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ORIGINAL RESEARCH

# Urolithiasis Burden in Somalia: Associated Factors and Regional Distribution Among Patients Undergoing CT Scan in Selected Centers in Mogadishu

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**Background:** Urolithiasis is a significant global health burden with varying prevalence rates across different regions. In Somalia, data on the prevalence and risk factors associated with urinary stone disease are limited. This study aimed to investigate the prevalence and associated factors of urolithiasis among patients undergoing CT scans at selected centers in Mogadishu.

**Methods:** This cross-sectional study was conducted between January and May 2024 at three medical facilities in Mogadishu, Somalia. This study included 211 patients who underwent non-contrast abdominopelvic CT scans. Data were collected using a structured questionnaire that covered sociodemographic characteristics, lifestyle habits, dietary patterns, and clinical data. Statistical analysis was performed using R statistical software version 4.4.0, employing descriptive statistics, bivariate analyses, and logistic regression.

**Results:** The study revealed a prevalence of 26.07% (95% CI: 20.28–32.54%) for urolithiasis. Significant associations were found with marital status (married individuals showing higher risk, AOR 30.42, 95% CI 3.32–278.58) and education level (higher education showing a protective effect). Dietary factors played a crucial role, with irregular dairy consumption (AOR 37.05, 95% CI 3.44–398.62) and occasional meat consumption (AOR 3.58, 95% CI 1.41–9.08) showing increased risk. Previous diagnosis of urolithiasis (AOR 5.2, 95% CI 1.19–22.81) and history of UTIs (AOR 3.43, 95% CI 1.7–6.95) were significant risk factors.

**Conclusion:** This study identified a substantial prevalence of urolithiasis in Mogadishu, with significant associations between sociodemographic factors, dietary habits, and medical history. These findings emphasize the need for comprehensive screening programs and targeted interventions, particularly for high-risk individuals.

**Keywords:** urolithiasis, risk factors, CT scan, Somalia, prevalence

## Introduction

Urolithiasis is a prevalent condition characterized by calculi formation within the urinary tract, influenced by a combination of environmental, dietary, and genetic factors.[1–3] While urolithiasis is generally manageable with proper treatment, fatal complications such as urosepsis and severe bleeding have been reported.[4] A longitudinal study in England and Wales documented 1954 deaths due to urolithiasis over 15 years, with an annual increment of 3.8 deaths.[5] The increasing mortality rate highlights the need for early diagnosis, proper management, and prevention. Urolithiasis is a growing global health concern, with prevalence rates ranging from 1% to 20% worldwide.[6,7] While its overall incidence has increased over the past 20–30 years, developing countries have seen a sharper rise due to changing



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dietary patterns and climate-related dehydration.[6,8,9] In Sub-Saharan Africa, lifestyle modifications have contributed to the rising incidence of kidney stones.[7] Although the age-standardized incidence rate has declined globally, from 1696.2 cases per 100,000 population in 1990 to 1394.0 cases per 100,000 in 2019, the total number of cases, deaths, and disability-adjusted life years (DALYs) attributed to urolithiasis has increased.[10] Urolithiasis also imposes a significant healthcare cost burden, with the number of affected individuals doubling in the United States over the past two decades.[11] Its recurrence rate, ranging from 10% to 75%, further exacerbates this economic impact,[12] further adds to this economic impact. Given the increasing prevalence and substantial economic burden, there is a need for effective prevention strategies and adaptable policies to address the global burden of urolithiasis.[13,14]

Several demographic, environmental, and metabolic factors contribute to stone formation. The peak incidence occurs in the fifth to sixth decades, with a persistent male predominance, although the gender gap has narrowed[15] Genetic predisposition and familial factors play a role, particularly in pediatric cases.[16,17] Environmental factors, such as climate, seasonal variations, and temperature, also significantly influence urolithiasis risk.[15] Geographical differences and lifestyle factors contribute to varying incidence rates across Asian countries, ranging from 1% to 19.1%.[18] In addition, chronic urinary tract infections (UTIs) are associated with stone formation, as they alter urinary pH, promote bacterial colonization, and contribute to the formation of struvite calculi.[19–21] Dietary patterns have a profound impact on urolithiasis risk. High consumption of animal protein, sodium, and oxalate increases susceptibility, while adequate hydration, calcium intake, and consumption of dairy products may have a protective effect.[15,18] Dehydration is a particularly strong risk factor, emphasizing the importance of maintaining adequate fluid intake.[15] Additionally, metabolic disorders such as obesity, hypertension, diabetes, and metabolic syndrome are linked to an increased risk of kidney stones, and urolithiasis itself is considered a systemic disorder associated with chronic kidney disease, bone loss, and cardiovascular complications.[22]

Given the relevance of hydration, dietary, and socioeconomic factors, this study aimed to investigate the prevalence and associated risk factors of urolithiasis among patients undergoing CT scans in selected centers in Mogadishu. A prior retrospective study in the same setting reported a 14.8% prevalence of urolithiasis; however, it was limited to basic prevalence estimates and lacked detailed demographic and risk factor analysis.[23] The current study expands upon these findings by incorporating a comparative analysis of affected and unaffected groups, as well as assessing dietary habits, water intake, and occupational factors, which were not explored previously. Emerging research highlights the role of water composition in stone formation, with studies suggesting that ion balance, rather than overall mineral content, influences calcium oxalate precipitation, the most common urinary stone type.[24] Furthermore, new treatment strategies, such as herbal-based medical expulsive therapy (MET) combining boldine, Phyllanthus niruri, and Ononis spinosa, have demonstrated improved stone expulsion rates and reduced pain in patients with ureteral stones.[9] By examining demographic, lifestyle, and clinical variables, this study aims to contribute to a better understanding of urolithiasis in this region, providing a foundation for more effective public health interventions.

# Methods and Materials

## Study Design and Setting

This study used a cross-sectional design to determine the prevalence of urolithiasis and its related factors among patients undergoing abdominopelvic CT scans. The study was conducted in three medical facilities: the urology department of Dr. Sumait Hospital, Kamil Diagnostic Center, and Sahan Diagnostic Center, all situated in Mogadishu, Somalia. These facilities were selected based on their high patient volume and availability of advanced CT imaging technology.

## Study Population and Sampling

The study population comprised patients who underwent non-contrast abdominopelvic CT scans between January 2024 and May 2024 at the selected study sites. The inclusion criteria included patients of all ages and sexes who provided informed consent. Patients who underwent contrast-enhanced CT scans, whether oral or intravenous, were excluded.

The sample size was determined using the Kish and Leslie formula, as follows:

$$n = \frac{Z^2 p(1-p)}{e^2}$$

n= Sample Size

Z= Confidence level at 95% (standard value of 1.96)

P= Estimated Prevalence 14.8%

e= Marginal error

where n represents the desired sample size, Z is 1.96 (CI 95%) and e is the margin of error, set at 5% (0.05) with a previously reported urolithiasis prevalence of 14.8% in Somalia.[23] The final sample size was increased to 212 participants to accommodate a 10% nonresponse rate. A consecutive sampling technique was used, meaning all eligible patients who met the inclusion criteria during the study period were included. While consecutive sampling ensures feasibility, it may introduce selection bias due to the non-random nature of participant recruitment. This limitation has been acknowledged in the Limitations section of the manuscript.

## Data Collection and Measures

The data were collected using structured questionnaires. The questionnaire covered various sections including socio-demographic characteristics, lifestyle habits, dietary patterns, and clinical data. The questionnaire was developed based on validated instruments used in previous urolithiasis studies and was adapted to suit the local context. It underwent a pilot test with 15 participants to assess clarity, reliability, and cultural appropriateness. Necessary modifications were made based on pilot feedback before full implementation. CT scans were used as the primary diagnostic tool for urolithiasis and were conducted at the designated centers using advanced imaging technology: Neosoft 64-slice scanner (Kamil Diagnostic Center), Siemens 128-slice scan ner (Sahan Diagnostic Center), and Canon 160-slice scanner (Dr. Sumait Hospital). CT results were interpreted by an experienced radiologist. Eligible participants were approached after their CT scans when they were thoroughly informed about the study's objectives and their potential involvement. They were informed that their participation was entirely voluntary, with the option to withdraw at any time without any consequences. Participants were also assured that all collected information would remain strictly confidential and would be used exclusively for research purposes. Informed consent was obtained before administering the questionnaire to gather relevant data.

## Data Analysis and Interpretation

The collected data were analyzed using R statistical software version 4.4.0. Descriptive statistics were used to determine frequencies and percentages. Binary logistic regression was used as the primary statistical method to assess the association between variables and urolithiasis. First, we performed univariate logistic regression to identify potential predictors of urolithiasis. Variables with a p-value of less than 0.25 in the univariate analysis were selected as candidates for multivariate binary logistic regression to adjust for confounding factors. In the multivariate model, only variables with p-values of less than 0.05 were considered statistically significant. The results of the regression analysis are reported as p-values, odds ratios (OR), and 95% confidence intervals (CI). Data are presented in a clear format using tables and figures for ease of interpretation.

# Results

## Prevalence of Urolithiasis

A total of 211 participants were included in the study, of whom 55 (26.07%) were diagnosed with urolithiasis based on their CT scan results (Table 1 and Figure 1). The 95% confidence interval for the prevalence of urolithiasis was 20.28% to 32.54%.

## Demographic Characteristics and Urolithiasis

The study participants had a mean age of 42.25 years, with a standard deviation of 20.28 (Table 2). The distribution across age groups was uneven, with a notably smaller proportion of participants under 18 years (7.58%) compared to the 18–40 age group (45.97%) and those over 40 years (46.45%). There were slightly more male participants (54.98%) than female participants (45.02%). Most participants (52.13%) had an education level below secondary school, followed by

**Table 1** Prevalence of Urolithiasis

| Characteristics | Frequency (%) | 95% Confidence Interval |
|---|---|---|
| Non-urolithiasis | 156 (73.93%) | 67.46% - 79.72% |
| Urolithiasis | 55 (26.07%) | 20.28% - 32.54% |

30.33% who had completed secondary school and 16.11% who had achieved a bachelor's degree (Figure 2). Only 1.42% of participants had postgraduate or professional degrees, leading to small sample sizes in certain educational categories. Almost half of the participants (48.82%) were unemployed, 32.23% were employed, and 18.96% were retired. Regarding marital status, 50.71% were married, 28.44% were single, and 20.85% were either divorced or widowed.2 Geographically, most of the participants (49.76%) came from the Benadir region. Other areas represented included Galmudug state (10.90%), Hirshabelle state (11.85%), Jubbaland state (10.43%), Puntland state (9.00%), and Southwest state (8.06%).

## Associations Between Sociodemographic Factors and Urolithiasis

Univariate analysis revealed that sex, marital status, and education level had a p-value less than 0.25 and were thus considered for multivariate analysis. In the multivariate analysis, both marital status and education level were significantly associated with the occurrence of urolithiasis, whereas sex was not significant. Married participants showed a notably elevated risk of urolithiasis compared with divorced or widowed participants (AOR 30.42, 95% CI 3.32–278.58, p=0.003). This increased likelihood of urolithiasis was also evident among single participants compared to the divorced/widowed group (AOR 42.45, 95% CI 4.03–447.35, p=0.002). Higher education levels were associated with a decreased risk of urolithiasis (Table 3). Compared to those with less than secondary school education, individuals

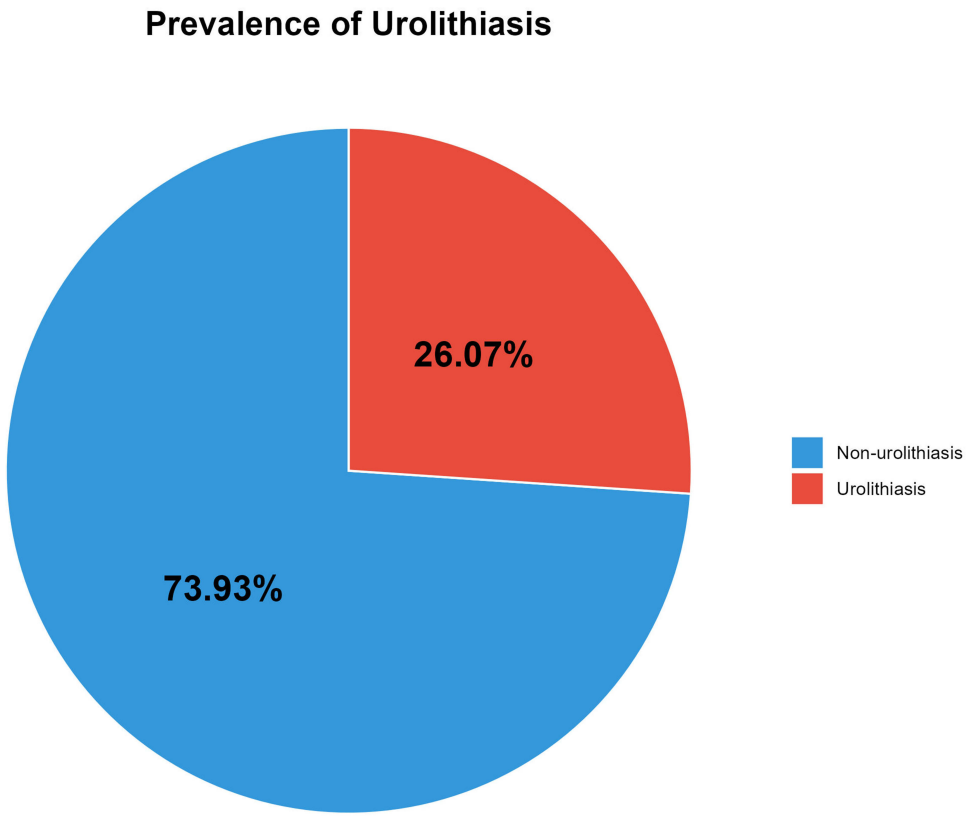


**Figure 1** Prevalence of urolithiasis.

**Table 2** Demographic Characteristics

| Variable | Frequency (N) | Percentage (%) |
|---|---|---|
| **Age Group** | | |
| 18–40 | 97 | 45.97 |
| <18 | 16 | 7.58 |
| >40 | 98 | 46.45 |
| Age (years) | Mean ± SD: 42.25 ± 20.28 | |
| **Sex** | | |
| Female | 95 | 45.02 |
| Male | 116 | 54.98 |
| **Education Status** | | |
| Bachelor's degree | 34 | 16.11 |
| Less than Secondary School | 110 | 52.13 |
| Postgraduate/Professional Degree | 3 | 1.42 |
| Secondary School | 64 | 30.33 |
| **Employment Status** | | |
| Employed | 68 | 32.23 |
| Retired | 40 | 18.96 |
| Unemployed | 103 | 48.82 |
| **Marital Status** | | |
| Divorced/Widowed | 44 | 20.85 |
| Married | 107 | 50.71 |
| Single | 60 | 28.44 |
| **Region** | | |
| Benadir region | 105 | 49.76 |
| Galmudug state | 23 | 10.90 |
| Hirshabelle state | 25 | 11.85 |
| Jubbaland state | 22 | 10.43 |
| Puntland state | 19 | 9.00 |
| Southwest state | 17 | 8.06 |

who had completed secondary school (AOR 0.36, 95% CI 0.16–0.82, p=0.015) or had a bachelor's degree (AOR 0.19, 95% CI 0.06–0.62; p=0.005) were significantly less likely to experience urolithiasis.

## Associations Between Lifestyle Factors and Urolithiasis

In the univariate analysis, daily water intake, source of water, high salt consumption, dairy product consumption, leafy green consumption, meat consumption, activity level, and smoking status were all considered for inclusion in the multivariate analysis because they had a p-value of less than 0.25. However, only dairy products and meat consumption were significantly associated with urolithiasis in the multivariate analysis. Participants who consumed dairy products occasionally (AOR 16.86, 95% CI 1.59–178.5, p=0.019) or rarely (AOR 37.05, 95% CI 3.44–398.62, p=0.003) compared to daily consumption had significantly higher odds of having urolithiasis (Table 4). Similarly, those who consumed meat occasionally (AOR 3.58, 95% CI 1.41–9.08, p=0.007) compared to daily consumption had significantly higher odds of urolithiasis. Daily water intake was significant in the univariate analysis (OR 0.19, 95% CI 0.07–0.52, p=0.001) but not in the multivariate analysis. Although it initially appeared to be a protective factor, its lack of significance in the

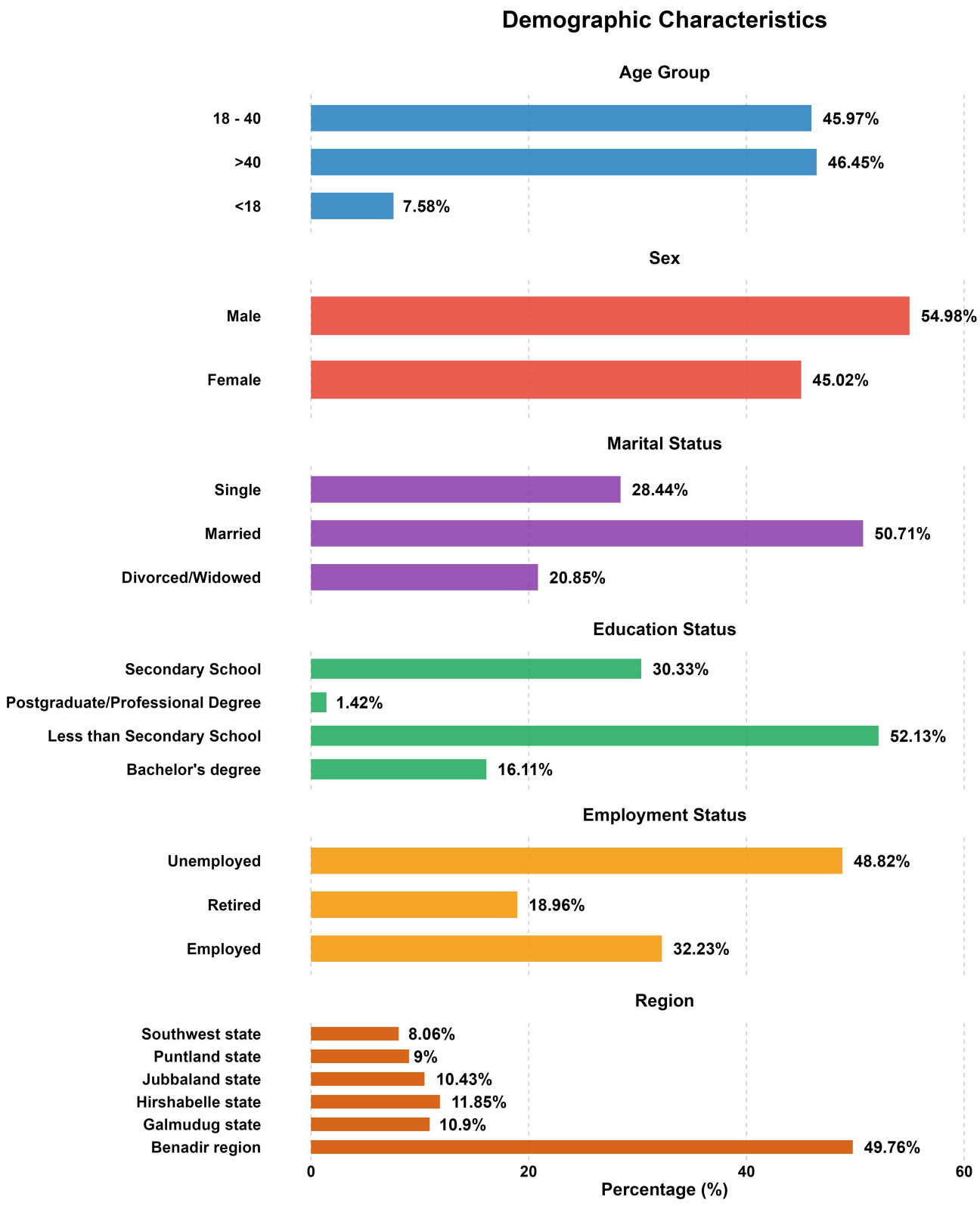


**Figure 2** Demographic Characteristics.

**Table 3** Associations Between Sociodemographic Factors and Urolithiasis

| Variable | Urolithiasis | | OR (95% CI) | P- value | AOR (95% CI) | P- value |
|---|---|---|---|---|---|---|
| | No, n (%) | Yes, n (%) | | | | |
| **Age Group** | | | | | | |
| <18 | 13 (81.2%) | 3 (18.8%) | 1.00 | | | |
| 18–40 | 70 (72.2%) | 27 (27.8%) | 1.1 (0.36–3.35) | 0.863 | | |
| >40 | 73 (74.5%) | 25 (25.5%) | 1.03 (0.34–3.12) | 0.962 | | |
| Mean ± SD | 42.7 ± 20.5 | 40.9 ± 19.9 | | | | |
| **Sex** | | | | | | |
| Female | 79 (83.2%) | 16 (16.8%) | 1.00 | | 1.00 | |
| Male | 77 (66.4%) | 39 (33.6%) | 2.5 (1.29–4.84) | 0.007* | 2 (0.92–4.37) | 0.081 |
| **Education** | | | | | | |
| Less than Secondary School | 75 (68.2%) | 35 (31.8%) | 1.00 | | 1.00 | |
| Secondary School | 50 (78.1%) | 14 (21.9%) | 0.6 (0.29–1.23) | 0.162 | 0.36 (0.16–0.82) | 0.015* |
| Bachelor's degree | 29 (85.3%) | 5 (14.7%) | 0.37 (0.13–1.04) | 0.058 | 0.19 (0.06–0.62) | 0.005* |
| Postgraduate/Professional Degree | 2 (66.7%) | 1 (33.3%) | 1.07 (0.09–12.22) | 0.956 | 0.45 (0.04–5.49) | 0.530 |
| **Employment** | | | | | | |
| Employed | 47 (69.1%) | 21 (30.9%) | 1.00 | | | |
| Retired | 34 (85.0%) | 6 (15.0%) | 0.39 (0.14–1.08) | 0.071 | | |
| Unemployed | 75 (72.8%) | 28 (27.2%) | 0.84 (0.43–1.64) | 0.601 | | |
| **Marital Status** | | | | | | |
| Divorced/Widowed | 43 (97.7%) | 1 (2.3%) | 1.00 | | 1.00 | |
| Married | 71 (66.4%) | 36 (33.6%) | 21.8 (2.88–164.82) | 0.003* | 30.42 (3.32–278.58) | 0.003* |
| Single | 42 (70%) | 18 (30%) | 18.43 (2.35–144.32) | 0.006* | 42.45 (4.03–447.35) | 0.002* |
| **Region** | | | | | | |
| Benadir region | 77 (73.3%) | 28 (26.7%) | | | | |
| Galmudug state | 14 (60.9%) | 9 (39.1%) | 1.77 (0.69–4.54) | 0.236 | | |
| Hirshabelle state | 17 (68.0%) | 8 (32.0%) | 1.29 (0.5–3.33) | 0.593 | | |
| Jubbaland state | 18 (81.8%) | 4 (18.2%) | 0.61 (0.19–1.96) | 0.408 | | |
| Puntland state | 17 (89.5%) | 2 (10.5%) | 0.32 (0.07–1.49) | 0.148 | | |
| Southwest state | 13 (76.5%) | 4 (23.5%) | 0.85 (0.25–2.81) | 0.785 | | |

**Note:** * denotes p-values that are statistically significant at the specified threshold ($p < 0.05$).

**Table 4** Associations Between Lifestyle Factors and Urolithiasis

| Variable | Urolithiasis | | OR (95% CI) | P- value | AOR (95% CI) | P- value |
|---|---|---|---|---|---|---|
| | No, n (%) | Yes, n (%) | | | | |
| **BMI Category** | | | | | | |
| <18.5 | 21 (80.8%) | 5 (19.2%) | 1 | | | |
| 18.5–23.9 | 63 (67.7%) | 30 (32.3%) | 1.94 (0.67–5.63) | 0.224 | | |
| >24 | 70 (77.8%) | 20 (22.2%) | 1.2 (0.4–3.59) | 0.744 | | |
| BMI (Mean ± SD) | 23.8 ± 4.88 | 23.0 ± 3.36 | | | | |
| **Daily Water Intake** | | | | | | |
| Less than 1 Litre | 91 (66.4%) | 46 (33.6%) | 1 | | | |
| 1 Litre | 51 (91.1%) | 5 (8.9%) | 0.19 (0.07–0.52) | 0.001* | | |
| 2 Litres | 12 (85.7%) | 2 (14.3%) | 0.33 (0.07–1.54) | 0.157 | | |
| More than 2 Litres | 3 (75%) | 1 (25%) | 0.99 (0.09–11.2) | 0.993 | | |

(*Continued*)

**Table 4** (Continued).

| Variable | Urolithiasis | | OR (95% CI) | P- value | AOR (95% CI) | P- value |
|---|---|---|---|---|---|---|
| | No, n (%) | Yes, n (%) | | | | |
| **Source of water** | | | | | | |
| Bottled water | 39 (79.6%) | 10 (20.4%) | 1 | | | |
| Tap water | 115 (72.3%) | 44 (27.7%) | 1.49 (0.69–3.24) | 0.313 | | |
| Well water | 2 (66.7%) | 1 (33.3%) | 1.95 (0.16–23.73) | 0.600 | | |
| **High salt consumption** | | | | | | |
| No | 122 (71.3%) | 49 (28.7%) | 1 | | | |
| Yes | 34 (85.0%) | 6 (15.0%) | 0.44 (0.17–1.11) | 0.083 | | |
| **Dairy product consumption** | | | | | | |
| Daily | 39 (95.1%) | 2 (4.9%) | 1.00 | | 1.00 | |
| Occasionally | 80 (75.5%) | 26 (24.5%) | 14.23 (3.16–64.1) | 0.001* | 16.86 (1.59–178.5) | 0.019* |
| Rarely | 37 (57.8%) | 27 (42.2%) | 6.34 (1.43–28.07) | 0.015* | 37.05 (3.44–398.62) | 0.003* |
| **Leafy greens consumption** | | | | | | |
| Daily | 8 (72.7%) | 3 (27.3%) | 1 | | | |
| Occasionally | 95 (72.5%) | 36 (27.5%) | 0.81 (0.19–3.4) | 0.768 | 0.300 | |
| Rarely | 53 (76.8%) | 16 (23.2%) | 1.01 (0.25–4.02) | 0.988 | | |
| **Meat consumption** | | | | | | |
| Daily | 67 (85.9%) | 11 (14.1%) | 1 | | | |
| Occasionally | 67 (63.2%) | 39 (36.8%) | 1.38 (0.43–4.42) | 0.583 | 3.58 (1.41–9.08) | 0.007* |
| Rarely | 22 (81.5%) | 5 (18.5%) | 3.55 (1.67–7.51) | 0.001* | 1.13 (0.25–5.06) | 0.869 |
| **Activity level** | | | | | | |
| Sedentary | 99 (71.7%) | 39 (28.3%) | 1 | | | |
| Light exercise | 34 (82.9%) | 7 (17.1%) | 0.52 (0.21–1.28) | 0.155 | | |
| Moderate exercise | 19 (79.2%) | 5 (20.8%) | 0.67 (0.23–1.91) | 0.452 | | |
| Intense exercise | 4 (50.0%) | 4 (50.0%) | 2.54 (0.6–10.66) | 0.203 | | |
| **Smoking Status** | | | | | | |
| Non-smoker | 145 (73.2%) | 53 (26.8%) | 1 | | | |
| Former smoker | 8 (88.9%) | 1 (11.1%) | 0.34 (0.04–2.8) | 0.317 | | |
| Current smoker | 3 (75.0%) | 1 (25.0%) | 0.91 (0.09–8.96) | 0.937 | | |
| **Medications** | | | | | | |
| None | 102 (73.4%) | 37 (26.6%) | 1 | | 1.00 | |
| Diuretics | 2 (14.3%) | 12 (85.7%) | 3.68 (2.59–5.21) | <0.001* | 0.01 (0–0.11) | <0.001* |
| Diuretics, PPI | 7 (77.8%) | 2 (22.2%) | 0.05 (0.01–0.21) | <0.001* | 47.41 (4.85–463.37) | 0.001* |
| PPI | 45 (91.8%) | 4 (8.2%) | 0.95 (0.19–4.76) | 0.953 | 1.51 (0.23–9.95) | 0.670 |

**Note:** * Denotes p-values that are statistically significant at the specified threshold ($p < 0.05$).

multivariate analysis suggests that other factors, such as dietary intake or metabolic conditions, may have a stronger influence on the risk of urolithiasis.

## Associations Between Medical History and Urolithiasis

In the multivariate analysis, a prior diagnosis of urolithiasis, a history of diabetes, and a history of urinary tract infections (UTI) were identified as significant factors related to urolithiasis. Individuals with a previous diagnosis of urolithiasis were significantly more likely to have urolithiasis (AOR 5.2, 95% CI 1.19–22.81, p=0.029).7 Conversely, having a history of diabetes was associated with a significantly lower likelihood of urolithiasis (AOR 0.11, 95% CI 0.03–0.38, p=0.001).8 A history of UTI was linked to a significantly higher chance of urolithiasis (AOR 3.43, 95% CI 1.7–6.95, p=0.001). Although family history of urolithiasis and diuretic use were significant in the univariate analysis, they were not retained as significant factors in the multivariate analysis (Table 5). This suggests that their association with urolithiasis may be confounded by other stronger predictors, which is further explored in the Discussion section.

**Table 5** Associations Between Medical History and Urolithiasis

| Variable | Urolithiasis | | OR (95% CI) | P- value | AOR (95% CI) | P- value |
|---|---|---|---|---|---|---|
| | No n (%) | Yes n (%) | | | | |
| **Previously diagnosed with Urolithiasis** | | | | | | |
| No | 153 (76.5%) | 47 (23.5%) | 1 | | 1 | |
| Yes | 3 (27.3%) | 8 (72.7%) | 8.68 (2.21–34.05) | 0.002* | 5.2 (1.19–22.81) | 0.029* |
| **Previous diagnosis of urolithiasis in family member** | | | | | | |
| No | 113 (72.0%) | 44 (28.0%) | 1 | | | |
| Yes | 43 (79.6%) | 11 (20.4%) | 0.66 (0.31–1.39) | 0.271 | | |
| **History of Diabetes** | | | | | | |
| No | 117 (69.2%) | 52 (30.8%) | 1 | | 1 | |
| Yes | 39 (92.9%) | 3 (7.1%) | 0.17 (0.05–0.59) | 0.005* | 0.11 (0.03–0.38) | 0.001* |
| **History of Hypertension** | | | | | | |
| No | 129 (72.5%) | 49 (27.5%) | 1 | | | |
| Yes | 27 (81.8%) | 6 (18.2%) | 0.59 (0.23–1.5) | 0.266 | | |
| **History of UTI** | | | | | | |
| No | 103 (81.1%) | 24 (18.9%) | 1 | | 1.00 | |
| Yes | 53 (63.1%) | 31 (36.9%) | 2.51 (1.34–4.7) | 0.004* | 3.43 (1.7–6.95) | 0.001* |
| **History of gout or severe joint pain** | | | | | | |
| No | 146 (73.4%) | 53 (26.6%) | 1 | | | |
| Yes | 10 (83.3%) | 2 (16.7%) | 0.55 (0.12–2.6) | 0.451 | | |

**Note:** * Denotes p-values that are statistically significant at the specified threshold ($p < 0.05$).

## Symptoms and Pain Characteristics in Urolithiasis Patients

All 55 participants who were diagnosed with urolithiasis experienced pain (Table 6). The most reported symptom was increased urinary frequency, affecting 47 patients (85.45%), followed closely by an increased urge to urinate, reported by 50 patients (90.91%). Nausea or vomiting was also prevalent, experienced by 52 patients (94.55%). Flank pain was the most frequent location, affecting 29 patients (52.73%). Dull, heavy ache was the most common type of pain reported by

**Table 6** Symptoms and Pain Characteristics in Urolithiasis Patients

| Variable | Frequency (N) | Percent (%) |
|---|---|---|
| **Increased frequency of urination** | | |
| Yes | 47 | 85.45 |
| No | 8 | 14.55 |
| **Increased urge to urinate** | | |
| Yes | 50 | 90.91 |
| No | 5 | 9.09 |
| **Pain or burning sensation during urination** | | |
| Yes | 29 | 52.73 |
| No | 26 | 47.27 |
| **Blood in urine** | | |
| No | 44 | 80.00 |
| Yes | 11 | 20.00 |
| **Changes in urine color** | | |
| Yes | 46 | 83.64 |
| No | 9 | 16.36 |
| **Urine color change** | | |
| Dark yellow | 37 | 67.27 |
| Brown | 9 | 16.36 |
| No | 9 | 16.36 |

(*Continued*)


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**Table 6** (Continued).

| Variable | Frequency (N) | Percent (%) |
|---|---|---|
| **Nausea or vomiting** | | |
| Yes | 52 | 94.55 |
| No | 3 | 5.45 |
| **Fever or chills** | | |
| No | 39 | 70.91 |
| Yes | 16 | 29.09 |
| **Gravel or stones in urine** | | |
| No | 46 | 83.64 |
| Yes | 9 | 16.36 |
| **Pain** | | |
| Yes | 55 | 100.00 |
| **Pain location** | | |
| Flank | 29 | 52.73 |
| Flank, Groin | 14 | 25.45 |
| Groin | 5 | 9.09 |
| Flank, Lower abdomen | 4 | 7.27 |
| Other combinations | 3 | 5.46 |
| **Pain side** | | |
| Left side | 19 | 34.55 |
| Both | 18 | 32.73 |
| Right side | 18 | 32.73 |
| **Type of pain** | | |
| Dull ache (heaviness) | 40 | 72.73 |
| Colicky (comes and goes) | 14 | 25.45 |
| No | 1 | 1.82 |
| **Pain trigger** | | |
| Physical activity | 43 | 78.18 |
| Slight movement | 5 | 9.09 |
| No | 3 | 5.45 |
| During urination | 2 | 3.64 |
| Physical activity, Any movement | 1 | 1.82 |
| Physical activity, Slight movement | 1 | 1.82 |
| **Duration of symptoms** | | |
| <2 years | 11 | 20.00 |
| 2–5 years | 28 | 50.91 |
| >5 years | 16 | 29.09 |
| Mean ± SD | 5.12 ± 5.48 | |

40 patients (72.73%). Physical activity (78.18% of patients) and even slight movements (9.09%) were frequently identified as pain triggers. The average duration of symptoms was 5.12 years, with a standard deviation of 5.48.

## Discussion

This study revealed a substantial prevalence of urolithiasis (26.07%) among patients undergoing CT scans in selected centers in Mogadishu, with a 95% confidence interval ranging from 20.28% to 32.54%. This prevalence rate is notably higher than our previously reported figures in the region, suggesting a potentially increasing burden of urinary stone disease in Somalia.[23] Our findings demonstrated significant associations between urolithiasis and several sociodemographic factors, including marital status and educational level. It is particularly noteworthy that married individuals showed substantially higher odds of developing urolithiasis than divorced or widowed participants. One possible explanation for this association is that married individuals may experience lifestyle and dietary changes, including

increased consumption of certain foods associated with stone formation, such as high sodium and high protein diets. Additionally, marriage is often linked to changes in physical activity levels, metabolic alterations, and stress, all of which may contribute to the formation of stones.[25–27] However, further investigation is needed to fully understand these relationships. Education level displayed an inverse relationship with the risk of urolithiasis, as individuals with higher education levels demonstrated significantly lower odds of developing the condition. This finding may reflect differences in health literacy, as individuals with higher education levels are more likely to be aware of dietary recommendations, hydration practices, and risk factors for kidney stone formation. Additionally, higher education is often associated with improved socioeconomic status, which may provide better access to healthcare, preventive measures, and dietary options that reduce the risk of stone formation.[28]

The findings regarding dietary factors align with the existing literature, particularly concerning the protective effect of regular dairy consumption. Participants with occasional or rare dairy intake showed significantly higher odds of urolithiasis than those with daily dairy intake. This correlation supports previous research demonstrating the protective role of calcium-rich foods in preventing stone formation.[29] Similarly, the association between meat consumption patterns and urolithiasis risk corresponds with established literature on the role of animal protein in stone formation.[30] The medical history findings revealed interesting patterns, particularly the significant association between a previous urolithiasis diagnosis and current stone formation. A history of prior urolithiasis emerged as a strong predictor of recurrence, with patients having 5.2 times higher odds of developing stones than those without prior episodes (AOR 5.2, 95% CI 1.19–22.81). This finding underscores the chronic and recurrent nature of the condition. Urinary tract infections (UTIs) have demonstrated a notable correlation with the development of urolithiasis. Patients with a history of UTIs had 3.43 times higher odds of developing urinary stones than those without (AOR 3.43, 95% CI 1.7–6.95). This strong association suggests a potential interplay between tract infections and stone formation, possibly due to changes in urinary pH or bacterial involvement in crystal formation. The observed relationship between urinary tract infections and increased urolithiasis risk corroborates existing literature.[31]

An intriguing and somewhat counterintuitive finding has emerged regarding diabetes. Contrary to many international studies, diabetic patients in this study showed significantly lower odds of developing urolithiasis (AOR 0.11, 95% CI 0.03–0.38). While previous research has generally associated diabetes with an increased risk of urinary stones due to metabolic disturbances and insulin resistance, our findings suggest that additional population-specific factors may be involved. Differences in dietary habits, medication use, or genetic predispositions unique to this study population may have influenced this result. However, given the inconsistency with global literature, further investigation is warranted to determine whether this association is due to true protective factors or potential confounding effects.[32] Similarly, the associations observed in the univariate analysis, such as diuretic use and family history of urolithiasis, did not persist in the multivariate analysis, indicating that their effects may be confounded by other, stronger predictors. These results suggest that factors such as dietary habits, metabolic conditions, and environmental influences may have a more direct impact on stone formation, which warrants further exploration in future studies.[33] These findings have important implications in clinical practice, particularly in the context of patient monitoring and preventive care. The high recurrence rate among previously diagnosed patients suggests a need for more rigorous follow-up protocols. Similarly, a strong association with UTIs indicates that patients with recurrent urinary infections may benefit from enhanced screening for urolithiasis. Based on these findings, we recommend implementing comprehensive screening programs for high-risk individuals, particularly those with a history of urolithiasis or recurrent tract infections.

Healthcare providers should emphasize the importance of regular dairy and moderate meat intake in preventing stone formation. Public health initiatives should focus on education about modifiable risk factors, especially targeting populations with lower educational levels who showed higher risks in our study. Future research should include longitudinal studies to better understand the causative factors and the natural history of urolithiasis in the Somali population. Additionally, investigation of the protective factors observed in certain demographic groups could provide valuable insights for prevention strategies. The findings of this study contribute significantly to our understanding of urolithiasis in Somalia and provide a foundation for the development of targeted interventions. The high prevalence rate underscores the need for increased attention to this condition in both clinical practice and public health policies within the region. Our study had some limitations. The sample was drawn from patients already seeking medical attention through CT,

potentially introducing selection bias and limiting generalizability to the broader population. Additionally, consecutive sampling, while practical for data collection, may not fully represent the diversity of individuals at risk of urolithiasis in the general community. This selection bias has been acknowledged, and future studies employing random sampling techniques will improve external validity. Another limitation is the relatively small number of urolithiasis cases (n=55) in the study population. Although the sample size was determined based on prevalence estimates, the limited number of cases may have reduced the statistical power for detecting associations, particularly in subgroup analyses. This highlights the need for larger multicenter studies to further validate our findings. Moreover, certain sociodemographic and lifestyle subgroups, such as participants under 18 years of age, postgraduate degree holders, widowed individuals, and those with different drinking water sources, had relatively small sample sizes in this study. These imbalances may have affected the robustness of the subgroup comparisons and the ability to detect significant associations. Future studies should ensure more evenly distributed samples across key demographic and lifestyle factors to strengthen statistical reliability. Furthermore, recall bias might have affected the accuracy of the self-reported dietary, medical, and lifestyle information, which could have influenced the observed associations.

## Conclusion

This study found a high prevalence of urolithiasis (26.07%) among patients who underwent CT scans. This rate is higher than previously reported in the region, suggesting an increasing burden of urinary stone disease in Somalia. This study identified key sociodemographic and lifestyle factors associated with urolithiasis, notably marital status, education level, dairy product consumption, and meat consumption. Married individuals and those with lower educational levels exhibited higher odds of urolithiasis. The study also found that infrequent consumption of dairy products and meat correlated with an increased risk of urolithiasis. This research highlights the significant role of medical history in the development of urolithiasis. Individuals with a prior diagnosis of urolithiasis have a considerably higher risk of recurrence. A history of tract infections also showed a strong association with urolithiasis, suggesting a potential interplay between these conditions. Unexpectedly, diabetes was associated with a lower likelihood of urolithiasis in this study, which contradicts common understanding. Although diuretic use initially appeared significant, this association was not maintained in the multivariate analysis, indicating the influence of other mediating or confounding factors. This study emphasizes the importance of comprehensive screening of high-risk individuals, particularly those with a history of urolithiasis or recurrent tract infections. Healthcare providers should advocate regular dairy and moderate meat intake as preventive measures. Public health initiatives should focus on educating the public, especially those with lower educational levels, about modifiable risk factors. Future research should include longitudinal studies to further investigate the causative factors and the natural history of urolithiasis in the Somali population.

## Data Sharing Statement

The Data supporting the findings of this study are available from the corresponding author upon reasonable request.

## Ethical Approval and Consent to Participate

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of SIMAD University, Mogadishu, Somalia, as per the approval letter dated December 30, 2023, with reference number 2024/SU-IRB /FMHS/P064. In accordance with this approval, informed consent was obtained from all the participants involved in the study. Participants were adequately informed about the study's objectives, their right to confidentiality, and their right to withdraw consent at any time without repercussions. This study was conducted in full compliance with the principles outlined in the Declaration of Helsinki. For participants under 18 years of age, parental or legal guardian informed consent was obtained prior to their participation in the study.

## Disclosure

The authors declare no conflicts of interest in this work.

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