	

* indicates significant result.

Table 5: Comorbidities among study participants by cases and controls.

Characteristics	Cases (N = 63) F (%)	Controls (N = 118) F (%)	P-value
Diabetes mellitus			
Yes	10 (15.9)	17 (14.4)	0.792
No	53 (84.1)	101 (85.6)	
Hypertension			
Yes	27 (42.9)	30 (25.4)	**0.016***
No	36 (57.1)	88 (74.6)	
Chronic Kidney diseases			
Yes	2 (3.2)	1 (0.8)	0.258
No	61 (96.8)	117 (99.2)	
Parathyroid disorders			
Yes	8 (12.7)	4 (3.4)	**0.02***
No	55 (87.3)	114 (96.6)	

* indicates significant result.

Dietary Factors and Risk of urinary tract Stone Formation

Regarding dietary items, there was a statistically significant association between two groups in terms of dairy, cheese and their derivatives, cattle meat, fresh fruits, other vegetables, legumes and salty foods. Table 6.

Table 6: Dietary habits among study participants by cases and controls.

Dietary habits	Cases (N = 63) F (%)	Controls (N = 118) F (%)	P-value
1. Dairy, cheese and their derivatives			
Daily	35 (55.6)	18 (15.3)	**0.000***
Weekly	22 (34.9)	69 (58.5)	
Monthly	3 (4.8)	24 (20.3)	
Never	3 (4.8)	7 (5.9)	
2. Cattle meat			
Daily	4 (6.3)	4 (3.4)	**0.006***
Weekly	26 (41.3)	24 (20.3)	
Monthly	31 (49.2)	77 (65.3)	
Never	2 (3.2)	13 (11)	
3. Fish and sea food			
Daily	1 (1.6)	3 (2.5)	0.553
Weekly	15 (23.8)	29 (24.6)	
Monthly	44 (69.8)	74 (62.7)	
Never	3 (4.8)	12 (10.2)	
4. Poultry meat (Chicken)			
Daily	11 (17.5)	21 (17.8)	0.642
Weekly	46 (73)	78 (66.1)	
Monthly	4 (6.3)	12 (10.2)	
Never	2 (3.2)	7 (5.9)	
5. Eggs			
Daily	10 (15.9)	31 (26.3)	0.201
Weekly	50 (79.4)	81 (68.6)	
Monthly	3 (4.8)	4 (3.4)	
Never	0 (0)	2 (1.7)	
6. Dark Chocolate			
Daily	4 (6.3)	10 (8.5)	0.51
Weekly	12 (19)	30 (25.4)	
Monthly	20 (31.7)	40 (33.9)	
Never	27 (42.9)	38 (32.2)	
7. Tea			
Daily	56 (88.9)	103 (87.3)	0.976
Weekly	4 (6.3)	8 (6.8)	
Monthly	1 (1.6)	3 (2.5)	
Never	2 (3.2)	4 (3.4)	
8. Fresh Fruits			
Daily	10 (15.9)	34 (28.8)	**0.000***
Weekly	39 (61.9)	80 (67.8)	
Monthly	10 (15.9)	2 (1.7)	
Never	4 (6.3)	2 (1.7)	
9. Spinach			
Daily	1 (1.6)	1 (0.8)	0.828
Weekly	9 (14.3)	12 (10.2)	
Monthly	29 (46)	58 (49.2)	
Never	24 (38.1)	47 (39.8)	
10. Other Vegetables			
Daily	6 (14.3)	5 (33.1)	**0.029***
Weekly	39 (61.9)	62 (52.5)	

Monthly	9 (14.3)	12 (10.2)	
Never	9 (9.5)	39 (4.2)	
11. Legumes (beans, peas, beans)			
Daily	17 (27)	62 (52.5)	**0.005***
Weekly	29 (46)	40 (33.9)	
Monthly	12 (19)	9 (7.6)	
Never	5 (7.9)	7 (5.9)	
12. Salty foods			
Daily	1 (1.6)	3 (2.5)	**0.000***
Weekly	3 (4.8)	10 (8.5)	
Monthly	4 (6.3)	17 (14.4)	
Never	55 (87.3)	88 (74.6)	

Characteristics of urinary tract Stone Formation

The age mean at onset stone was 29.79 ± 9.55 years. Mean size of stone was 13.23 ± 4.2 mm. Most of the stones were found in the right kidney 18 (28.6), followed by left kidney in 15 (23.8%) patients. Bilateral kidney stone was found in 12 (19%) patients. There were 8 (12.7%), 7 (11.1%), and 3 (4.8%) patients had stones in left ureter, right ureter, and bladder respectively. Figure 2.

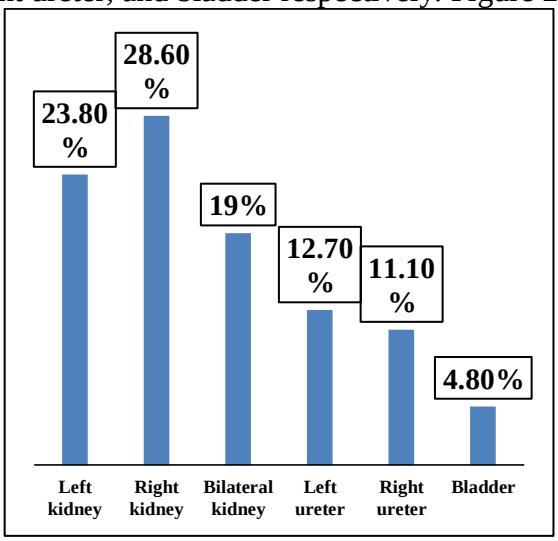


Figure 5: Stone location in patients group

Logistic regression analysis

As shown in table 7, a binary logistic regression was used to find the unadjusted and adjusted odds ratio (OR) based on risks that identified with Chi square. In unadjusted analysis, individuals with positive FH were 12 times more likely to present with urinary tract stone than those without FH (OR= 11.9, 95% CI= 5.66-25.17).

Individuals who were walking less than an hour per day were nearly 6 times more likely to present with urinary tract stone compared to those who were walking more than 2 hours per day (OR= 5.8, 95% CI= 1.87-18.47). Individuals who were drinking less than a bottle/day, and who were drinking a bottle/day were 7.7 and 4 times more likely to present with urinary tract stone compared to those who were drinking ≥ 4 bottles/day respectively (OR= 7.7 and 4, 95% CI= 1.72-34.44 and 1.02-15.76 respectively), while individuals who were drinking mineral water were 80% less likely to present with urinary tract stone compared to those who were drinking mixed of both treated and mineral (OR= 0.2, 95% CI= 0.066-0.59).

Regarding dietary habits factors, individuals who were daily consumption of dairy or its derivatives were 15.5 times more likely to present with urinary tract stone compared to those who were monthly consumption of dairy or its derivatives (OR= 15.5, 95% CI= 4.122-58.7). Individuals with weekly consumption of cattle meat were 2.7 times more likely to present with urinary tract stone compared to those who were monthly consumption of cattle meat (OR= 2.7, 95% CI= 1.34-5.38). Those individuals who were daily and weekly consumption of fresh fruits were 140% and 90% less likely to present with urinary tract stone compared to those who were monthly consumption of fresh respectively (OR= 0.06 and 0.1, 95% CI= 0.01-0.314 and 0.02-0.46 respectively). Similarly, individuals who were weekly consumption of green vegetables were 70% less likely to present with urinary tract stones compared to those who were monthly consumption of green vegetables (OR= 0.3, 95% CI= 0.100-0.95).

An adjusted multivariate logistic analysis was also performed to identify independent risk factors of urinary tract stone in patients presenting with the condition at Ibn Sina Hospital. Accordingly, individuals with family members with urinary tract stones were more likely to present with urinary tract stone than those without (OR= 24.9, 95% CI= 5.58-111.9). Additional predisposing factors included walking less than an hour per day (OR= 28.6, 95% CI= 3.14-260.4), consumption of less than one bottle

of drinking water/day (OR= 145.7, 95% CI= 4.2-5101.4), consumption of one bottle of drinking water/day (OR= 29.3, 95% CI= 1.56-549.2), daily consumption of dairy or its derivatives (OR= 14.9, 95% CI= 1.27-174.7), and both daily and weekly consumption of fresh fruits (OR= 0.02 and 0.004, 95% CI= 0.001-0.37 and 0.000-.095 respectively).

Table 7: Univariate and Multivariate logistic regression analyses predicting possible risk factors for urinary tract stones at Ibn Sina Hospital.

Risk Factors		Unadjusted			Adjusted		
		OR	95% CI	P- value	OR	95% CI	P-value
FH	Yes	11.9	(5.66-25.17)	**0.000***	24.9	(5.58-111.9)	**0.000***
	No	Reference			Reference		
Physical Activities							
1.Walking /day	< 1 hr/day	5.8	(1.87-18.47)	**0.002***	28.6	(3.14-260.4)	**0.003***
	1-2 hr/ day	1.7	(0.52-5.76)	0.368	7.1	(0.7-71.3)	0.096
	> 2 hr/day	Reference			Reference		
2. Regular exercise	No	3.6	(1.01-12.73)	**0.047***	17.2	(0.92-319.8)	0.057
	Yes	Reference			Reference		
Water intake							
Water Quantity	< one bottle/day	7.7	(1.72-34.44)	**0.008***	145.7	(4.2-5101.4)	**0.006***
	one bottle/ day	4	(1.02-15.76)	**0.047***	29.3	(1.56-549.2)	**0.024***
	2 bottles	1.5	(0.38-6.28)	0.535	2	(0.15-26.0)	0.596
	3 bottles	0.7	(0.15-3.48)	0.685	2.2	(0.13-37.33)	0.58
	≥ 4 bottles	Reference			Reference		
Water source	Home water network	0.7	(0.175-2.59)	0.565	1.7	(0.03-92.3)	0.781
	Treated water	0.7	(0.299-1.66)	0.426	4.6	(0.45-46.6)	0.198
	Mineral water	0.2	(0.066-0.59)	**0.004***	0.5	(0.055-4.78)	0.559
	Both treated and mineral	Reference			Reference		
Dietary Habits							
1. Dairy	Daily	15.5	(4.122-58.7)	**0.000***	14.9	(1.27-174.7)	**0.031***
	Weekly	2.5	(0.70-9.29)	0.156	1.7	(0.20-15.34)	0.612
	Monthly	Reference			Reference		
	Never	3.4	(0.562-20.9)	0.182	0.4	(0.02-9.078)	0.578
2. Cattle meat	Daily	2.5	(0.58-10.56)	0.218	1.7	(0.065-47.7)	0.738
	Weekly	2.7	(1.34-5.38)	**0.005***	2.6	(0.55-12.46)	0.229
	Monthly	Reference			Reference		
	Never	0.4	(0.08-1.79)	0.223	0.3	(0.01-9.99)	0.509

* indicates significant result.

Discussion

The Not surprisingly, positive family history was significantly higher in the patient group, as this result was previously reported in other studies[13].

The current study patients present nearly 3 and 7 years older than their Iranian and Eritrean counterparts as showcased in *Karandish et al.,*[14], *Achila et al.,*[15] respectively. However, they present nearly 6 years younger than their Saudi counterparts[16].

Consistent with current study, *Shabani et al.,*[17], *Nayak and D'Souza*[18] reported there were no significant associations between the two groups in gender.

In agreement with other studies *Shabani et al.*[17], *Safdar et al.,*[19], there were no statistically significant association between marital status and urinary tract stone formation according to current study data.

Educational level had statistically significant association with risk urinary tract stone

formation. This is consistent with most other studies[18,19,20]. However, it is inconsistent with few other studies[17.]

Type of occupation was not associated with urinary tract stone formation in the current study. It goes with[17]. Other than that, *Achila et al.*[15], *Sofa and Manickavasakam,*[21] reported occupation had significant associations with renal stone formation. *Sofa and Manickavasakam,*[21] reported that the skilled occupation had the highest relationship with renal stone formation. In recent years the epidemiology of renal stone disease was still changing as social conditions gradually improved particularly in the urban areas of the more affluent developing countries. Occupation can have an impact on the incidence of renal stones. Physician and white collar workers have an increased incidence of stones compared with manual laborers. This finding may be related to differences in diet but also may be related to physical activity. Physical activity may agitate urine and dislodge crystal aggregates[2]. According to *Achila et al.*[15], interpretation can be in line with ambient temperatures in work environment. Lack of association in current study might be due to lack of sensitivity toward occupation.

In the current study while weather had statistically significant association with urinary tract stone formation, governorate of participants had not. It is consistent with Eritrean study *Achila et al.,*[15] who reported that there were a significant association between weather and risk of renal stone formation. Patients governorates diversity in current study who were from 14 different governorates might be culprit. One study reported that stone recurrence is higher in summer/hot season than in winter and spring[22]. In a North American study, it was noted that the prevalence of stones tended to increase as the average annual temperature (5.2 °C in North Dakota to 22 °C in Florida) and sunlight index (14.6 in Washington State to 39.7 in Florida) increased[23].

In this study, the frequency of urinary tract stone recurrence in individuals with a previous history of urinary tract stone was evaluated. In this regard, this study data indicated that 47.6% of the patients had a history of urinary tract stone. This value nearly matched to what were reported among Eritrean and Saudi patients (52% and 57 respectively)[15,19].

According to the findings of the current study, the water consumption showed a statistically significant relationship with the formation of urinary tract stones. Increasing water intake reduces the concentration of compounds that can be sedated in the urine[17]. On the other hand, it decreases the free crystalline particles staying time in the urine. There are also some evidences indicating that adequate water intake prevents the recurrence of renal stones[17].

HTN was observed more in individuals with urinary tract stones than in healthy participants. It goes with *Sofa and Manickavasakam,*[21], *Safdar et al.,*[19], while with *Dongre et al.,*[12], *Nayak and D'Souza,*[18] does not. HTN may lead to the formation of stones. In a study conducted at the University of Naples by *Cappuccio et al.,*[24] found a clinical association between HTN and renal stone formation. Specifically, the prevalence of renal stone in treated HTN was found to be in 32.8% of the subjects, compared to 13.4% in the normotensive subjects.

Based on the current study findings, the high intake of cattle meat was statistically significantly associated with higher risk of urinary tract stone formation. High dietary intake of protein was reported to exert potential detrimental effects on urinary risk factors of stone formation[25], however the evidence from systematic reviews regarding the relationship between protein intake and the risk of renal stone formation is inconclusive[26]. The acid load provided by a high protein intake may increase urinary calcium and reduce urine pH and citrate excretion[28]. A study of 18 hypercalciuric stone patients showed that a protein restriction to 0.8 g/kg body weight/day decreased urinary calcium and uric acid and increased urinary citrate excretion ***(Giannini et al., 1999)***. In contrast, the two cohort studies found no association between dietary protein intake and stone formation[29].

However, one systematic review confirmed that high-protein diets were associated with increased urinary calcium excretion, which is a risk factor for calcium stone formation[30]. To date, there is no randomized controlled trial comparing the isolated effect of a high versus low protein intake on the risk of urinary tract stone formation..

Conclusion

According to the findings of the current study, majority of stones were located in kidneys. Nearly half of patients were re-formed urinary tract stones. There were no associations between formation of urinary tract stones with age, gender, marital status, occupation, governorate, personal habits (smoking and Khat chewing), co-morbidities (HTN, diabetes mellitus, chronic kidney diseases and parathyroid disorders), and some dietary factors (fish and sea food, poultry meat, eggs, dark chocolate, tea, and spinach).

On the other hand, the factors which are at more risk to get urinary tract stones are family history, sedentary life style, low fluid intake and increased dairy derivatives and animal meat consumption. The current study also established a significant negative relationship between consumption of fresh fruits, vegetables and legumes with development of urinary tract stones stone.

References

1. Al-Kazwini, A. T., Al-Arif, M. S., Abu-Mweis, S. S. & Al-Hammouri, T. F. 2019. The relationship between kidney stones and dietary habits. *Research and reports in urology*, 11**,** 201.
2. Gindi, S., Methra, T., Chandu, B. R., Boyina, R. & Dasari, V. 2019. Antiurolithiatic and invitro anti-oxidant activity of leaves of Ageratum conyzoides in rat. World J. Pharm. Pharm. Sci, 2, 636-649.
3. Niroomand, H., Rezaei, V. & Mirzaii-Dizgah, M.-R. 2020. Nutritional Habits in Patients with Urinary Tract Stones Referred to Imam Reza Hospital in 2019. Annals of Military and Health Sciences Research, 18.
4. Agarwal, M. M., Singh, S. K., Mavuduru, R. & Mandal, A. K. 2019. Preventive fluid and dietary therapy for urolithiasis: An appraisal of strength, controversies and lacunae of current literature. Indian journal of urology: IJU: journal of the Urological Society of India, 27, 310.
5. Hossain Khani, A., Nemati, A., Naser Saead, M., Hosseinzadeh, S. & Barak, M. 2019. Relationship between Urolithiasis and Nutrition in Patients with Urinary Stones in Ardabil City. Journal of Ardabil University of Medical Sciences, 12, 65-76.
6. Romero, V., Akpinar, H. & Assimos, D. G. 2020. Kidney stones: a global picture of prevalence, incidence, and associated risk factors. Reviews in urology, 12, e86.
7. Lee, Y.-H., Huang, W.-C., Tsai, J.-Y., Lu, C.-M., Chen, W.-C., Lee, M.-H., Hsu, H.-S., Huang, J.-K. & Chang, L. S. 2022. Epidemiological studies on the prevalence of upper urinary calculi in Taiwan. Urologia internationalis, 68, 172-177.
8. Wang, C., Liu, Q., Guo, G., Huo, W., Pei, C., Zhang, S. & Yang, W. 2018. Effects of dietary protein levels and 2- methylbutyrate on ruminal fermentation, nutrient degradability, bacterial populations and urinary purine derivatives in Simmental steers. Journal of animal physiology and animal nutrition, 102, 611-619.
9. Shavit, L., Ferraro, P. M., Johri, N., Robertson, W., Walsh, S. B., Moochhala, S. & Unwin, R. 2015. Effect of being overweight on urinary metabolic risk factors for kidney stone formation. Nephrology Dialysis Transplantation, 30, 607-613.
10. Assadi, F. & Moghtaderi, M. 2017. Preventive kidney stones: continue medical education. International journal of preventive medicine, 8.
11. Al-Kamarany, M., Al-Osimi, M., Majam, S. & Ogaili, M. 2016. Renal Stones among Adult of Hodeidah as Subtropical Region in Yemen: Prevalence, Risk Factors and Common Medication Used. Journal Home Page.
12. Dongre, A. R., Rajalakshmi, M., Deshmukh, P. R., Thirunavukarasu, M. & Kumar, R. 2017. Risk Factors for Kidney Stones in Rural Puducherry: Case-Control Study. Journal of

clinical and diagnostic research: JCDR, 11, LC01.
13. Gurler, H. & Gunduz, E. S. 2021. Risk factors in urinary stones: A case–control study. International Journal of Urological Nursing, 15, 117-122.
14. Karandish, M., Parvizi, P. & Haghighizadeh, M. H. 2017. A case-control study on food insecurity among patients with kidney stones. Helix, 7, 1161-1165.
15. Achila, O., Araya, M., Simel, L. L., Nanduri, L., Asmerom, A., Kiflay, A., Okbagergish, D., Tsegai, F. & Kahsu, R. 2018. An assessment of kidney stone composition and risk factors: Matched case-control study at Orotta referral hospital in Asmara, Eritrea. Int J Adv Community Med, 1, 7-14.
16. Alkhunaizi, A. M. 2016. Urinary Stones In Eastern Saudi Arabia. Urology Annals, 8, 6.
17. Shabani, E., Khorshidi, A., Sayehmiri, K., Moradi, K. & Alimardani, D. 2019. Investigating relation of type and frequency of fluid intake with formation of kidney and urinary tract stones: a case-control study. Journal of Advanced Pharmacy Education & Research| Apr-Jun, 9.
18. Nayak, S. G. & D'souza, J. P. 2019. Risk Factors of Urolithiasis: A Case Control Study. International Journal of Caring Sciences, 12, 1-10.
19. Safdar, O. Y., Alblowi, S. S., Aboulola, N. A. & Alharazy, D. T. 2021a. Renal Stones and Risk Factors in Jeddah and Riyadh. Saudi Journal of Kidney Diseases and Transplantation, 32, 191.
20. Renuka, K. & Poongodi, V. 2020. Assessment of the Risk Factors for Renal Calculi among its Patients at Nephrology OPD in MGMCRI, Puducherry, with a View to Develop Self-instructional Module. Assessment, 13.
21. Sofa & Manickavasakam 2019. Prevalence And Risk Factors Of Kidney Stone. Global Journal For Research Analysis, 5, 183-7.
22. Sternberg, K., Greenfield, S. P., WILLIOT, P. & WAN, J. 2005. Pediatric stone disease: an evolving experience. The Journal of urology, 174, 1711-1714.
23. Soucie, J. M., Coates, R. J., Mcclellan, W., Austin, H. & Thun, M. 1996. Relation between geographic variability in kidney stones prevalence and risk factors for stones. American journal of epidemiology, 143, 487-495.
24. Cappuccio, F. P., Siani, A., Barba, G., Mellone, M. C., Russo, L., Farinaro, E., Trevisan, M., Mancini, M. & Strazzullo, P. 1919. A prospective study of hypertension and the incidence of kidney stones in men. Journal of hypertension, 17, 1017-1022.
25. Siener, R. 2021. Nutrition and kidney stone disease. Nutrients, 13, 1917.
26. Van Elswyk, M. E., Weatherford, C. A. & Mcneill, S. H. 2018. A systematic review of renal health in healthy individuals associated with protein intake above the US recommended daily allowance in randomized controlled trials and observational studies. Advances in Nutrition, 9, 404-418.
27. Reddy, S. T., Wang, C.-Y., Sakhaee, K., Brinkley, L. & Pak, C. Y. 2002. Effect of low-carbohydrate high-protein diets on acid-base balance, stone-forming propensity, and calcium metabolism. American Journal of Kidney Diseases, 40, 265-274.
28. Giannini, S., Nobile, M., Sartori, L., Carbonare, L. D., Ciuffreda, M., Corrò, P., D'angelo, A., Calò, L. & Crepaldi, G. 1999. Acute effects of moderate dietary protein restriction in patients with idiopathic hypercalciuria and calcium nephrolithiasis. The American journal of clinical nutrition, 69, 267-271.
29. Taylor, E. N. & Curhan, G. C. 2006. Body size and 24-hour urine composition. American Journal of Kidney Diseases, 48, 905-915.
30. Schwingshackl, L. & Hoffmann, G. 2014. Comparison of high vs. normal/low protein diets on renal function in subjects without chronic kidney disease: a systematic review and meta-analysis. PloS one, 9, e97656.