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THE RELATION BETWEEN OCCUPATION AND RENAL STONES IN SYRIAN COAST

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ABSTRACT

Background: The relation between occupation and kidney stones is an area of increasing interest, certain occupations may increase the risk of kidney stone formation due to factors such as heat exposure, dehydration, stress, and exposure to specific chemicals. **Objective:** Study the relation between occupation, chemical composition, and urinary disorders in patients diagnosed with kidney stones, while studying the causes of their occurrence and identifying methods of prevention and recurrence control. **Materials and Methods:** A prospective study was conducted on adult kidney stone patients who attended the Urology Department at Lattakia University Hospital in Syria during 2023 and 2024. They were classified according to occupation. The study involved chemical analysis of isolated kidney stones and investigation of associated metabolic disorders. **Results:** This study examined 964 kidney stone patients, comprising 596 males and 368 females, with employees constituting the largest occupational group (40%). The most common presenting symptom was flank pain (65.7%). Pure calcium oxalate stones were the most frequently identified stone type (58.4%). A significant proportion of patients (67.4%) presented with metabolic disorders, with hypercalciuria (46.8%) and hypocitraturia (39.3%) being the most prevalent. Manual workers showed the highest susceptibility to urinary metabolic disorders and kidney stone recurrence. **Conclusion:** It is recommended to conduct an analysis of the components of urinary stones to determine the chemical composition, in addition to an adequate metabolic study. It is also recommended to take preventive measures to prevent stone formation, especially for patients in the (manual worker) category, such as good hydration.

KEYWORDS: Renal stones, occupation, stone recurrence, Syria.

INTRODUCTION

Urolithiasis is a widespread disease globally, and an increase in the prevalence of urinary stones has been observed, especially in civilized urban societies.[1]

The causes of kidney stone formation vary among patients, with predisposing factors such as race, gender, and occupations which involving exposure to heat and dehydration are associated with an increased risk of kidney stone formation.[2]

Also, the risk of kidney stones can increase when work demands lead to reduced water intake and infrequent urination.[3]

Importance and objectives of the research

Located within the "stone belt," the Syrian coast experiences a high prevalence of urinary stones. Research indicates that occupational factors influence the likelihood of developing kidney stones, with elevated recurrence rates observed in specific occupations. This study aims to pinpoint the occupations that heighten the risk of both kidney stone formation and recurrence, and to determine effective preventive strategies.

PATIENTS AND METHODS

Study population

Between 2023 and 2024, 964 adult patients (over 18 years old) diagnosed with kidney stones at Lattakia University Hospital were included in the study. Data collected for each patient included:

1. **Patient Information:** Age, gender, weight, comorbidities, medical and surgical history, and main complaint.
2. **Occupation Information:** Type of occupation and working conditions, including exposure to heat or direct sunlight, work-related stress, and the availability of rest periods.
3. **Stone Information:** Number, location, stone history, and chemical composition of extracted stones.
4. **Laboratory Investigations:** urine analysis, 24-hour urine collection, study of calcium, magnesium, phosphorus, citrate, and oxalate electrolytes, kidney function, and serum PTH (when necessary).
5. **Radiological Investigations:** Ultrasound, plain X-

ray, computed tomography (CT), intravenous urography, retrograde urography, and urinary tract scintigraphy.

6. **Follow-up Results:** To determine stone recurrence and analyze the patient's stone history.

Patients were categorized into four occupational groups

- **Student:** University level
- **Unemployed:** Home-based only
- **Employee:** Administrative or office jobs, government departments, or teaching (indoor work without sun exposure).
- **Manual worker:** Self-employed professions and occupations requiring physical effort (outdoor occupations or those causing excessive sweating, sun exposure, or high temperatures).

Patients with urinary stones who attended the study center were followed up, and after the stones were extracted, they underwent chemical analysis.[4,5] Chemical reagents from Medichem Middle East, licensed from its parent company in Germany, were used for the analysis.[6]

Statistical analysis

The statistical analysis was conducted utilizing IBM SPSS version 20. The basic descriptive statistics included means, standard deviations (SD), medians, frequencies, and percentages. To assess the differences between paired groups, the Friedman test was employed. All tests held significance at a type I error rate of 5% ($p<0.05$), with $\beta=20\%$, and 80% power for this study.

RESULTS

The research sample included 964 patients, 596 males and 368 females.

Table 1: Distribution of patients by gender.

The research sample	N	Percentage %
Male	596	61.8%
Female	368	38.2%
Total	964	100%

According to Table 1, kidney stones were diagnosed more frequently in males, with a male-to-female ratio of 1:1.62.

The patients were categorized according to occupation, and the results were as the following:

Based on the previous (Table 2), 40% of the kidney stone patients studied belonged to the (Employee) group.

Patients in this study presented with a variety of complaints, both in the clinic and the emergency department, as detailed in the following table:

Table 2: Distribution of patients by occupation.

The occupation	N	%
Student	94	9.7%
Unemployed	189	19.6%
Employee	385	40%
Manual worker	296	30.7%
Total	964	100%

Table 3: Distribution of patients according to the main complaint.

The main complaint	N	Percentage %
flank pain	633	65.7%
urinary tract infection (UTI)	102	10.6%
Urine discoloration/hematuria	129	13.4%
Lower urinary tract symptoms (LUTS)	53	5.5%
oliguria	29	3%
Asymptomatic	18	1.8%
Total	964	100%

We note from the previous (Table 3) that

- Flank pain was the most prevalent presenting complaint.
- Oliguria, indicating impaired kidney function, was seen in some patients due to obstructive urolithiasis in the upper urinary tract, particularly in those with a single kidney or bilateral obstruction.
- Some patients were diagnosed incidentally through routine investigations, demonstrating asymptomatic urolithiasis.

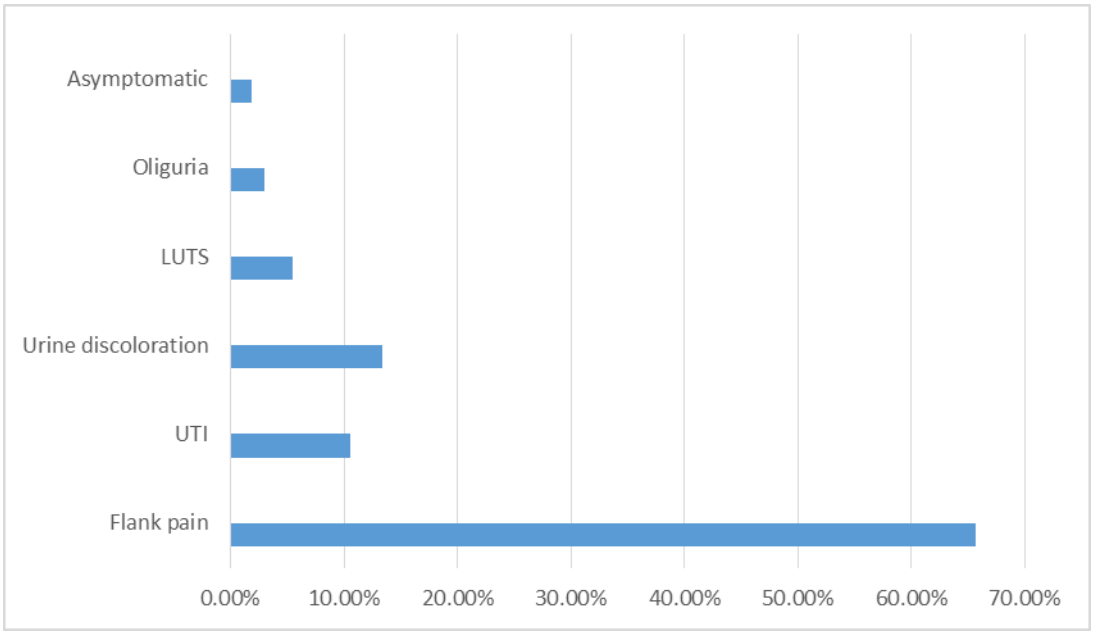

Figure 1: Distribution of patients according to the main complaint.

The relation between occupation and the chemical composition of stones was studied, categorizing stone types based on patients' occupations as the following table:

Table 4: The relation between occupation and the chemical composition of stones in the study sample.

The Chemical composition of the stone	Student N=94	Unemployed N=189	Employee N=385	Manual worker N=296
Pure stones	**61**	**114**	**219**	**169**
Calcium oxalate	29	47	124	98
Calcium phosphate	8	14	26	24
Uric acid	12	21	29	25
Ammonium urate	7	13	24	12
Struvite	3	16	10	5
Cystine	2	3	6	5
Mixed stones	**33**	**75**	**166**	**127**
Calcium oxalate + Calcium phosphate	9	27	57	45
Calcium oxalate + Uric acid	5	14	50	40
Calcium oxalate + Ammonium urate	8	17	36	27
Calcium oxalate + Cystine	8	15	18	12
Uric acid + Cystine	3	2	5	3

The P value was calculated from the previous (Table 4), and all values were (P value > 0.05), indicating that:
There is no relation between the type of occupation and the chemical composition of the stones.

The correlation between occupation and metabolic disorders predisposing to kidney stone formation, as assessed through 24-hour urine analysis, was examined based on patient occupation. The findings were detailed as the following table:

Table 5: The relation between occupation and the type of metabolic disorder in 24-hour urine.

Urine metabolic disorder	Student N=94		Unemployed N=189		Employee N=385		Manual worker N=296	
	N	%	N	%	N	%	N	%
Hypercalciuria	39	40.5%	87	46%	178	46.2%	147	49.6%
Hyperoxaluria	15	16%	29	15.3%	61	15.8%	54	18.2%

Hyperuricosuria	12	12.7%	46	24.4%	50	13.5%	78	26.4%
Hypocitraturia	31	32.9%	63	33.3%	124	32.2%	161	54.4%
Hypomagnesiuria	8	8.5%	16	8.5%	36	9.3%	24	8.1%
Hyperphosphaturia	2	2.1%	4	1.4%	6	1.6%	5	1.7%
Low urine volume	11	11.7%	27	14.3%	118	30.7%	116	39.1%

Statistical analysis, utilizing p-values, was performed to assess the relation between metabolic disorders identified in 24-hour urine samples across the four occupational groups. Significant observations ($p < 0.05$) included:

- **Manual worker:** Elevated hyperuricosuria, hypocitraturia, and low urine volume. This may be attributed to excessive perspiration leading to reduced urine volume, as well as dietary factors.

- **Unemployed:** Significant hyperuricosuria, possibly due to physical inactivity, the presence of metabolic syndrome contributing to a lower urine pH, and dietary patterns.

- **Employee:** Significant low urine volume, potentially resulting from low oral fluid intake during working hours.

The hyperuricosuria observed in the manual worker group could be related to a higher protein intake compared to the employee group, where a lower-protein diet may be more common due to economic factors.

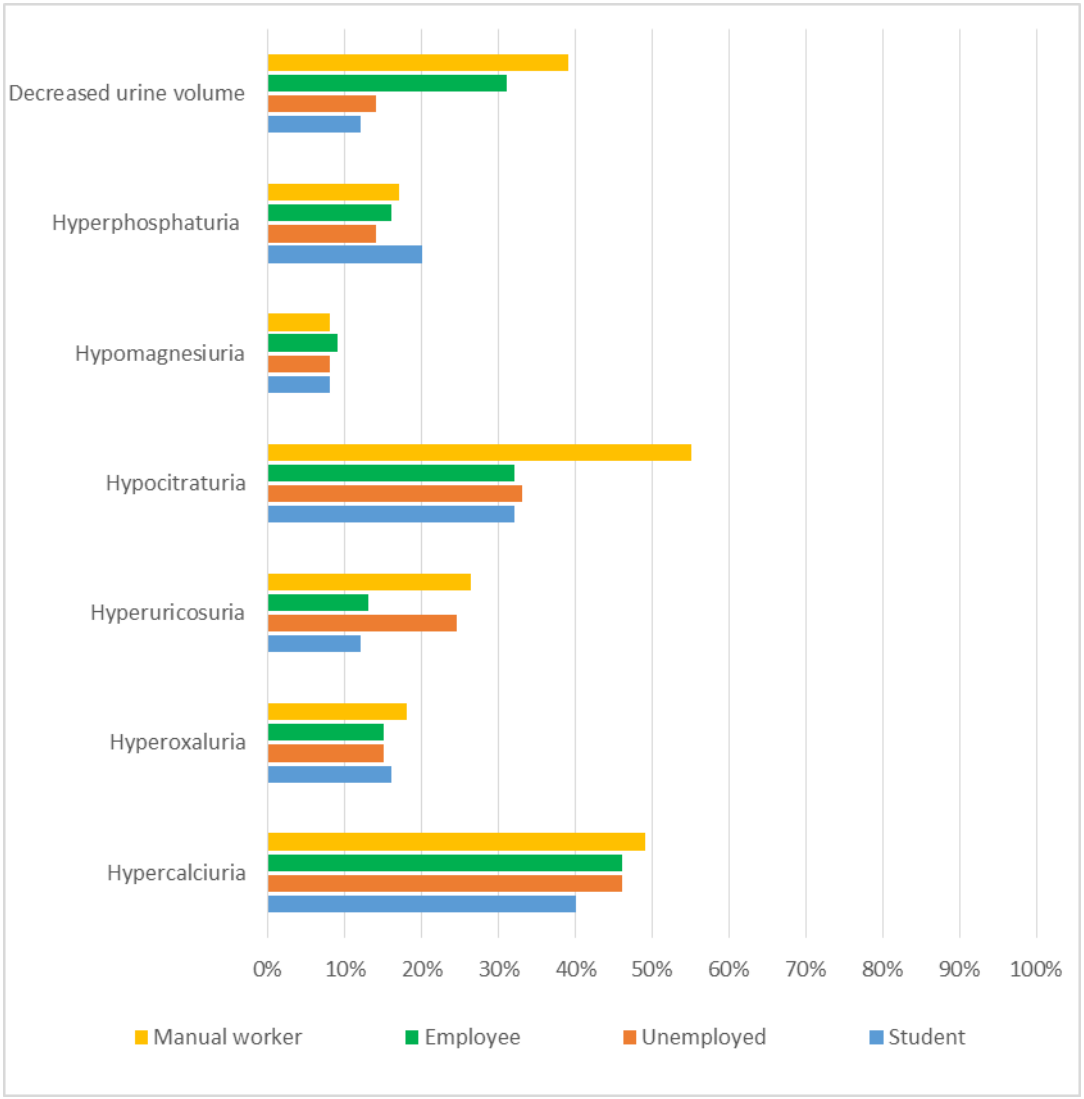

Figure 2: Distribution of metabolic disorders in 24-hour urine by occupation.

The relation between the presence of a single or multiple metabolic disorder and occupation was studied, and the results were as shown in the following table:

Table 6: Distribution of study sample according to the relation between occupation and the presence of a single or multiple metabolic disorder in the urine.

	Single metabolic disorder N=390		Multiple metabolic disorder N=259		P-value
	N	%	N	%	
Student	39	10%	12	4.7%	0.64
Unemployed	84	21.5%	36	13.9%	0.56
Employee	168	43.1%	84	32.4%	0.53
Manual worker	99	25.4%	127	49%	0.02

We note from the previous (Table 6) that there is a statistically significant difference in the category of " Manual worker " in terms of the association between the type of occupation and the frequency of metabolic disorders (P value < 0.05). We conclude that:

The nature of the occupation affects the frequency of metabolic disorders if the patient is a "Manual worker".

Prior history of kidney stones was recorded for the study sample. Among them, 523 patients had a prior diagnosis of at least one episode of urolithiasis, indicating recurrent stone formers. These results were documented in the following table:

Table 7: Distribution of study sample according to the presence of stone recurrence.

	Number	Percentage %
Diagnosing a stone for the first time	441	45.7%
History of stones (stone recurrence)	523	54.3%
Total	964	100%

Upon further data collection (Table 7) regarding the recurrent stone formers, it was found that most of them did not undergo a comprehensive evaluation to determine the cause of their previous stone formation. Specifically, stone analysis to identify the chemical composition was performed in only 41 patients, and a 24-hour urine metabolic study was conducted in only 24 patients.

The recurrence rate was calculated by dividing the number of stone recurrence by the time period between the initial stone diagnosis and the current recurrence, with the time period expressed in years. This calculation is represented by the following equation:
Recurrence rate = (Number of stone recurrence) / (Time period in years).

Table 8: The relation between stone recurrence rate and occupation.

	Number	Mean recurrence rate	P-value
Student	44	0.063	0.003
Unemployed	96	0.068	
Employee	202	0.073	
Manual worker	181	0.092	
Total	523	0.078	

The previous results (Table 8) indicate that the average recurrence rate is higher among employed individuals compared to those who are not employed. Furthermore, recurrence rates are elevated in those with manual occupations compared to those with manual jobs. The calculated P-value for occupational categories was less than 0.05 (P < 0.05), indicating a statistically significant difference. Therefore, we conclude that the risk of kidney stone recurrence is increased in individuals with manual occupations.

DISCUSSION

The study included 964 adult patients presenting with complaints of kidney stones, categorized into four groups based on their occupation. The most common primary complaint was flank pain, reported by 65.7% of patients. The proportion of patients with recurrent kidney stones was 54.3%, and 67.4% of the patient group exhibited one or more metabolic disorders. The most prevalent metabolic disorder was hypercalciuria (46.8%), followed by hypocitraturia (39.3%), and low 24-hour urine volume (28.2%).

Pure calcium oxalate stones were the most frequent type observed in the study sample, accounting for 58.4% of cases.

Analysis of 24-hour urine samples revealed a higher frequency of metabolic disturbances in the urine of patients in the "Manual worker" category, attributed to excessive sweating and dietary habits. Hyperuricosuria and hypocitraturia were the most common disturbances in this group.

Low 24-hour urine volume was the most prevalent metabolic disorder among patients in the "Employed" category, attributed to reduced oral intake during work due to being busy, fewer breaks, and avoiding restroom

visits at the workplace.

The recurrence rate of kidney stones was higher in the "Manual worker" category, followed by the "Employed" category, compared to the other occupational categories, due to the aforementioned reasons.

In discussing this study in the context of existing literature, it is necessary to explore how these findings correlate with or diverge from other significant research in the field of urology about to urinary stones.

The first study by Malieckal et al. (2020) suggests that proper fluid intake, increased access to restrooms, and increased use of potassium citrate may be the best options for those who encounter greater risk for stones because of their occupation.[7]

The second study by Lu et al. (2022) investigates the risk of radiolucent stone formation among workers in a high-temperature workplace and the related risk factors. The study concluded that heat exposure is an independent factor for radiolucent stone development in steel workers, highlighting the need for attention to be paid to those working in similar environments. Workers in high-temperature workplaces with inadequate water supply may exhibit symptoms of chronic dehydration and have increased risk of nephrolithiasis.[8]

CONCLUSION

This study highlights a significant relation between occupation and kidney stone formation, particularly among manual workers who exhibited the highest susceptibility to urinary metabolic disorders and stone recurrence. The findings underscore the importance of analyzing the chemical composition of urinary stones and conducting thorough metabolic evaluations in patients diagnosed with kidney stones. Furthermore, implementing preventive measures, such as ensuring good hydration, is crucial, especially for individuals in high-risk occupations like manual labor, to mitigate stone formation and recurrence.

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