

# Diet and lifestyle advice for the prevention of kidney stones

In this diet sheet we will give you general dietary advice to help prevent the formation of all types of kidney stones. This will be followed by advice specific to the most common stones: calcium oxalate, calcium phosphate and uric acid. Your doctor will discuss with you the type of stone that you have or, if it is not known, the most likely type. Most of the advice is applicable to all types of kidney stone.

**My stone type is: ..... / unknown**

## What is a kidney stone?

A kidney stone is a clump of crystals which, when formed together, create a hard lump in one or both kidneys. They can vary in size from a few millimetres to several centimetres. They can be present for long periods of time without causing problems or they may move, causing discomfort. If they drop into the ureter (pipe from kidney to bladder) they can get stuck and cause severe pain. The majority of stones will pass out of the body in the urine without any help, but some will require intervention to remove them.

Your diet can affect the concentration of certain substances in your urine and can affect the acidity of your urine. You may have had a 24 hour urine collection looking for any abnormalities in your urine – if your urine has any of the following properties, you will be at increased risk of forming a stone:

- High levels of calcium (hypercalciuria)
- High levels of oxalate (hyperoxaluria)
- High levels of uric acid (hyperuricaemia)
- Low levels of citrate (hypocitraturia)

Calcium, oxalate, uric acid and citrate are normal substances found in the blood.

The acidity of any fluid is expressed as pH. A pH of less than 7 is acidic, a pH greater than 7 is alkaline. Normal urine pH will vary during the day depending on diet and will usually range between 5 and 8. Calcium oxalate stones can form in any pH of urine. Uric acid stones form in more acidic urine while calcium phosphate stones form in more alkaline urine.

## General advice for the prevention of kidney stones

- Maintain adequate fluid intake to produce at least two litres of urine per day. To achieve this you will need to drink two to three litres of fluid per day and maybe more if exercising or in hot weather. Drink enough to make your urine clear.
- Limit salt intake to 6g/day.
- Reduce intake of animal protein (meat and dairy).
- Aim to achieve or maintain a healthy weight.
- Maintain adequate dietary calcium intake (at least the recommended daily allowance) from food sources.
- Increase intake of fruit and vegetables (at least five portions per day).
- Drink fruit juices, but avoid grapefruit juice.
- Ensure adequate fibre intake.

## Tips and further advice

### 1) Fluid

Fluid intake reduces the risk of stone formation. When you are well hydrated your urine will be a pale colour (like champagne) rather than very yellow (like lucozade). Pale urine is less concentrated in waste products such as calcium, oxalate and uric acid and therefore less likely to lead to stone formation. You should aim to drink two to three litres per day or enough fluid to produce a urine output of two litres per day. This reduces the risk of recurrence by 30-40%. You can easily monitor your daily urine output yourself at home.

### Tips to help you increase your fluid intake:

- Drink a large glass of water at specific times during the day, for example, when you get up in the morning, when you arrive at work, after using the toilet, and so on.
- Enjoy a glass of fruit juice with your breakfast.
- Keep a large bottle or mug of water at your desk and sip from it throughout the day.
- Try drinking through a straw, it may help you drink more.
- Drink one glass of water each hour on the hour.
- When you have a craving for a snack, drink a glass of water, squash or a fizzy drink instead (choose diet drinks if you are watching your weight).
- Add slices of lemon, lime or oranges to cool water. This gives it a pleasant flavour and helps to alkalinise your urine.
- Drink two full glasses of fluid at each meal – one before eating and one after eating.
- Carry a refillable water bottle everywhere – walking, shopping, driving, watching television or doing laundry.
- Flavour your water with squash.
- Eat more fruits and vegetables as they contain a high amount of water.
- Include liquid and moist foods, such as soups, stews and jellies in your diet.

The alkalinising (acid-reducing) effect of water with a high bicarbonate content is particularly useful for those who form uric acid stones. Mineral water with a high bicarbonate content increases citrate levels in the urine, which is also useful. For those who form pure calcium

phosphate stones and who should avoid alkalinisation of the urine, water with a low content of bicarbonate (tap water rather than mineral water) is a better choice. You should also check the sodium content of mineral waters and avoid mineral waters with high sodium content.

Alcohol is generally bad for stone formation because it dehydrates you later on. Alcohol intake should therefore be spread throughout the week (not in binges) and should be within the advised weekly limits (21 units for men; 14 units for women).

Of the fizzy drinks, the colas (diet coke, coke zero, diet pepsi) have little alkalinising effect on the urine and are therefore not good for stone formers. One study found that diet 7-up, diet Sunkist and diet Sprite were the best and are a better choice for uric acid or calcium oxalate stone formers.

## 2) Salt

A high salt (sodium chloride) intake is directly associated with high calcium and low citrate levels in the urine, leading to increased risk of stone formation.

Limit salt intake to no more than 6g per day. Seventy five per cent of our salt intake is from processed foods, so in addition to limiting/avoiding the amount of salt you add to your food, you should also check the labels on food packaging.

### Quick guide to checking salt content on food labels

	Low	Medium	High
Sodium (per 100g)	Less than <b>0.12g</b>	<b>0.12g – 0.6g</b>	More than <b>0.6g</b>
Salt (per 100g)	Less than <b>0.3g</b>	<b>0.3g – 1.5g</b>	More than <b>1.5g</b>

## 3) Animal protein

Protein is an important nutrient in the body. One of its functions in the body is growth and repair. It is important that you eat enough protein to meet your body's needs. There are both animal and vegetable sources of protein available to us in our diets (see table below). Some people at risk of kidney stone formation have an excessive amount of animal protein in their diet, for example, servings of meat greater than 100g per meal.

Animal protein foods	Vegetable protein foods
<ul style="list-style-type: none"> <li>• Meat</li> <li>• Poultry</li> <li>• Fish</li> <li>• Eggs</li> <li>• Cheese</li> <li>• Yoghurt</li> </ul>	<ul style="list-style-type: none"> <li>• Lentils</li> <li>• Chickpeas</li> <li>• Beans, such as kidney beans, butter beans, baked beans</li> <li>• Hummus</li> <li>• Quorn</li> </ul>

A reduction of animal protein decreases calcium and uric acid in the urine and increases citrate, therefore decreasing the overall risk of stone formation.

Protein build-up drinks should be avoided.

#### 4) Healthy weight

A healthy weight can be defined as having a body mass index (BMI) between 19 – 25 kg/m<sup>2</sup>. This can be calculated by dividing your weight (in kg) by your height (in metres) squared (wt/h<sup>2</sup>). For example, if you are 80kg and 170cm tall then your BMI is  $80/(1.7*1.7) = 27.7$ . There are a number of online calculators that can do this for you. A higher BMI has been linked to high uric acid levels. Urine pH tends to be acidic in overweight people and there is an increased risk of most stone types.

#### 5) Calcium

Calcium in the diet can be helpful because it binds oxalate in the gut, which prevents it from being absorbed. Therefore low-calcium diets are not recommended as they result in increased oxalate absorption to the body, higher levels in the urine and increased risk of stone formation. It is important that you have normal levels of calcium in your diet, but you should not have excessive amounts (more than 1200mg/day) unless you are a woman who is breastfeeding.

##### Recommended daily amounts of calcium

Men	11–18 years	1,000mg
	19+ years	700mg
Women	11–18 years	800mg
	19+ years	700mg
	Pregnant	700mg
	Breastfeeding	1,250mg

Here are some examples of the calcium content of foods:

- 1 glass of semi-skimmed milk – 355mg of calcium
- 150g pot of fruit yoghurt – 240mg of calcium
- 50g of cheddar cheese – 360mg of calcium
- 50g of tinned sardines – 275mg of calcium
- 80g of dried figs – 200mg of calcium

If you are taking calcium supplements you should discuss this with your doctor to see if they are really necessary. Do not take them if you have not been advised to. This includes 'over-the-counter' medicines for indigestion. If you have been advised to take calcium supplements, taking them at meal times with your food will help to reduce the risk of stone formation because it binds to oxalate in the gut. Calcium citrate rather than calcium carbonate may be better, as it increases the citrate in urine.

## 6) Fruit juice

Drinking fruit juices (orange, lemon, apple) appears to decrease oxalate and increase citrate levels in the urine. However, these can be also high in sugars which can have a detrimental effect on weight, general health and stone formation. There is mixed evidence for cranberry juice and grapefruit juice. Overall, while there is some evidence that fruit juices may help, increasing your intake is generally not recommended. They may be detrimental if you have calcium phosphate stones.

## 7) Fruit and vegetables

Fruit and vegetables have an alkalinising effect on the urine. They often also contain fluid, which helps with your daily intake. Oxalate stone formers should limit their intake of oxalate-rich fruit and vegetables (see below).

## 8) Fibre

A wide variety of high-fibre plant foods contain a compound called phytate. It has been demonstrated in experimental studies that patients with a low phytate intake had an increased risk of calcium oxalate stone formation and so increasing your fibre intake may be beneficial. It is recommended that the average intake of fibre for adults should be 18g/day (individual range 12–24g/day). Please see the table below for the fibre content of some common foods.

Food	Average portion size	Fibre content per 100g	Fibre content per portion
Wholemeal bread	2 slices (72g)	5g	3.6g
Porridge	160g	0.9g	1.4g
Baked beans	135g	3.7g	5g
Fibre cereal, such as Weetabix or Fruit 'n' Fibre	45g	8.4g	3.8g
Pear	150g	2.2g	3.3g
Dried apricots	32g	6.3g	2g
Spinach	90g	2.1g	1.9g
Jacket potato	180g	2.7g	4.9g
Brown rice	180g	0.8g	1.4g

## Additional advice for the prevention of calcium oxalate stones

Only a small proportion of urinary oxalate is of dietary origin (10–15%), so it isn't necessary to completely avoid foods containing oxalate, but you should aim for a moderate intake. Many foods contain low to moderate amounts of oxalate. There are some foods that are particularly high in oxalates, and should therefore be eaten sparingly. These include All-Bran, almonds, beets, rhubarb and spinach.

The following foods are rich in oxalates – aim to limit your intake to no more than one item from this list per day:

- Some fruits, including blackberries, blueberries, raspberries, strawberries, currants, kiwifruit, concord (purple) grapes, figs, tangerines, and plums.
- Some vegetables, such as okra, parsley and leeks.
- Nuts and seeds.
- Cocoa and chocolate.
- Soy products, including soy milk, soy cheese, tofu and soy ice creams.

Tea and coffee have a moderate oxalate content, aim to have no more than two to three cups per day.

### **Additional advice for the prevention of uric acid stones**

Purines are natural substances found in the body and in most foods. The body breaks them down into uric acid. Therefore, if you form uric acid stones, you should try to limit the amount of purines in your diet. Uric acid is also formed from body mass, so weight reduction may help in overweight individuals.

#### **Main dietary sources of purines**

<b>Meat sources</b>	<b>Fish sources</b>	<b>Other sources</b>
All meat sources (beef, lamb, chicken, pork, ham, duck, and so on) Liver, heart and kidney Sweetbreads Meat extracts, such as Oxo	Anchovies Crab Fish Roes Herring Mackerel Sardines Shrimps Whitebait	Yeast and extracts Beer Asparagus Cauliflower Mushrooms Beans and peas Spinach

### **Additional advice for the prevention of calcium phosphate stones**

There is not much evidence for diet advice in patients who form calcium phosphate stones. In principal the general advice above applies, however, it may be detrimental to alkalinise the urine. Cranberry juice may be beneficial as it acidifies the urine. Orange and lemon juice will have the opposite effect.

## Contact us

If you have any queries regarding diet and stones disease, please contact Angela Doherty (senior specialist renal dietitian) on **020 7188 4128** (Monday to Friday, 9am to 5pm). If we are unable to take your call, please leave us a message and we will call you back.

For more information leaflets on conditions, procedures, treatments and services offered at our hospitals, please visit [www.guysandstthomas.nhs.uk/leaflets](http://www.guysandstthomas.nhs.uk/leaflets)

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**t:** 020 7188 8748 9am to 5pm, Monday to Friday

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**t:** 020 7188 8801 at St Thomas'    **t:** 020 7188 8803 at Guy's    **e:** [pals@gstt.nhs.uk](mailto:pals@gstt.nhs.uk)

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**Leaflet number: 2390/VER3**

Date published: April 2014

Review date: April 2017