

ORIGINAL RESEARCH

PREVALENCE AND COMPOSITION OF KIDNEY STONES IN SOUTH INDIA: AN OBSERVATIONAL STUDY

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ABSTRACT

Background: Kidney stone disease is a growing health concern in South India, influenced by environmental factors, dietary habits, and genetic predispositions. Understanding the prevalent types of kidney stones in specific regions can aid in developing targeted prevention strategies.

Methods: An observational study was conducted at MVJ Medical College and Research Hospital, Bangalore, involving 40 adult patients from both urban and rural areas of Karnataka. Each participant underwent clinical evaluation, ultrasonography, and biochemical analysis of extracted kidney stones to determine their composition.

Results: The analysis revealed that calcium oxalate stones were the most common, accounting for 71% of cases, while uric acid stones comprised 29%. No cystine stones were identified. Additionally, a higher incidence was observed in male patients compared to females.

Conclusion: The predominance of calcium oxalate stones suggests a correlation with regional dietary patterns, fluid intake, and metabolic factors. The gender disparity indicates a need for further investigation into behavioral and physiological differences. These findings underscore the importance of tailored public health interventions focusing on diet and hydration to prevent kidney stone formation in this population.

Keywords: Kidney stones, Calcium oxalate, Uric acid

INTRODUCTION

Kidney stones are increasingly becoming a problem in developing countries with hot tropical weather. The etiology of kidney stones is multifactorial and thus includes, amongst others, age, sex, diet, climate, and socioeconomic status, describing the condition known as nephrolithiasis. The prevalence and causes of kidney stones vary significantly across different regions. Economically developed and underdeveloped nations have different prevalence rates, which may be partially explained by the former's higher frequency of asymptomatic kidney stone identification. The higher incidence of kidney stones in affluent nations has been linked to increased consumption of salt and protein as well as the rising prevalence of metabolic syndrome; in underdeveloped countries, the increase may be attributed to malnourishment and dehydration. In India, the nation's southern region has a relatively low incidence of renal calculi. In contrast, the Northern areas of Maharashtra, Gujarat, Rajasthan, Punjab, Haryana, Delhi, Madhya Pradesh, Bihar, and West Bengal tend to have high prevalence rates. In India, nephrolithiasis has been reported to be primarily caused by calcium oxalate. Not much information is available on the prevalence of kidney stones in South India, particularly in Karnataka. Therefore, this study aims to identify common stone types in Karnataka. It would be helpful to have an idea about the stone composition of a patient while describing the etiology of this condition, suggesting the best treatment course, and approximating the possibility of recurrence. It may help thereby improve patient care.

MATERIALS AND METHODS

This retrospective observational study was conducted at MVJ Medical College and Research Hospital, Bangalore, from July 2024 to September 2024. Patients aged 18 years and older with renal stones were included in this study. Age, sex, stone weight, composition, and comorbidities were recorded. Patients less than 18 years of age, those with transplanted kidneys, sepsis, and acute renal colic were excluded from this study. Informed consent was obtained from the participants. The selection process is shown in Figure 1.

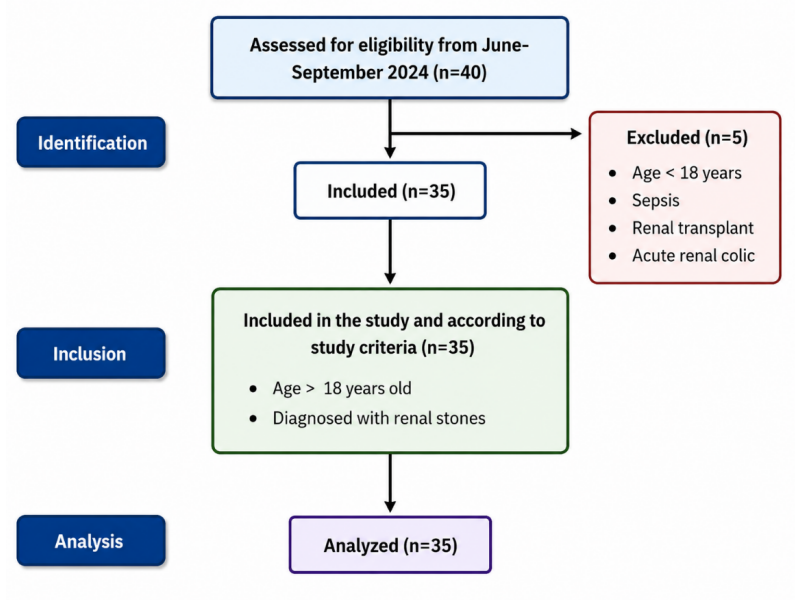


Figure 1. Selection criteria for the participants

RESULTS

The study involved 35 participants evaluated from July 2024 to September 2024. The mean age of participants was 50±16 years (Figure 2). Among the participants, 30 (85%) were male, while the remaining 5 (15%) were female. The most prevalent type of renal stone was Calcium oxalate, which had a prevalence of 71% (n=25), followed by Uric acid stones at 29% (n=10), as depicted in Figure 2. No other stone types were seen in our study. The mean stone weight was 0.454±0.233 gms, and the composition of the stones is shown in Figure 3.

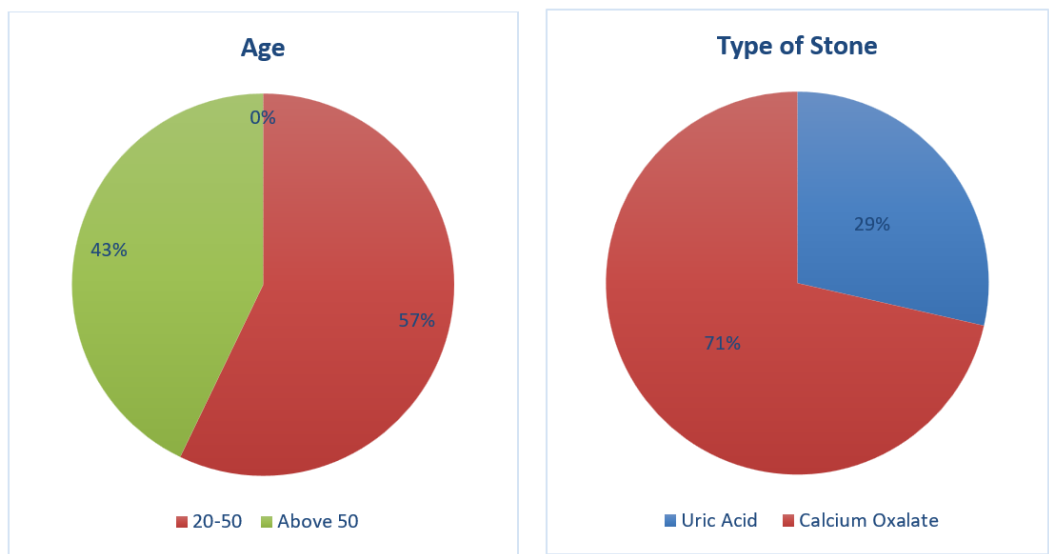


Figure 2. Age and type of stone

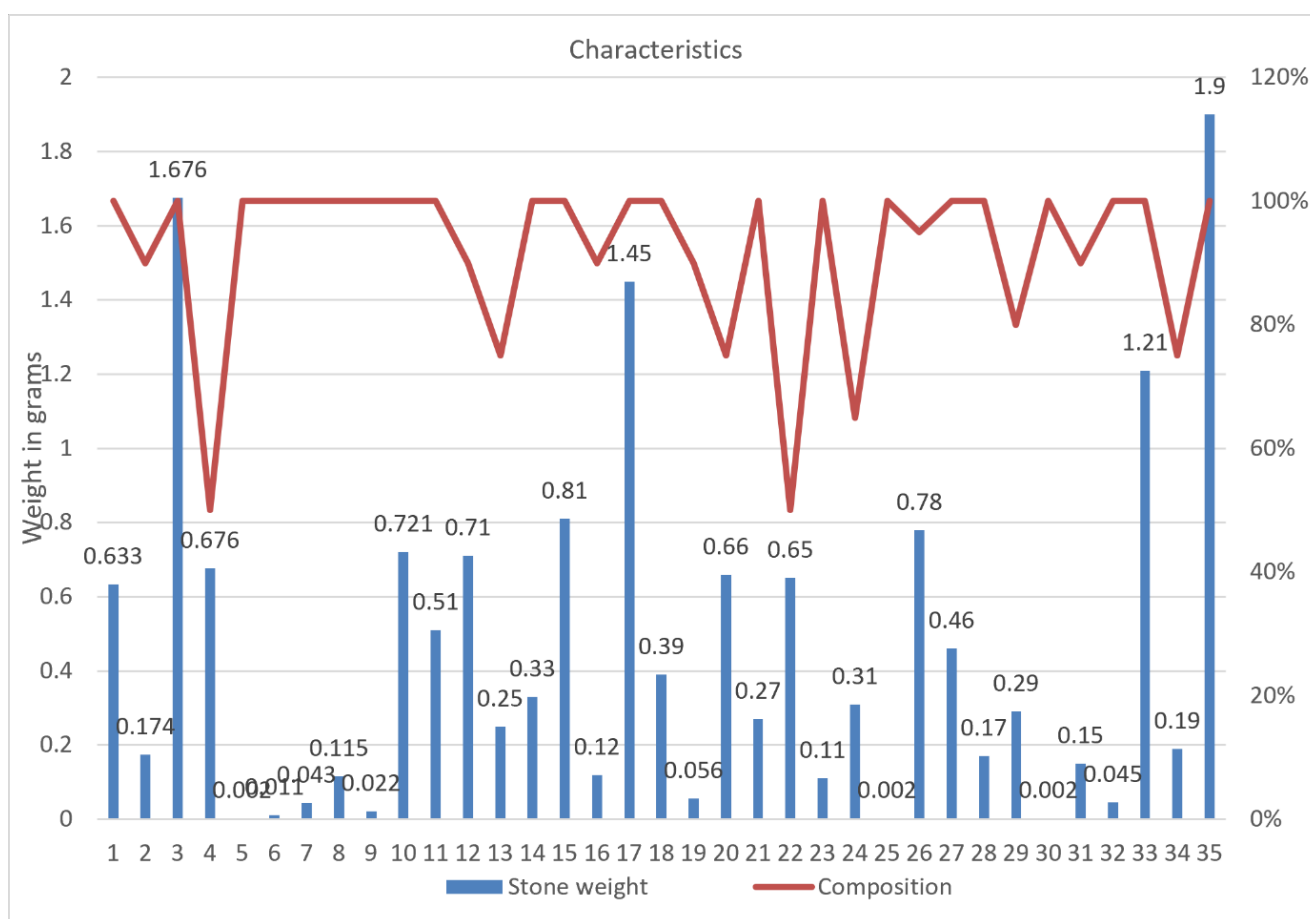


Figure 3. Characteristics of the stones

DISCUSSION

This study was done to find the prevalence of various stones in the Southern part of India. Kidney stones are one of the most common kidney diseases, and their incidence is increasing. The current study included 35 participants and investigated the prevalence and composition of kidney stones. Various studies have explored the causes of urolithiasis, including age, sex, industrialization, socioeconomic status, diet, and environment as determinants, according to epidemiologic research.

The results from this study are not different from the reported global and regional data. In most cases, it is in the form of calcium oxalate. Calcium oxalate stones cause more than 80% of all cases of urolithiasis in many regions, both in developing and developed countries. This trend is closely associated with dietary and environmental factors. Some significant contributory factors to the high prevalence of calcium oxalate stones in South India include climate, fluid intake, and diet containing high amounts of oxalate.

Climatic Influence: The hot, humid climate over South India results in excessive fluid loss due to sweating. This reduces urine output and allows the concentration of stone-forming substances like calcium and oxalate. Dehydration is a high risk for stone formation because insufficient fluid intake reduces urine volume, an ideal condition for calcium oxalate crystals to form.

Diet was the significant risk factor for the formation of kidney stones. The staple diet of South Indians predominantly consists of dietary elements like spinach, beets, and tea containing oxalate, accounting for the high prevalence of calcium oxalate stones⁹. Diets rich in oxalate with low dietary calcium intake augment the risk of producing calcium oxalate stones. Low calcium intake limits the binding of oxalates in the gut, which further leads to higher absorption and excretion of the urine.

Socioeconomic and Lifestyle Factors: The cases of metabolic syndrome are high in the more economically developed areas of the development of kidney stones. Conversely, in rural South India, malnutrition is considered a risk factor, while higher dehydration cases are encountered due to the unavailability of pure drinking water; these together play a significant role in causing a higher concentration of calcium and oxalate in the urine, promoting the formation of stones consisting of calcium oxalate.

Metabolic Factors: Other metabolic factors influencing stone formation include hypercalciuria, characterized by excess calcium in the urine, and hyperoxaluria, where excess oxalate is present. Both can be hereditary and can have some dietary influence. A diet high in animal protein, standard for urban and rural inhabitants, leads to higher calcium excretion in the urine, thus increasing the chances of developing stones of calcium oxalate types.

Regional Comparison: Kidney stones, especially the calcium oxalate type, are much more significant in similar climates and dietary patterns in the Middle East and Southeast Asia. Lifestyle and environmental factors determine the nature of the disease epidemiology because the rate at which stones are formed within those regions is the same.

Preventive Interventions: The preventive interventions should be on dietary change. These interventions include hydration, reducing dietary intake of specific components rich in oxalate, and adequate calcium. Public health efforts to improve hydration among rural dwellers and education about reducing stone-promoting food consumption may help reduce the prevalence of kidney stones. Regular screening for metabolic causes, including hypercalciuria, in those predisposed populations may prevent recurrences and offer better relief to the patient.

The study has numerous limitations. A sample size of only seven may have limited the generalizability of such findings to the broader population. The regional focus on South India, specifically Karnataka, does not reflect the country's spectrum of kidney stone cases. The short-term nature of the study might not have accommodated seasonal variation in stone formation. Future research would also significantly benefit from a more diversified population and bigger sample sizes. Longitudinal studies will help identify if diet, lifestyle, or environmental factors cause the formation of stones over time. Incorporating metabolic and genetic screenings can significantly provide insights regarding predispositions at an individual level and may be used to build specific preventive measures. Based on findings from this study, public health interventions to support hydration and dietary change are also suggested, especially in rural areas.

CONCLUSION

This study establishes that calcium oxalate is the most predominant form of renal stone in South India, likely due to environmental, dietary, and metabolic factors. These findings highlight the need for targeted prevention strategies, including promoting appropriate dietary habits, adequate hydration, and early metabolic screening to reduce the risk and recurrence of kidney stones. Further research involving larger, more diverse populations over longer durations is necessary to better understand the underlying contributing factors. Such insights will support the development of more effective public health interventions.

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