

Medical Nutrition Therapy for Pediatric Kidney Stone Prevention, Part One



Jennifer Carvalho-Salemi, MPH, RDN, LD,* Lorrie Moreno, RDN, LD,* and Mini Michael, MD, FRACP, MMed (Clin Epi)†

Intended Audience: Pediatrics; Nephrology Outpatient Clinic; Children With Kidney Stones

RENAL STONE DISEASE, or nephrolithiasis, is a major health concern associated with significant pain, morbidity, and medical cost. Recurrent nephrolithiasis can lead to chronic kidney disease, as well as increased risk of related conditions such as cardiovascular disease and fracture.¹

The incidence of nephrolithiasis appears to be increasing among US children in recent decades. Moreover, the health and economic burden of nephrolithiasis may be heightened in children who have increased rates of metabolic abnormalities, resulting in recurrent nephrolithiasis, leading to increased risk for developing end-stage renal disease.² The majority of children (up to 95%) with nephrolithiasis have at least one metabolic abnormality that will likely require a combination of dietary and pharmacological therapy. Most common metabolic abnormalities are hypercalciuria and hypocitraturia, either isolated or co-occurring; other metabolic abnormalities include hyperuricosuria, hyperoxaluria, and cystinuria.³⁻⁵ Although studies that focus on pediatric populations are scarce, extrapolations from adult research suggest that the increasing rates of nephrolithiasis are related to shifting dietary norms, such as the widespread consumption of processed and fast foods, diets high in sodium and animal protein, and the decline in the consumption of fruits, vegetables, and calcium-rich foods.⁴⁻⁸

Medical nutrition therapy aims to prevent recurrence, and as such, attenuate the burden of kidney stone disease in pediatric populations. Although the role of nutrition is increasingly appreciated, its therapeutic impact may be diminished due to a lack of teaching tools and resources designed to meet the specific needs of pediatric patients and their families. This introduction represents the first of a three-part series of handouts intended to provide a comprehensive nutrition education tool for the prevention of pediatric nephrolithiasis. The dietary recommendations presented below are relevant to most children with nephrolithiasis, regardless of metabolic abnormality.

Increase Fluids

Increased fluid intake is recommended for all children with nephrolithiasis, irrespective of stone type.⁹ Adequate hydration increases urine volume, which decreases the relative concentration of stone-forming substances and thereby prevents the supersaturation that can lead to crystallization. In general, fluid intake of 1.5 times “maintenance” fluids is used; this translates to approximately 3 liters (L) of fluid intake for a teenager with stone disease to maintain a daily urine output of at least 2 L.⁹ Likewise, urine output goals are >750 mL for infants, >1,000 mL for children 1–4 years in age, and >1,500 mL for children 5–10 years of age.^{4,10} An alternative way to calculate the amount of fluid required to account for the size of the child is to use body surface area and to use a minimum of 2 L/m². Patients should increase fluid intake during hot weather or strenuous exercise.

The type of beverage may also play a role; orange and lemon juices are beneficial because they increase urinary citrate, whereas sugar-sweetened beverages may increase risk of stone development.^{4,7,11}

Limit Sodium

Excessive dietary sodium can promote hypercalciuria or loss of calcium in the urine. Since calcium is a component of more than 80% of stones, minimizing calcium supersaturation is a reasonable prophylactic goal for overall stone prevention. A reduction in sodium is also recommended for cystine stones, as these patients are also at risk for

*Department of Renal Services, Texas Children's Hospital, Houston, Texas.
†Renal Section, Department of Pediatrics, Texas Children's Hospital/Baylor College of Medicine, Houston, Texas.

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Address correspondence to Jennifer Carvalho-Salemi, MPH, RDN, LD, Texas Children's Hospital, 1102 Bates Ave (Feigin 245), Houston, TX 77030. E-mail: jcsalemi@texaschildrens.org

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subsequent calcium-stone formation.¹² While arguably less important for uric acid and struvite stones, limiting excessive sodium intake is a sensible goal for all patients, especially considering the long-term risk of hypertension and stroke associated with nephrolithiasis.^{5,7,13,14} Daily sodium intake should not exceed the tolerable upper intake levels recommended by the Institute of Medicine: <1.5 g for children aged 1–3 years; <1.9 g for ages 4–8 years, <2.2 g for ages 9–13 years, and <2.3 g for ages 14–18 years.¹⁵

Enjoy More Fruits and Vegetables

Evidence from both observational and experimental studies suggest that diets high in fruits and vegetables, adequate in dairy products, and low in animal protein—such as the dietary approaches to stop hypertension eating plan—confer combined protective benefits. Fruits and vegetables alkalinize the urine, helping to prevent calcium oxalate, cystine, and uric acid stones. Nutrients such as potassium, calcium, and magnesium diminish intestinal absorption of oxalate. Finally, plant foods increase urinary citrate, an important inhibitor of stone crystallization.^{16,17}

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Nutrition and Kidney Stones

Name: _____
 Height: _____ Weight: _____
 Age: _____ BSA: _____
 Nephrologist: _____
 Dietitian: _____

5 Nutrition Tips

1. Increase fluids.
2. Limit sodium.
3. Enjoy more fruits and vegetables.
4. Choose more plant protein.
5. Know the facts about nutrients and supplements.

What type of stone?

There are different types of kidney stones. Your doctor may test your child's blood or urine to determine if there is a metabolic abnormality which may be causing the stones.

If your child is suffering from kidney stone disease, this handout will provide diet tips to help. This handout is good for all types of kidney stones. Depending on the particular metabolic abnormality, you may be instructed on additional restrictions.

Tip #1:

Drink more water

Water intake is the key to preventing stones.

Your child needs _____ mL of fluid every day.

Daily Fluid Goal: _____ cups

1000 mL = 32 ounces = 4 cups



1500 mL = 50 ounces = 6 cups



2000 mL = 67 ounces = 8 cups



2500 mL = 83 ounces = 10 cup



Here are some simple tips to encourage your child to stay hydrated:

- **Inspire your child to drink more water** with brightly colored cups, straws, and re-usable water bottles.
- **Have fun with water** by adding fruit or cucumbers. Keep cold water in the refrigerator and lemons on the counter to squirt some flavor into their drink.
- **Encourage** your child to drink enough fluid so that their urine is pale or almost colorless.
- **Enjoy** sugar-free lemonade – which can help prevent stones.

Tip #2: Cut back on sodium

Children who eat diets high in sodium are at risk for kidney stones.

How to Limit Sodium:

Learning to read food labels can help control sodium intake. Food labels provide information about the amount of sodium and other nutrients per serving. When eating out, ask to see the nutrition information of your child's meal. Be careful to count serving sizes and condiments.

Food labels should be checked for hidden sodium such as: salt, monosodium glutamate (MSG), sodium bicarbonate, disodium phosphate, sodium alginate, and sodium nitrate or nitrite. Ask your dietitian if you have questions about reading food labels.

Foods that contain high levels of sodium should be avoided. These include:

- Fast food and restaurant meals
- Processed meats such as hot dogs, sausage, deli meats, pepperoni, and bacon
- Canned soups and boxed meals
- Packaged and salted snacks
- Salt packets, sauces, and condiments

Sodium Limit: _____ mg per day

Nutrition Facts	
Serving Size 100 g	
Amount Per Serving	
Calories 250	Calories from fat 10
% Daily Value*	
Total Fat 4%	4%
Saturated Fat 1.5%	4%
Trans Fat	
Cholesterol 50mg	28%
Sodium 150mg	15%
Total Carbohydrate 40g	3%
Dietary Fiber 5g	
Sugars 3g	
Protein 16%	
Vitamin A 1%	Vitamin C 3%
Calcium 2%	Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Tip #3: Eat more fruits & vegetables

Add a fruit or vegetable to every meal or enjoy them as a snack. Here are some ideas:

- fresh fruits such as sliced oranges, apples, tangerines, and kiwi
- sugar-free lemonade and fruit popsicles
- strawberries and cool whip for dessert
- unsalted macadamia nuts and dried mango
- celery, peanut butter, and raisins or "ants on a log"
- sliced cucumbers and cherry tomatoes
- green peppers and hummus
- sweet potato fries and no-salt ketchup
- mashed-cauliflower-potatoes
- frozen berries and yogurt

