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THE ROLE OF NUTRITION IN THE PREVENTION OF UROLITHIASIS

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Abstract

Background:
Urolithiasis is a common urinary tract disease with a lifetime prevalence of 10–15%, characterized by the formation of calculi in the kidneys and urinary system. The increasing incidence, particularly among women, is associated with lifestyle changes, obesity, and dietary habits. Nutrition plays a crucial role in modulating urinary composition and influencing stone formation risk.

Objective:
To analyze the role of dietary factors in the prevention of urolithiasis and to develop evidence-based nutritional recommendations for reducing the risk of stone formation and recurrence.

Methods:
This study is based on a narrative and systematic review of literature published between 2000 and 2025. Data were obtained from international and national peer-reviewed journals and clinical guidelines from the European Association of Urology and the American Urological Association. Comparative and analytical methods were used to evaluate the impact of fluid intake, dietary salt, protein consumption, oxalate-rich foods, vitamins, and micronutrients on urolithiasis risk.

Results:
Adequate fluid intake (2–2.5 L/day) significantly reduces urinary supersaturation and prevents crystallization. High salt intake increases urinary calcium excretion, while excessive animal protein consumption promotes acidification of urine and uric acid formation. Oxalate-rich foods contribute to calcium oxalate stone formation but can be mitigated by adequate calcium intake. Fruits, vegetables, and dietary fiber increase urinary citrate levels and promote alkalization. Magnesium, potassium, and citrate inhibit crystallization, whereas excessive intake of vitamin C and vitamin D may increase stone risk.

Conclusion:
Dietary modification is a key strategy in the prevention of urolithiasis. Adequate hydration, reduced salt intake, moderate consumption of animal protein, controlled intake of oxalate-rich foods, and a balanced intake of micronutrients significantly reduce the risk of stone formation and recurrence. Nutritional interventions should be considered an essential component of comprehensive preventive care.

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Keywords: urolithiasis, kidney stones, diet, prevention, oxalates, calcium, hydration, nutrition, nephrolithiasis

Introduction

Urolithiasis, or kidney stone disease, is one of the most prevalent disorders of the urinary system, characterized by the formation of calculi in the kidneys and urinary tract. Lifetime prevalence ranges between 10% and 15%, occurring 2–3 times more frequently in men than women. Recent trends indicate an increasing incidence among women, likely due to lifestyle changes, rising obesity, and dietary habits.

Risk factors include genetic predisposition, metabolic disorders such as hypercalciuria, hyperoxaluria, hyperuricosuria, and cystinuria, sedentary lifestyle, and unbalanced diet. Nutrition plays a major role in determining urinary chemistry, including levels of calcium, oxalates, uric acid, and citrate, which are crucial in stone formation. Additionally, dietary patterns influence acid–base balance and the risk of stone recurrence.

The aim of this study was to examine the role of nutrition in urolithiasis prevention, identify dietary factors promoting or preventing stone formation, and develop evidence-based recommendations to reduce disease risk.

Materials and Methods

This study is analytical and review-based.

Data Sources:

Peer-reviewed articles from international and national journals

Clinical guidelines of the European Association of Urology (EAU) and the American Urological Association (AUA)

Textbooks and reference materials in dietetics and urology

Methods:

1. Systematic literature review (2000–2025) regarding nutrition and urolithiasis prevention

2. Comparative analysis of dietary recommendations from different authors and urological societies

3. Synthesis of clinical studies on the effects of foods, vitamins, and micronutrients on stone formation

4. Identification of key principles of rational nutrition for prevention

Special focus was on: fluid intake, salt and protein consumption, oxalate-rich foods, vitamins, and micronutrients (magnesium, calcium, vitamin D, vitamin C, potassium, citrate).

Results

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Fluid Intake:
Insufficient hydration is a major risk factor for stone formation. Recommended daily intake is 2–2.5 L. Adequate fluids reduce urinary solute concentration, preventing crystallization.

Salt and Protein Intake:
High salt consumption increases urinary calcium excretion, raising calcium stone risk. Limiting salt to ≤5 g/day is advised. Excessive animal protein increases urinary acidity and uric acid formation, promoting urate stones. Recommended protein intake is 0.8–1 g/kg body weight.

Oxalate-Rich Foods:
Spinach, rhubarb, chocolate, nuts, and black tea contain high oxalates. Moderate consumption with calcium intake reduces intestinal oxalate absorption and prevents calcium oxalate stones.

Fruits, Vegetables, and Fiber:
Fruits and vegetables increase urinary citrate, alkalinize urine, and improve mineral metabolism. Dietary fiber lowers calcium and oxalate concentrations, enhances metabolism, and reduces recurrence risk.

Micronutrients and Vitamins:
Magnesium reduces calcium and oxalate crystallization. Calcium prevents intestinal oxalate absorption. Excessive vitamin D may increase calcium stone risk, and high vitamin C may raise oxalate production. Potassium and citrate promote alkalinization and inhibit crystallization.

Discussion

Rational nutrition is crucial for urolithiasis prevention. Key measures include:

1. Adequate fluid intake
2. Salt and animal protein limitation
3. Moderated oxalate-rich foods with adequate calcium
4. Regular fruits, vegetables, and fiber
5. Micronutrient and vitamin monitoring

Particularly important for patients with recurrent stones, metabolic disorders, or genetic predisposition. Maintaining healthy body weight, physical activity, and managing comorbidities (hypertension, diabetes) enhance prevention. These measures reduce recurrence, improve quality of life, and decrease healthcare burden.

Conclusion

Nutrition is a critical factor in urolithiasis prevention. Recommendations:

Hydration: 2–2.5 L/day

Salt restriction: ≤5 g/day

Moderate animal protein

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Controlled oxalate-rich foods with calcium

Fruits, vegetables, fiber

Monitoring magnesium, calcium, potassium, and citrate

Adherence reduces stone formation, recurrence, and complications and is a vital component of preventive care.

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