If an individual has a history of kidney stones, but the type of stone has not been identified, the recommendations for individuals with calcium oxalate stones should be followed, as calcium oxalate stones are the most common type of stone in adults. [1]

Recommendations:

- Fluid intake of greater than 2.5 L per day should be encouraged to decrease the risk of stone formation.
- For patients with a history of calcium oxalate stones, limiting sodium intake to less than 2300 mg (100 mmol) per day, when combined with normal calcium and animal protein intake, is associated with lower stone recurrence.
- A moderate protein intake, to achieve but not exceed the Dietary Reference Intake (DRI), is recommended to prevent stone formation.
- Restriction of dietary oxalate should not be routinely implemented in healthy individuals.
- Oxalate restrictions should only be considered for patients with pre-existing hyperoxaluria, and conditions which increase oxalate absorption and/or fat malabsorption, such as patients with a previous Roux-en-Y gastric bypass surgery. For those requiring an oxalate restriction, care should be placed in also meeting the DRI for calcium.
- Individuals should achieve the DRI for calcium through dietary sources. Calcium intake through supplements should be discouraged. In the case where a calcium supplement must be taken, it should be taken with food.
- A dietary vitamin C restriction is not warranted in healthy individuals to prevent kidney stone formation. For individuals with a history of stones, high dose vitamin C supplements are not recommended. All individuals should not exceed 2000 mg/day of vitamin C from supplements, which is the tolerable upper intake level.
- Supplemental vitamin D, in the form of combined calcium-vitamin D supplements, should be avoided.
- Limit the consumption of sweetened beverages, such as juice and pop, and foods with added sugar as per *Eating Well with Canada's Food Guide*
- Follow *Canada's Low-Risk Drinking Guidelines* for recommendations related to alcohol consumption. For those with a history of calcium oxalate stones, a reduction/elimination of alcohol may be warranted.
- Caffeine intake should be limited below current recommendations in individuals with a history of calcium oxalate stones.
- Aim for a healthy body weight. Strategies to prevent weight gain, obesity, and metabolic syndrome should be employed to prevent stone formation.
- All patients with a history of kidney stones should be referred to a Registered Dietitian for nutrition counselling to ensure nutritional adequacy and appropriateness of the diet.

Health Benefits

Following the recommendations above can help individuals:

- Decrease stone formation in those with a propensity to stone formation (also known as "stone formers")
- Decrease recurrence of stone formation in those with a history of stones
- Alter urine composition of offending constituents that increase the risk of stone formation

Key Question(s)

What are the risk factors for kidney stones?

Diet has been implicated as a factor in the development of kidney stones for years, either as a single cause or in conjunction with environmental/genetic factors.[2] Kidney stones are formed through a number of mechanisms. A family history of nephrolithiasis (kidney stones) puts one at a 2.5 times higher risk for stone formation. [3] This may be due to a genetic predisposition as well as similar environmental factors, including diet.[3] Other medical conditions such as primary hyperparathyroidism, Crohn's disease, gout, diabetes and renal tubular acidosis all increase the risk of calcium-containing stones, specifically.[4,5]. People who are "stone-formers" have higher concentration of stone-promoting constituents in their urine, compared with "non-formers". They may have higher calcium excretion, higher oxalate excretion and/or lower urine volumes.[6]

Approximately 90% of all kidney stones are calcium-based, with calcium oxalate stones being the most common type of stone and comprise approximately 56 to 61% of all stones in adults.[1] Other types of stones include calcium phosphate (8 - 18% of all stones in adults, with a higher prevalence in pregnant women), cystine (1% of all stones in adults), struvite (2 to 4% of all stones in adults), and uric acid stones (8 to 18% of all stones in adults).[1] The prevalence of uric acid stones is on the rise, likely because insulin resistance is a risk factor. [1]

Specific risk factors for each type of stone are as follows:[7]

- Calcium oxalate stones: low urine volume (<2 L/day), hypercalciuria (high urinary calcium), hyperoxaluria (high urinary oxalate), hyperuricosuria (high urinary uric acid), hypocitraturia (low urinary citrate) and hypomagnesuria (low urinary magnesium)
- Calcium phosphate stones: low urine volume (<2 L/day), hyperphosphaturia (high urinary phosphate), excessively alkaline urinary pH (>7.0), hypercitraturia (high urinary citrate) and hypercalciuria (high urinary calcium)
- Cystine stones: cystinuria is an autosomal recessive genetic condition leading to hypercystinuria and stone formation due to the low solubility of cystine at low urinary pH.[8] Cystinuric patient can also form calcium oxalate or calcium phosphate stones, since many patients have metabolic abnormalities (hypercacliuria, hyperuricosuria, hypocitruria) that predispose them to calcium-based stones[9]
- Struvite stones: these stones (magnesium ammonium phosphate) occur only in association with a urinary infection by urea-splitting bacteria[10]
- Uric acid stones: low urine volume (<2 L/day), hyperuricosuria (high urinary uric acid), hyperuricemia, and excessively low urinary pH (<5.5)[1]

How does fluid intake affect kidney stone development?

An adequate fluid intake may be more important than any other dietary modification in the prevention of certain types of stones, including calcium oxalate, calcium phosphate, cystine, and struvite stones. In certain cases, active kidney stone formers that consume adequate fluid to produce greater than 2 litres of urine per day can be transformed into non-active stone formers.[6]

Low urine volumes can have an effect on saturation levels in the urine, leading to stone formation.[11] At urine outputs of less than 1 litre per day, urine concentration can reach super-saturation levels and promote

crystallization. When urine output is >2.5 L per day, urine is barely super-saturated for constituents like uric acid, calcium oxalate, and calcium phosphate. When urine output is >3.5 L per day, urine super-saturation is low enough for constituents like cystine and struvite to decrease the risk of spontaneous stone formation.[11]

For uric acid stone formers, alkalinizing the urine takes precedence over fluid intake.[4] See section below for more information on "what dietary factors affect urinary pH".

How much fluid should be consumed for those with a history of kidney stones?

For calcium-based stones (calcium oxalate and calcium phosphate), as well as uric acid stones, a high fluid intake of >2.5 L (2500 mL) per day decreases the risk of stone formation.[7] For cystine and struvite stone formers, a high fluid intake of >3 – 3.5 L (3000 – 3500 mL) per day decreases the risk of stone formation.[7] The goal of increased fluid intake is to attain a urine output of >2.5 L per day for calcium based and uric acid stones, and >3 L per day for cystine and struvite stones. There is no evidence from clinical trials to support any specific beverage being superior in terms of preventing stone development, including filtered vs. non-filtered, hard vs. soft).[7,12]

General guidelines that will assist patients in achieving a high fluid intake include. [6]

- Drink enough that the patient has to get up at night to urinate
- Don't wait until they are thirsty to drink
- Urine should be pale in colour

Work and climate influences (e.g. a hot environment) will increase sweat losses and should be taken into account when determining fluid intake recommendations. Other non-urine losses such as stool and respiration losses should also be considered.[6]

What dietary factors affect urinary pH?

A low (acidic) urinary pH creates an environment where constituents like uric acid and cystine are more likely to precipitate, even if the 24-hour urinary excretion is normal.[9,13] On the other hand, acidifying the urine can decrease the formation of calcium phosphate and struvite stones in genetically predisposed rats. There is minimal human data on the subject of urinary pH and its influence on stone formation.[1]

Advice regarding acidifying the urine may be effective in the prevention of calcium phosphate and struvite stones.[1] However, in the case of preventing calcium oxalate, cystine and uric acid stones, interventions should be aimed at alkalinizing the urine.[1] Western style diets typically are high in acid-producing foods, such as grains, dairy products, legumes, and meat. Encouraging intake of certain foods, such as meat, to further acidify urine can increase risk of certain types of stones, such as cystine and uric acid stones.[1]

There is very limited evidence to support the intake of cranberry juice to acidify the urine, as would be considered in calcium phosphate and struvite stone prevention. Studies have shown mixed results, with no long term data, small sample sizes, and ultimately, no associations between increased intake of cranberry juice/cranberry concentrate tablets and a reduction in kidney stones.[14,15,16,17] At this time, there is insufficient evidence to recommend cranberry juice (or cranberry concentrate tablets) to acidify the urine and assist with prevention of calcium phosphate or struvite stones.

Many practitioners may be reluctant to encourage increased fruit and vegetable intake in patients with a history of stone formation, due to increased dietary oxalate in the formation of calcium oxalate stones. However, in the case of patients at risk or with a history of uric acid stones, fruits and vegetables can have an anti-lithogenic effect because of their potential impact on urine volume, potassium, and pH. If the patient has risk factors associated with hyperoxaluria, the practitioner can still recommend increasing the patient's fruit and vegetable intake, with more consideration given to avoiding specific high oxalate fruits and vegetables, where appropriate.[7]

Careful consideration of the type of stone should be given prior to providing any dietary advice to acidify or alkalinize the urine. Where possible, every attempt to identify the type of stone should be made prior to initiating dietary advice related to raising or lowering urinary pH.[18] Strategies to address the urine pH should be addressed upon initial visit with the patient under the guidance of a Registered Dietitian. The Registered Dietitian can review other aspects of the diet, including dietary changes to affect risk factors of certain types of stones.

Do all individuals with a history of kidney stones need a sodium restriction?

High salt (sodium chloride) intake is associated with increased excretion of urinary calcium, a risk factor for certain types of stones. A high salt intake also decreases urinary citrate concentration, another risk factor for stone formation. Even for individuals with no prior history of stone formation, a high dietary salt intake increases risk for stones. Limiting sodium, when combined with adequate calcium intake and adequate, but not excessive, protein intake is associated with a lower risk of stone recurrence and for those at risk for stone formation.[6]

Patients requiring a sodium restricted diet should be referred to a Registered Dietitian for nutrition counselling. The Registered Dietitian can take into account other dietary factors and modifications that may be required. Education of the patient should include foods containing high amounts of sodium, low sodium alternatives, cooking methods, and appropriate serving sizes. Sodium bicarbonate and sodium citrate do not appear to have the same effect on urinary calcium and citrate as sodium chloride due to their alkali content.

Refer to Nutrition Guideline: Sodium

What amount of sodium should be prescribed if a sodium restriction is required?

Individuals with a history of stone formation or at risk for stone formation should be encouraged to reduce their sodium intake to <2300 mg (100 mmol) per day.[11] This includes any sodium from processed or prepared/canned foods as well as sodium/salt added to food during the cooking process as recommended in *Eating Well with Canada's Food Guide*.[19]

Low sodium diets may be poorly tolerated by patients when they are initially introduced. Dietary sodium strategies for reduction of stone risk are recommended as part of a comprehensive patient management approach.

Sodium reduction strategies should be addressed upon initial visit with the patient under the guidance of a Registered Dietitian. The Registered Dietitian can review other aspects of the diet, including calcium and protein intake.

Refer to Nutrition Guidelines: Sodium

Do all individuals with a history of kidney stones need a protein restriction?

Although some studies have shown an association between a diet high in animal protein (>2 grams per kilogram of body weight per day) and increased risk of kidney stones, there is an overall lack of convincing evidence to demonstrate the efficacy of a low protein or protein restricted diet. Data from observational studies has been conflicting, and further studies are needed to verify the effect in different populations.[7,11] A low protein diet can also have nutritional consequences, such as malnutrition and certain nutrient deficiencies. It is unclear what the effect of high protein levels from non-animal (plant) sources is, due to the composition of non-animal sources (include higher content of phytates, oxalates, vitamin C and magnesium.[20]

Patients with a history of kidney stones should meet, but not exceed the Dietary Reference Intake/Value (DRI) for protein.[11] DRI values for protein can be found at: http://www.iom.edu/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx.

Patients requiring a protein modified diet should be referred to a Registered Dietitian for nutrition counselling. Education of the patient should include foods containing higher protein quality, appropriate serving sizes, and adequate energy (calorie) provisions.

Do all individuals with a history of calcium oxalate stones need a dietary oxalate restriction?

Patients with a propensity toward stone formation may absorb more oxalate than non-formers.[4,21]
At present, there is inadequate evidence to support dietary oxalate restriction as a preventative measure for stone formation. A dietary oxalate restriction should be recommended in otherwise healthy adults, with or without a history of calcium oxalate stones.[22]

Dietary oxalate restriction should only be considered in patients with pre-existing hyperoxaluria, and conditions which increase oxalate absorption and/or fat malabsorption.[22] For example, patients who have had gastric bypass surgery, specifically Roux-en-Y bypass, are prone to fat malabsorption. The higher fat content in the bowel leads to more calcium being bound and oxalate left unbound.[6] This process increases risk of stone formation.

In which cases should an oxalate restriction be implemented?

An oxalate restriction is defined as a limit of dietary oxalate to no more than 40 to 50 milligrams per day.[2,23] High oxalate foods include rhubarb, spinach (and dark leafy greens), leeks, parsley, black tea, beets, star fruit, nuts (peanuts, almonds, cashews, hazelnuts), soybeans (including tofu and meat substitutes made with soy), wheat bran, and chocolate (including chocolate bars and cocoa powder used for baking).[24]

Only <10% of ingested oxalate is absorbed.[7] This may render dietary oxalate restrictions somewhat ineffective. Furthermore, determining exact oxalate intake is difficult as there are variations in food levels, the environment in which the food is grown, and the levels also depend on methods of analysis used and cooking methods (e.g. boiling reduces oxalate content more than other cooking methods).[6,23,25] The first step in a dietary oxalate restriction includes limiting the foods highest in oxalate (as listed).[23]

The total dietary calcium intake plays an important role in oxalate absorption. Increased dietary oxalate, in combination with decreased dietary calcium, results in decreased urinary oxalate excretion. This leads to higher risk for calcium oxalate stone formation.[22] For those requiring an oxalate restriction, care should be taken to ensure the DRI for calcium is also met. DRI values for calcium can be found at: http://www.iom.edu/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx.

How much calcium should be consumed for those with a history of calcium-based kidney stones?

Calcium intake has an inverse association with kidney stone formation. In other words, higher dietary calcium intake leads to a lower risk of calcium-based kidney stones. Low calcium intake is associated with increased oxalate absorption and hyperoxaluria, which is a risk factor for certain types of stones. Calcium intake affects urinary calcium excretion, which increased to a higher degree in stone formers, who tend to hyper-absorb calcium in the intestine.[7]

Although calcium is present in most stones (>80%), it is unclear if calcium, or other nutrients, independently or in combination with other nutrients, increase risk of stone formation. It may be that individual physiology, or a combination of dietary and non-dietary factors, including the presence or absence of certain nutrients such as calcium, that influence stone formation.[26]

The recommended calcium intake should meet the DRI for calcium, found at: http://www.iom.edu/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx.

Refer to Nutrition Guidelines: Calcium and Vitamin D

What are the best sources of calcium for those with a history of calcium-based kidney stones?

Calcium intake from supplements compared to calcium from dietary sources (both dairy and non-dairy) may have impact on stone formation risk. Individuals with a history of kidney stones are at higher risk for stone formation when they receive their calcium intake from supplements rather than food.[26] The differences between calcium containing foods and calcium supplements has been attributed to timing of ingestion, where supplement ingestion without food leads to increased calcium absorption and urinary excretion, with little or no effect on oxalate excretion/absorption. It is possible that dairy foods also contain specific components that inhibit stone formation.[11]

A total calcium intake of 2100 milligrams per day (from food and supplement), especially in combination with a vitamin D supplement of 400 IU per day (in the same supplement or at the same time), has been associated with increased kidney stones in post menopausal women with no history of kidney stones.[11,27] It is suspected that the timing of the calcium supplement may be, at least in part, responsible for the increased risk seen in calcium supplements, versus calcium from dietary sources.[26] If taken with meals, the calcium has a higher chance of being bound to oxalate, thus preventing oxalate absorption and thus lowers risk of stones.[2] Based on this, if an individual is taking a calcium supplement, it should be low dose (not to exceed 2000 milligrams per day from the combination of food and supplement) and taken with food.[20] Calcium supplements should only be used to bring total calcium intake to DRI levels.[2]

Refer to Nutrition Guidelines: Calcium and Vitamin D

What other vitamins might be of concern in an individual with a history of kidney stones?

The effect of nutritional vitamin D use in those prone to stone formation remains unclear.[28] A recent Cochrane review found an increased risk of kidney stones with vitamin D_3 and calcium given as a combined supplement (RR = 1.17).[29] There are limiting studies, however investigating vitamin D intake (via supplement or diet) alone and overall stone formation risk. High serum 25(OH) vitamin D levels are not associated with prevalent kidney stone disease.[30,31]

Generally, the effect of supplemental vitamin D in those predisposed to stone formation is not fully understood. Vitamin D deficiency is known to be prevalent in stone-formers, however larger prospective studies are needed to establish the safety and efficacy of vitamin D therapy.[28] The amount of supplemental vitamin D needed to increase kidney stone risk is not known. Vitamin D repletion among stone formers with inadequate vitamin D levels does not appear to increase urinary calcium excretion, though the long term effects of vitamin D supplementation has not been studied in this population.[30]

Observational studies have found an association with vitamin C intake and risk of kidney stone formation in healthy men with no previous history of kidney stones.[32] However, dietary intake of vitamin C, as modeled in the DASH-style diet, also includes higher intakes of nutrients such as potassium, magnesium, calcium, and oxalate, which may play a protective role against the development of kidney stones. It is difficult to assess the role of dietary vitamin C alone because studies to date have not excluded other nutrients, including nutrients that either present or absent, may have a protective effect on the development of kidney stones. For example, foods that contain both vitamin C and oxalate, which can both increase urinary oxalate, also contain nutrients such as citrate and potassium, which can inhibit the development of stones.[33] It is recommended that individuals at risk for development of kidney stones should not limit their dietary intake of vitamin C.[33]

Large scale observational studies have not shed light on the role of vitamin C supplements in the development of kidney stones, largely due to conflicting evidence. Urinary oxalate, as a marker for the development of stones, is increased with vitamin C supplementation of >1000 milligrams per day. Therefore, for an individual with a history of kidney stones, high dose vitamin C supplementation of more than 1000 mg per day is not recommended. And for those with no history of stones, vitamin C supplementation beyond the upper limit (UL) of 2000 mg vitamin C per day is not recommended.

Refer to Nutrition Guidelines: Calcium and Vitamin D, Vitamins and Minerals

Are there specific beverages that should be avoided in individuals with a history of kidney stones?

Sweetened beverages, particularly those sweetened with fructose have been found to be independently associated with an increased risk of kidney stones in observational trials.[34] However, these types of beverages have not been evaluated in randomized trials.[18] The consumption of sweetened beverages and foods with added sugar should be limited as recommended by *Eating Well with Canada's Food Guide*.[19,35]

There is a lack of consensus in terms of evidence to support specific beverages in the prevention of kidney stones. Therefore, there are no recommendations to support intake of any beverage to prevent/reduce the recurrence or formation of kidney stones.[36]

Should alcohol be avoided for individuals with a history of kidney stones?

Observational studies have shown that moderate alcohol consumption (two drinks per day for women and three drinks per day for men of wine or beer, but not liquor) may have a protective effect on kidney stone formation in otherwise healthy adults, due to its effect on antidiuretic hormone (ADH).[35,36,37]

Those with a history of kidney stones should follow *Canada's Low-Risk Drinking Guidelines* recommendations for alcohol consumption,[37] which are:

- No more than 10 drinks a week for women, with no more than 2 drinks a day most days
- No more than 15 drinks for men, with no more than 3 drinks a day most days
- One drink is considered: 341 mL (12 oz) beer/cooler/cider, 142 mL (5 oz) wine, 43 mL (1.5 oz) distilled alcohol such as rye, gin, rum, etc.

For those with a history of calcium oxalate stones, a reduction/elimination of alcohol may be warranted.[38] One uncontrolled study of men and women with a history of calcium oxalate stones showed that a diet comprised of no alcohol, moderate protein, and high fluid intake lead to an improvement of urinary markers including hyperuricosuria that increase risk of calcium oxalate stone formation. It is unclear, due to the uncontrolled nature of the study, whether alcohol may have a detrimental effect on those with a history of calcium oxalate stones.[38]

Alcohol has been suggested to contribute to increased uric acid production and delayed excretion of uric acid through the kidneys.[39] Beer, in particular, contains purines which are catabolized into uric acid and therefore may contribute to increased uric acid stone formation. Recommendations for those with a history of uric acid stones should be similar to those with a history of other types of kidney stones, which is as per *Canada's Low-Risk Drinking Guidelines.*[37]

Should purine be limited for those with a history of uric acid stone formation?

Animal protein provides a source of purines, which contribute to hyperuricosuria, and acid load, which in turn lowers urinary pH. The lower pH leads to low urinary citrate levels (hypercitraturia) due to reduced citrate reabsorption.[40] The evidence-based guidelines for the treatment of uric acid stones developed by the Caring for Australians with Renal Impairment (CARI) state that although older reports recommend dietary purine restriction to reduce urinary urate excretion, there are no controlled trials to support this practice.[41] The authors of the guidelines go on to suggest that, despite this, it is prudent to curb overindulgence in higher purine foods, given the effect of high dietary purine on increased urinary urate excretion.

Little is known about the precise quantity of individual purines in most foods, especially when the cooking or processing techniques are considered.[25,42] Observational data has shown that a strict purine-free diet will decrease serum urate about 15 – 20%; however there is no data to indicate how much a purine-free diet would impact (reduce) urinary uric acid levels. The rigidity of a purine-free diet greatly impacts long term compliance, therefore, moderation of high purine foods is likely a more realistic approach.[42] Bioavailability of purine is also known to vary substantially.

Because it is mainly the purine component that can impact the purine-to-uric acid metabolism, animal protein foods such as meats, poultry, eggs, and fish/seafood ("flesh foods"), as well as cheese, meat extracts/consommé/gravies, and grains should be reviewed if the patient requires a limited purine intake.[2]

High-purine vegetables are not considered significant to uric acid biosynthesis, and therefore need not be restricted.[2,43] In addition, milk, yogurt, and fats are considered neutral on the acid-base scale and similarly, do not be restricted.

Patients requiring a purine modified diet should be referred to a Registered Dietitian for nutrition counselling. Specific nutrition education by a Registered Dietitian is essential for balancing a purine restriction along with other dietary restrictions/limitations and overall nutritional adequacy. Without careful dietary education and specific strategies, the patient could be at risk for protein-energy malnutrition.

How much caffeine is advised for people with a history of kidney stones?

Caffeine causes increased urinary flow (diuresis) through action on both the proximal and distal tubules of the nephron, and decreases the maximal concentrating ability of the kidneys (natriuresis).[35] In an eight-year follow up study of the Nurses' Health and Health Professionals' studies, a reduction of the risk of kidney stone formation was observed with consumption of coffee, decaffeinated coffee, and tea (≥1 cup/day) in previously healthy individuals with no history of stones. It is unclear if there is another constituent of these beverages that may hinder stone formation, as the effect was seen in decaffeinated beverages as well.[44]

The effect of caffeine consumption on those with a history of kidney stones remains unclear, and has not been well studied. One small, open label study showed increased urinary calcium and sodium excretion, but not oxalate excretion. The authors concluded that the increased urinary calcium excretion from caffeine consumption can increase the risk of stone formation in those with a history of stones when compared to healthy subjects.[44]

For those with a history of stone formation, caffeine intake should be limited below current recommendations from Health Canada. Health Canada recommends the following maximum daily limits for caffeine:[45]

- For women of child bearing age: no more than 300 milligrams per day
- For healthy adults: no more than 400 milligrams per day

Quantities of caffeine in particular beverages can be accessed at:
http://www.hc-sc.gc.ca/fn-an/securit/addit/caf/food-caf-aliments-eng.php

How does body weight affect kidney stone formation?

Epidemiological data from large trials indicates that obesity, as well as weight gain, increase risk of developing kidney stones in otherwise healthy individuals. The effect appears to be greater in women than men (RR 1.9 for women and 1.33 for men with BMI ≥30, compared to those with BMI 21 - 23).[46] Other observational data suggests that the proportion of uric acid stone formers in males is higher in the obese category, when compared to the normal BMI range.[47]

A diagnosis of diabetes and/or metabolic syndrome also appears to increase the risk of kidney stones. A diagnosis of metabolic syndrome appears to be associated with a higher prevalence of kidney stones.[48] Similarly, three large cohort studies have shown that diabetes increases risk of developing the kidney stones in both men and women, however the effect has been found to be more pronounced in women.

Large scale observational studies have linked obesity with low urinary pH and uric acid stones, specifically.[49] The cause of this is suspected to be a higher BMI (and/or reduction in insulin sensitivity), combined with hyperinsulinemia, as seen in diabetes and metabolic syndrome, which contribute to uric acid stone formation.[11,48] A renal insulin-resistant state may explain the excretion of abnormally acidic urine with these conditions, leading to increased uric acid stone formation. Urine pH may be linked to BMI as well.[40] One study of more than 4500 patients showed urine pH values fall as body weight/BMI increased.[49]

Where can I get more information about a diet for kidney stones?

Kidney Foundation of Canada – Has a website with information for patients with kidney stones.
http://www.kidney.ca/kidney-stones?
Nutrition information about kidney stones can be found at:
http://www.kidney.ca/blog/dietitian?&storyid2939=1794&ncs2939=3

Davita – Has general information about kidney stones, treatment options, nutrition information and renal recipes. Available at:
http://www.davita.com/kidney-disease/overview/symptoms-and-diagnosis/kidney-stones-and-chronic-kidney-disease/e/4722
Recipes can be found at:
http://www.davita.com/recipes/

Handouts

Refer to approved provincial Alberta Health Services renal nutrition handouts to support patient education. For more information, contact Nutrition.Resources@albertahealthservices.ca

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