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Research Article

PREVALENCE OF UROLITHIASIS TYPES AND FACTORS OF STONE FORMATION AMONG LOCAL RESIDENTS OF SOUTH WAZIRISTAN

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ABSTRACT

Background: Kidney stone disease (KSD), a widespread public health issue around the globe, is caused by the confluence of demography, contact with the environment, eating choices, and hereditary factors. **Aims:** The current study examined the prevalence of urolithiasis types and factors of stone formation among residents of Waziristan since a rising water consumption (>3 l everyday) is frequently advised by doctors to avoid kidney disease. **Methods:** From 110 renal stone individuals ages 18 to 55. There were 25 women and 85 men in Waziristan, and data on a household residence, daily water intake, and origin of water supply were gathered. Drinking water samples were taken twice a year from the case (high stone frequency) and control (zero stone epidemiologic) locations using the correct techniques. Potential of hydrogen (pH), acidity, total dissolved solutes (TDS), electrical conductivity (EC), and salinity were all measured in the samples collected. To see if there had been any statistically meaningful variations among the case and control regions, mean estimates of the examined variables were evaluated. **Findings:** 53.6% of the patients, we found, drank less than 3 L of water each day. Testing of samples from drinking water reveals calcium oxalate (CaOx) (94%) and struvite (3%), as well as 3% uric acid (UA). TDS levels were around 650 ppm. It was determined that every water sample was fit for human drinking. According to the findings, urolithiasis is quite prevalent in Waziristan and has a wide range of risk variables. **Conclusions:** The most important factor in the development of KSD is the purity of the water, not the quantity drank. Stone formation is influenced by genetic factors as well as higher overall solute concentrations. Supporting and advancing awareness initiatives that focus on the key urolithiasis risk variables is crucial.

KEY WORDS

Renal stones, calcium oxalate (CaOx), urolithiasis, water, calcium phosphate (CaP), Residents

1 | INTRODUCTION

The development of urinal calculi in the urinary channel is referred to that as urolithiasis[1]. Risk indicators for the occurrence of urolithiasis include aging, sex, ethnicity, regional climate, dietary practices, exercise habits, and profession. Additional significant risks include the prevalence of concomitant medical diseases such as diabetes, hypertensive, and being overweight. Although the general likelihood of developing stones varies from nation to nation, it is a global community health issue[2].

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Kidney stones can have major long-term repercussions, indicating that they are notsimply acute episodes, as per current studies. To lessen the impact of kidney stones, however, measures must be undertaken[3]. Kidney stones can potentially raise the cost of medical care. To identify potential risks for urolithiasis, prior research has demonstrated various global efforts by analyzing the occurrence of urolithiasis in various population groups[4]. These worthwhile studies primarily suggest an interventionist study or a research problem, to investigate if the identified risk variables might result in kidney stones. Also to investigate whether treating these potential risks can stop the progression of stone formation[5]. As a result, the overall public's life satisfaction is enhanced[6]. Ecological and biochemical factors play a role in the multifactorial condition known as urolithiasis. One of the main factors that increase the risk of developing stones, particularly in males between the ages of 25 and 70, is exposure to extreme temperatures[7]. Thecrystals that make up kidney stones include calcium oxalate, calcium phosphate, calcium carbonate, uric acid, and cysteine. Kidney stones develop as a consequence of crystal accumulation.

Since kidney stones are a significant burden on national healthcare, sufficient attention must be paid to their prevention. It is generally recommended to drink a lot of water to lower your risk of developing stones and having them return[7]. When the amount of urine voided is less than 1 L/d, the likelihood of developing urinary stones increases dramatically. In individuals who have already experienced stone problems, everyday urine amounts greater than 3 to 3.5 L can stop stone development[8]. Waziristan is more likely than other places to have urolithiasis because of the environment in the area[9]. Properly determining the consequences of urolithiasis rate changes and their potential causes in the local Waziristani community requires the use of an adequate diagnostic approach and well- defined community sampling. The effect of water conditions on the likelihood of stone formation is a matter of debate. There was relatively little research that looked at the connection between renal stone production and watercondition. To determine whether residents of any specific Waziristan geographical region are significantly more likely to develop renal stones. Moreover, to evaluate perhaps drinking water is to blame for the occurrence, our study focuses on the everyday volume of water consumption by individuals withkidney stone conditions. To ascertain the prevalence of renal stones kinds and factors associated with urolithiasis among residents of Waziristan, this studywas conducted.

2 | METHODOLOGY

The participants in this cross-sectional study were South Waziristan locals. As research participants, patients hospitalized at the Waziristan hospital's Urology dept were chosen. There were 110 participants, ages 18 to 55. There were 25 women and 85 men. Through a survey, it attempted to evaluate the prevalence and contributing variables of urolithiasis among the local Waziristani citizens. All Waziristan residents who are18 years of age or older and who agree toengage in the research meet the inclusioncriteria. Individuals who reside outside ofWaziristan, are under the age of 18, or submitted insufficient information weredisqualified. Both renal ultrasonography and plain X- ray film supported the diagnosis of stones. A survey was used to gather data from the study subjects about their ages, sex, place of living, genetic history,amount of water they drink each day, and where they get their water from. Additionally, we looked at the medicalhistories of the patients. We examined data from urine tests related to calcium, oxalate, citrate, potassium, and urate. Patients having histories of unknown metabolism, gastrointestinal diseases, orthose using any medications like steroids or diuretics were not included in this study. The patient populace was divided into groups based on how much waterthey consumed each day.

A questionnaire survey was also developed to determine the causes andprevalence of urolithiasis. Numerous issues were included in the survey and were categorized. 110 individuals with urolithiasis in Waziristan were surveyed to learn more about their daily water intake and the source of their drinkingwater. The survey was filled out with the consent of the respondents. Water samples were taken from cases (high stone occurrence) and controls (no stone occurrence) regions using the correct techniques[11]. Total dissolved solutes and pH were measured in the samples taken. To see whether there werestatistically meaningful distinctionsamong the case and control regions, values obtained of the examined variables were examined.

3 | COLLECTION OF SAMPLES OF WATER

Waziristan's drinkable water was gathered in 500 mL. This water was with slightly elevated density, sterilized, and hygienic polyethylene containers from the locations where we received the greatest amount of

patients (case areas). Additionally, we gathered water from regions with a 0% to 1% incidence of kidney stones (control areas). In each region, water was gathered twice annually. The water was originally released for a while to assure fresh water even before samples were collected. Thebottle was instantly sealed after being filled with water that was free of any acid or air pockets[11]. Following 1 day, the material was examined in our facility after being appropriately marked and kept in an ice refrigerator.

4 | WATER SAMPLE ANALYSIS

Analysis of the pH, total dissolved solutes (TDS), and electrical conductivity of the samples from drinking water was performed (EC). Since pH shows the acidity amount of water and the extent of contamination, it was researched. Another indication of the chemical pollution load of water, the EC provides information on the mineral composition and saltiness of the water. TDS stands fortotal dissolved solids, which is the sumof all the inorganic (such as potassium, calcite, sodium, bicarbonate ions, chloride ions, magnesium, and sulfides) and biological elements in the water. A portable tester from the 35 series of Eutech Devices' multi parameter analyzer was used. This analyzer detects pH, TDS, and EC. The device was originally validated with the appropriate buffermixtures for each variable.

5 | STATISTICAL ANALYSIS

All parameters, including the biographical information about the individuals and their medical records, underwent descriptive evaluation basedon frequencies and percentagedistribution. The evaluation ofurolithiasis-related parameters, including respondent personal information and medical background, was done using cross-tabulation. The precise probabilities test for tiny frequency counts and the Pearson chi-square testwere both used to examine relationships. The production of kidney stones (urolithiasis) related entire variables were included in the modified binary logistic regression model. We employed the Independent sample t- test to determine whether there were statistically meaningful variations between parameters, such as pH, hardness, TDS, and EC. Means andstandard variations were used to describe all the data. Employing SPSS (Statistical package for social sciences) version 25, the p-values were evaluated to determine whether the variables differed substantially across the case and control regions. A p-value of less than 0.05 was regarded as statistically meaningful.

6 | RESULTS

110 individuals with stone formation, ages 18 to 55, who were hospitalized in the Waziristan Section of Urology were included in the research. The table lists the patients' fundamental features (Table 1). The cases were split around 2:1 between males and women, with 85 (93.5%) being men and 25 (27.5%) being women. The likelihood of developing stones was greater (68.2%) among people who led unhealthy lifestyles. The bulk of renal disease in Waziristan are calcium crystals, with calcium oxalate (CaOx) and calcium phosphate (CaP) making up around 94% of them altogether, uric acid (UA) making up about 3%, and struvite 3%, contributing for the remaining. In the urethra, ureter, and renal, stone development was typical. The most prevalent form ofcalcium oxalate in our group was 94%. Their nutritional intake was discovered to be typical (Table 1).

Table 1 Patients' fundamentalfeatures

Characteristic	Value
Age	40.8±7.85
Male	85(93.5)
Female	25(27.5)
Everyday water consumption(<3)	45(53.9)
Everyday water consumption(>3)	40(45.09)
Everyday water consumption(>5)	1(0.1)
Location of stone	Right and left kidney, ureter, and bladder
Calcium oxalate stone	~94
Calcium phosphate stone	~3
Struvite stone	~3

Symptoms	Back pain, flank pain, hematuria, burning sensation while urine.

For 41 individuals (45.09%), the everyday water consumption was greater than 3 L, while for 45 individuals (53.9%), the everyday waterconsumption was little than 3 L. Consuming water sampling from thoseparticular regions was examined for certain characteristics (pH, alkalinity, TDS, EC, and salinity). These findings were contrasted with consuming water from the state's controlled regions. TDS, a major metric that varied across the caseand control sites, was prominent (Table 2).

Table 2 Properties of drinking water in Waziristan and control area

	pH		EC		TDS (ppm)		Alkalinity		Salinity	
	Case area	Control area	Case area	Control area	Case area	Control area	Case area	Control area	Case area	Control area
Waziristan 1st sample	7.63	7.60	342.0	390.0	650	324	54.00	81.00	162.1	184.0
Waziristan 2nd sample	7.64	7.59	345.1	378.0	652	350	55.00	79.5	160.5	180.6
Average Mean ±S.D	7.5 ±0.1	7.85 ± 0.23	350.1 ±129	380.2 ±150	651 ± 101.2	324 ±14.2	53 ±25	80 ±26.0	160.2± 58.0	179.3± 55.4
p-value	0.104		0.308		0.09		0.912		0.108	

pH: The potential of hydrogen; EC: Electrical conductivity; TDS: total dissolved solids; SD: standard deviation

Five individuals (6%) who took part in the study had chronic renal disorder, neuropathic bladder, gastroenteritis, reflex disease, rheumatoid arthritis, hyperuricemia, and smoking. 28 (30%)of the respondents did have a family background of cousin marriage, which is a factor of urolithiasis, whereas 82 (90%)of the individuals did. Comorbid disorders account for 6% of stone-forming causes. Among the individuals, 1.1% of diabetic individuals and 1% of smokers reported having renalstones. Compared to 1% of other individuals, 2.1% of those with hyperuricemia and neurogenic bladder reported having urolithiasis. 1.3% of individuals with rheumatoid arthritis had renal stones, which was found. Furthermore, compared to 10.7% of participants who did have a family background of cousin marriage, 90% of patients with this history had renal stones (p= 0.001) (Table 3).

Table 3 Medical history of the participants

Medical history	No of participants	Percentage (%)
Smoker (Yes)	2	1%
Smoker (No)	Nill	Nill
Diabetes (Yes)	2	1%
Diabetes (No)	Nill	Nill
Hyperuricemia (Yes)	3	2.1%
Hyperuricemia (No)	Nill	Nill
Neurogenic bladder (Yes)	2	0.8%
Neurogenic bladder (No)	Nill	Nill
Rheumatoid arthritis (Yes)	2	1.3%
Rheumatoid arthritis (No)	Nill	Nill
History of stones (Yes)	14	13.7
History of stones (No)	Nill	Nill

7 | DISCUSSION

Among the most common conditions affecting the urine system is urolithiasis[12]. It is a complex issue that may be influenced by factors like age, sex, nutrition, and environment[13]. Consequently, this study was done to determine the prevalence of various urolithiasis kinds and factors involved among Waziristan residents. There were 110 participants, calcium oxalate (94%) struvite (3%), and uric acid (3%). In contrast to a different

study performed by Mitra et al.[12], our investigation revealed a significant frequency of urolithiasis within the people of Waziristan. The prevalence percentage ranges from 4% to 20% worldwide, but[13]. Data study revealed several modified risk factors for urolithiasis development. These included being male, aged, smoking, having the concomitant condition, and having a genetic predisposition. In contrast, according to studies [14,15,] it was noted that male subjects were more likely than female individuals to acquire urolithiasis. In addition, a retrospective study conducted in Pakistan reveals that males (74.5%) have a greater prevalence of urolithiasis, with calcium oxalate becoming the most common kind. Nevertheless, the preventive properties of estrogen could be to blame for this sexual identity discrepancy. The observation that this sexual identity discrepancy narrows for post-menopausal females [16] would indeed be better evidence for such an interpretation.

KSD is a serious health problem, and its prevalence is rising daily. Renal stone production is made more likely by a limited consumption of fluids, particularly water[11]. KSD is also influenced by personal variations such as color, culture, eating preferences, and heredity[12]. Nevertheless, in this study, we simply looked at if there was any correlation between the production of kidney stones and water cleanliness. We used the 3 L/d threshold value suggested by the study's doctor. This taking accounts the patients' employment level, outside hobbies, and regular dietary habits as well as the subtropical to the tropical environment of Waziristan. In light of this, we discovered that 53.6% of the participants in the current study drank just under 3 L of water daily. This conclusion was consistent with our earlier case-control investigation, which revealed that patients had a considerably greater predisposition to drink little water compared to controls ($p=0.0002$)[14]. Since KSD is influenced by temperature and geographical environment, our first goal was to pinpoint the specific areas of Waziristan that had the highest proportion of KSD cases.

Studies have looked into the connection between kidney stone development and the purity of water[15]. Therefore, the goal of our research was to see whether there are any geographical regions where people are significantly more likely to develop kidney stones. Also, whether KSD is more common due to poor drinking water sanitation. Tap water and fresh water from manual pumping are the most readily available sources for ingestion. Since the majority of our sufferers stay in local residences where having the availability of purified water is a myth. As a result, we took a sample of that water directly from the origin.

Our analysis revealed that the pH ranged from 7.63 to 7.06 in the samples we used. Even though pH seems to have no direct influence on individual well-being[16], it does have a close relationship with several other water components. An EC level between 0 and 800 S/cm indicates that the water is acceptable for drinking. The EC measures how salty the water is. The mean EC values of the samples collected were generally significant (342 and 390 S/cm, correspondingly), indicating that the water contained significant levels of dissolved salts. Elevated EC values also point to inorganic industrial effluents, which can be linked to the sampled site's excessive salinity and mineral composition. According to a literature review, drinking water with a lot of salt for an extended period may result in renal stones. We assessed TDS, which represents the total quantity of both inorganic and organic elements found in water, in addition to the EC[17]. We discovered that the TDS levels in each of our tests were below the WHO guideline threshold of 1,000 ppm. TDS readings also reveal how the water samples behave in terms of salinity[18]. The greatest mean salinity level in our sample, 650 ppm, was significantly below the WHO-recommended maximum acceptable range. The alkalinity levels of the samples collected were also below the WHO guidelines' tolerable and maximum allowable limits (250 mg/L and 550 mg/L, respectively).

The effect of water quality on renal stone production is still up for debate. The geographical prevalence of urinary calculus and water hardness was not shown to be significantly correlated in any of the investigations[19, 20]. Nevertheless, according to a different study, drinking hard water raises the risk of stone production. This was done by encouraging a 50% elevation in urine calcium percentage[21]. Because drinking soft water has been linked to a reduced chance of developing kidney stones including calcium, those authors advised against drinking hard water. Urolithiasis incidence increased as a result of drinking more hard water, according to a study[21]. Hard consumption is water as the molecular total of calcium and magnesium present in water and is essentially water with a higher calcium concentration. Although the case region is not lower than the standard value of 500 mg/L advised by the WHO as well as the ICMR. In this research, samples of the controls and the subject area were somewhat severe to tough. Therefore, it is toxic to locals and leads to the development of calcium oxalate crystals. Additionally, we looked for any notable discrepancies between the case and control regions' expected numbers for the examined parameters (p-value< 0.05). Our investigation showed that all the

groundwater tests studied were within the highest allowable level of the WHO and the ICMR guidelines. This was according to drinking water purity, which is a basic prerequisite for living a healthful lifestyle. The drawback of our research was that data were only collected from Waziristan hospitals. This research prevented us from drawing a more complete view of the occurrence of stones. A prospectively longitudinal study may also be more effective at identifying any important links between risk variables and the onset of urolithiasis.

8 | CONCLUSION

Urolithiasis is highly prevalent among Waziristan locals, according to survey respondents. The most common type of stone is calcium oxalate. Additionally, increasing total solute levels and hereditary causes also contribute to the production of stones. It was discovered that the presence of kidney stones and the water quality in Waziristan were related. The male sex, higher total solute concentrations, and a record of cousin marriage in the family were important risk factors for urolithiasis. The secondary cause of renal stones is comorbidity. Nevertheless, it is crucial to encourage and encourage empowerment strategies that focus on the significant urolithiasis risk factors. To comprehend the link between risk indicators and acquiring urolithiasis, more research should be done.

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