ISSN: 2457-0400

Impact Factor: 6.711

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

www.wjahr.com

Volume: 10, Issue: 1

Page N. 57-62

Year: 2026

Original Article

Coden USA: WJAMA3

RISK FACTORS OF RECURRENT RENAL STONES IN A SAMPLE OF IRAQI PATIENTS: A RETROSPECTIVE STUDY

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Article Received: 30 November 2025 **Article Revised:** 20 December 2025 **Article Published:** 01 January 2026

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DOI: https://doi.org/10.5281/zenodo.18105957

How to cite this Article: [*1]Dr. Aaid Abed Ibrahim, [2]Dr. Ahmad Mohammed Maree, [3]Dr. Saud Hussein Mousa. (2026). Risk Factors Of Recurrent Renal Stones In A Sample Of Iraqi Patients: A Retrospective Study. World Journal of Advance Healthcare Research, 10(1), 57–62.

ABSTRACT

Background: Renal stone disease is very common in Iraq due to the hot environment, dehydration, eating habits, and recurring urinary tract infections. Stone recurrence imposes a significant clinical and economic impact. Identifying modifiable risk factors is critical for reducing recurrence and improving patient outcomes. **Objectives:** Is to investigate clinical, metabolic, and lifestyle risk factors for recurrent kidney stone development among a sample of Iraqi patients. **Methods:** The study is case control retrospective study done at Al Salam and Al Bahthi Teaching Hospitals in Mosul, Iraq from the 1st of June 2024 to the end of November 2025. The questionnaire includes five parts, part one for sociodemographic information. The second part for relevant medical history including previous urinary tract infection, diabetes, hypertension, gout. Anthropometric information was covered in part three. While, lifestyle and environmental factors such as low daily water intake, high ambient temperature exposure, high salt, high animal protein consumption and taking plenty of soft drink were covered in part four. Lastly, stone composition was covered by part five. **Results:** The study includes 150 patients, 50 patients with recurrent stones (cases) and 100 patients with primary stone (controls). The mean age ± standard deviation of the study patients was 33.82 ± 11.71 years. Males represent 89 (59.33%) of the study patients and females represent 61 (40.67%) of the study patients, with male to female ratio equal to 1.45:1.Risky association and statistically significant difference found for male gender (odds ratio = 1.525), those aged 18-25 (odds ratio = 2.647), aged 26-35 (odds ratio = 2.275), family history of same condition (odds ratio = 16.128). Moreover, risky association and statistically significant difference found for recurrent urinary tract infection (odds ratio = 10.919), hypertension (odds ratio = 10.126), gout (odds ratio = 2.219). Additionally, risky association and statistically significant difference found for overweight (odds ratio = 2.092) and obesity (odds ratio = 5.733). Furthermore, risky association and statistically significant difference found for low daily water intake (odds ratio = 3.994), high ambient temperature exposure (odds ratio = 2.051), high animal protein consumption (odds ratio = 1.826), high salt intake (odds ratio = 2.196) and taking plenty of soft drink (odds ratio = 8.680). Lastly, Risky association and statistically significant difference found for calcium oxalate (odds ratio = 1.859), calcium phosphate (odds ratio = 1.211), cystine (odds ratio = 1.531). **Conclusion:** The study revealed that many factors can cause recurrent renal stones. Identification of these factors is mandatory for preventing the stone recurrence and management.

KEYWORDS: Calculi, Kidney, Mosul, Risky, Repeated.

1-INTRODUCTION

Renal stone disease is very common in Iraq due to the hot environment, dehydration, eating habits, and recurring urinary tract infections.[1] Stone recurrence imposes a significant clinical and economic impact. Identifying modifiable risk factors is critical for reducing recurrence and improving patient outcomes.[2] Renal stone disease affects around 1% to 15% of the global population.[3]

Recurrent kidney stones are caused by a variety of metabolic and genetic disorders. When a recurrence occurs, the future relapse risk increases, and the intervals between recurrences shorten.[4]

To better understand the causes of stones, metabolic assessment and stone analysis are necessary.[5] Shin S et al. conducted a global study in 2018 on the various confounding factors for stone formation and discovered that calcium oxalate stones account for 60% of recurrent stones, followed by phosphate stones at 30%, uric acid stones 5-10%, and cysteine stones 1-3%.[6]

Numerous studies have been carried out to identify risk factors for stone recurrence. Chronic diseases such as diabetes, hypertension, and chronic renal disease have been identified as a risk factor for stone formation.[7-9] Further study is being conducted to determine their influence on recurrence rates.[10-11] Diabetes has been linked to kidney stones through insulin resistance, hyperglycemia, and glycosuria, according to many studies.[12-13] Hypertensive people are more likely to develop kidney stones, especially if they are obese and consume a lot of salt and animal protein. Hypertensive individuals had greater levels of oxaluria and calcinuria than those with normal blood pressure.[14-15]

Renal stones can form in the ureters, kidneys, or bladder, causing damage to the kidneys by blocking urine flow, impairing kidney function and eventually resulting in renal failure.[16] The symptoms of stones in the urinary tract system may include obstruction, pain, hematuria, and infection.[17]

Renal stones are managed using surgical procedures such as extracorporeal shock wave lithotripsy, transurethral lithotripsy, and percutaneous lithotripsy. These operations are complicated and expensive, and they have little effect on the recurrence of stones.[18] Various medications, such as thiazide as a diuretic and alkali-citrate, are used to reduce the incidence of hypercalciuria and hyperoxaluria, but they are not promising due to their limited efficacy and tolerability.[19] Various medicinal herbs with antispasmodic, diuretic, and antioxidant properties suppress crystallization, nucleation, and aggregation, making them effective in the treatment of urolithiasis.[20]

The aim of study is to investigate clinical, metabolic, and lifestyle risk factors for recurrent kidney stone development among a sample of Iraqi patients.

2-PATIENTS AND METHODS

The study is case control retrospective study done at Al Salam and Al Bahthi Teaching Hospitals in Mosul, Iraq from the 1st of June 2024 to the end of November 2025. Ethical approval was given by Nineveh Health Directorate. The study is confidential and did not include any information that might be used to identify a specific individual. To be eligible to participate in the study, participants had to be at least eighteen years old with confirmed renal stones by ultrasound. In contrast, those with congenital renal anomalies, patients with chronic renal disease (stage 4-5), patients who were younger than 18 and those whose questionnaires contained missing or incomplete information were not included.

Recurrent stone formers were identified as having at least two episodes of renal stone formation. The patient's sociodemographic information, such as age, sex, residence and family history of same condition were asked in part one of the questionnaire. The second part for relevant medical history which include previous urinary tract infection, diabetes, hypertension, gout. Anthropometric information was covered in part three. While, lifestyle and environmental factors such as low daily water intake, high ambient temperature exposure (outdoor workers), high salt, high animal protein consumption and taking plenty of soft drink were covered in part four. Lastly, stone composition was covered by part five.

The statistical software SPSS-30 (Statistical Packages for Social Sciences, version 30) was used to analyze the data. Data were interpreted in simple measures of frequency, percentage, mean and standard deviation. The association between recurrent renal stone and related risk factors was investigated using the chi-Square test. P-values less than 0.05 were regarded as statistically significant.

3- RESULTS

The study includes 150 patients, 50 patients with recurrent stones (cases) and 100 patients with primary stone (controls). The mean age ± standard deviation of the study patients was 33.82 ± 11.71 years. Males represent 89 (59.33%) of the study patients and females represent 61 (40.67%) of the study patients, with male to female ratio equal to 1.45:1.

Table 1 shows comparison between cases and controls regarding their demographic variables. Risky association and statistically significant difference found for male gender (odds ratio = 1.525), those aged 18-25 (odds ratio = 2.647), aged 26-35 (odds ratio = 2.275) and family history of same condition (odds ratio = 16.128). While no significant association and difference found for residence.

Table 1: Comparison between cases and controls regarding their demographic variables (number= 150).

Variables	Cases		Controls		Odds ratio (CI)	P- value
	No.	%	No.	%		
Genders:						
-Male	33	66%	56	56%	**1.525 (1.042-1.920)**	**0.044**
-Female	17	34%	44	44%	0.655 (0.204-1.103)	
Ages:						
- 18-25	15	30%	17	17%	**2.647 (1.506-3.391)**	**0.003**
- 26-35	22	44%	29	29%	**2.275 (1.290-2.530)**	
- 36-45	7	14%	34	34%	0.617 (0.332-1.039)	
- 46-55	4	8%	14	14%	0.857 (0.582-1.402)	
- More than 55	2	4%	6	6%	Reference	
Residence:						
-Urban	26	52%	57	57%	0.817 (0.389-1.239)	0.390
-Rural	24	48%	43	43%	1.223 (0.462-1.403)	
Family history of same condition:						
-Yes	37	74%	15	15%	**16.128 (4.982-31.529)**	**<0.001**
-No	13	26%	85	85%	**0.062 (0.028-0.112)**	

Table 2 shows comparison between cases and controls regarding their past relevant medical history. Risky association and statistically significant difference found for recurrent urinary tract infection (odds ratio = 10.919), hypertension (odds ratio = 10.126), gout (odds ratio = 2.219). While no significant association and difference found for diabetes.

Table 2: Comparison between cases and controls regarding their past relevant medical history (number= 150).

Variables	Cases		Controls		Odds' ratio (CI)	P- value
	No.	%	No.	%		
Recurrent urinary tract infection:						
-Yes	31	62%	13	13%	**10.919 (5.891-15.782)**	**<0.001**
-No	19	38%	87	87%	**0.091 (0.013-0.301)**	
Hypertension:						
- Yes	29	58%	12	12%	**10.126 (5.202-15.441)**	**<0.001**
- No	21	42%	88	88%	**0.098 (0.029-0.188)**	
Diabetes:						
-Yes	7	14%	9	9%	1.645 (0.221-2.709)	0.309
-No	43	86%	91	91%	0.607 (0.382-1.130)	
Hyperuricemia:						
-Yes	9	18%	6	9%	**2.219 (1.341-3.495)**	**0.039**
-No	41	82%	94	91%	**0.450 (0.183-0.930)**	

Table 3 shows comparison between cases and controls regarding their anthropometric variables. Risky association and statistically significant difference found for overweight (odds ratio = 2.092) and obesity (odds ratio = 5.733). While no significant association and difference found for underweight.

Table 3: Comparison between cases and controls regarding their anthropometric variable (number = 150).

Variables	Cases		Controls		Odds' ratio (CI)	P- value
	No.	%	No.	%		
Body mass index:						
- Underweight	2	4%	6	6%	1.307 (0.689-1.820)	**<0.001**
- Normal	13	26%	51	51%	Reference	
- Overweight	16	32%	30	30%	**2.092 (1.347-2.626)**	
- Obesity	19	38%	13	13%	**5.733 (3.321-7.095)**	

Table 4 shows comparison between cases and controls regarding their Lifestyle variables. Risky association and statistically significant difference found for low daily water intake (odds ratio = 3.994), high ambient temperature exposure (odds ratio = 2.051), high animal protein consumption (odds ratio = 1.826), high salt intake (odds ratio = 2.196) and taking plenty of soft drink (odds ratio = 8.680).

Table 4: Comparison between cases and controls regarding their lifestyle variable (number = 150).

Variables	Cases		Controls		Odds' ratio (CI)	P- value
	No.	%	No.	%		
Low daily water intake:						
-Yes	31	62%	29	29%	**3.994 (1.996-7.025)**	**<0.001**
-No	19	38%	71	71%	**0.408 (0.210-0.589)**	
High ambient temperature exposure:						
Yes	19	38%	23	23%	**2.051 (1.104-2.729)**	
No	31	62%	77	77%	**0.487 (0.199-0.821)**	**0.032**
High animal protein consumption:						
-Yes	17	34%	22	22%	**1.826 (1.221-2.409)**	**0.041**
-No	33	66%	78	78%	**0.547 (0.098-0.908)**	
High salt intake:						
-Yes	17	34%	19	19%	**2.196 (1.616-2.963)**	**0.017**
-No	33	66%	81	81%	**0.455 (0.382-0.632)**	
Taking plenty of soft drink:						
-Yes	39	78%	29	29%	**8.680 (4.733-13.995)**	**<0.001**
-No	11	22%	71	71%	**0.115 (0.083-0.230)**	

Table 5 shows comparison between cases and controls regarding their stone composition. Risky association and statistically significant difference found for calcium oxalate (odds ratio = 1.859), calcium phosphate (odds ratio = 1.211), cystine (odds ratio = 1.531).

Table 5: Comparison between cases and controls regarding their stone composition (number = 150).

Variables	Cases		Controls		Odds' ratio (CI)	P- value
	No.	%	No.	%		
Stone type						
- Calcium oxalate	17	34%	16	16%	**1.859 (1.307-2.277)**	**0.011**
- Calcium phosphate	9	18%	13	13%	**1.211 (1.007-1.402)**	
- Cystine	7	14%	8	8%	**1.531 (1.209-1.789)**	
- Struvite	4	8%	7	7%	Reference	
- Unknown	13	26%	56	56%	0.406 (0.389-0.572)	

4. DISCUSSION

In this retrospective case control study 150 patients with renal stone were studies. Regarding patients' gender, males found to have risky association with recurrent renal stone, this due to the effect of sex hormones, as in male, testosterone is linked to increased oxalate formation, whereas estrogen in females is hypothesized to have a protective impact by suppressing oxalate biosynthesis and raising citrate.[21] Comparable results was obtained from Daudon et al[22] and Ferraro et al[23] Moreover, the study found recurrent renal stone were associated those of age categories of 18-25 and 25-35 years. This suggest that younger age patients had a stronger underlying genetic predisposition or metabolic disorder that could persist throughout life, consistent results found in meta-analysis conducted by Wang et al.[2] Additionally, the study found strong link between family history of same condition and recurrent renal stone, due to sharing of both genetic and environmental factors within the same family. Several studies showing comparable results.[2, 24, 25]

Regarding the patients past relevant history, repeated urinary tract infection found in the current study to risky for recurrent renal stone formation, this is because certain urinary tract infections (especially from urease-producing bacteria) can directly form specific stones (struvite), which runs with Ripa et al systemic review.[26]

Having hypertension found in this study to be risky for recurrent stone formation, this might occur due to common underlying physiological and metabolic factors between recurrent stone formation and hypertension. Kim et al showed similar results.[27] In the same way, the study found hyperuricemia had a risky association with recurrent stone formation. This could be happened due to the effect of urate crystals which can trigger inflammation and oxidative stress in the kidneys, leading to impair the kidney's ability of managing stone-forming substances.[28] Arowojolu et al had parallel findings.[29]

Overweight and obesity shown in this study to had a link with recurrent stone formation. This due to the fact that, obesity leads to several metabolic changes that promote stone formation, such as increased urinary excretion of calcium, oxalate, and uric acid, and lower urinary pH level.[30] This agrees Chen et al study findings.[31]

Different lifestyle factors were associated with recurrent stone according to the study result. Low daily water intake was shown to had a risky association with recurrent stone formation, as increased intake of water reduces the concentration of salts and minerals that cause

stones in the urine. Which comparable to Khan et al study findings.[32] Moreover, the study found high ambient temperature exposure found to had risky association with recurrent stone formation primarily through dehydration, which leads to reduced urine volume and higher concentrations of stone-forming salts. Fakheri et al had similar results.[33] Furthermore, consuming high animal protein intake found in risky association with recurrent stone, because animal protein diets can promote stone formation. Montgomery et al. had similar findings.[34] The study found the same with high salt intake, which might occur because the salt effect on excretion of calcium in urine, consistently with Ticinesi et al study results.[35] Lastly, taking plenty of soft drink found in the present study to be risky with recurrent stone formation. As these fluids containing high concentration fructose (sweetener), which in turn can raise calcium, oxalate, and uric acid levels in the urine and most kidney stones consist mostly of these components.[23] Ferraro et al showed consist findings.[23]

Calcium and cystine stone composition found in this study to have risky association with recurrent stone formation, due to metabolic causes. This suggesting aggressive treatment is need to decrease calcium and cystine concentration urine, which agrees Alshehri et al study findings.[36]

The study had certain limitations. Its generalizability is limited by the small sample size, requiring for additional study with larger, more varied samples. Finally, this study, when combined with other studies, may help develop customized clinical practice guidelines for Iraqi patients suffering from recurrent renal stones, which could greatly enhance preventive measures.

5- CONCLUSION

In conclusion, this study revealed that among individuals having recurrent renal stones. Male gender, younger than 35 years, having BMI of more than 25 Kg/ m^2, family history of same condition, low daily water intake, high ambient temperature exposure, high animal protein consumption, high salt intake, taking plenty of soft drink, emerged as identified risk factors for recurrent stone formation. To fully examine how many factors contribute to the development of recurrent stone formation, more researches are necessary.

ACKNOWLEDGEMENT

We appreciate the assistance offered by the medical staff at Al Salam and Al Bahthi Teaching Hospitals and the thorough attention the Nineveh Directorate of Health gave to our study project. This study could not have been done without the assistance of each of these people.

Conflict of intertest

About this study, the authors disclose no conflicts of interest.

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