

# Nutrition Action

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## BE KIND TO YOUR KIDNEYS

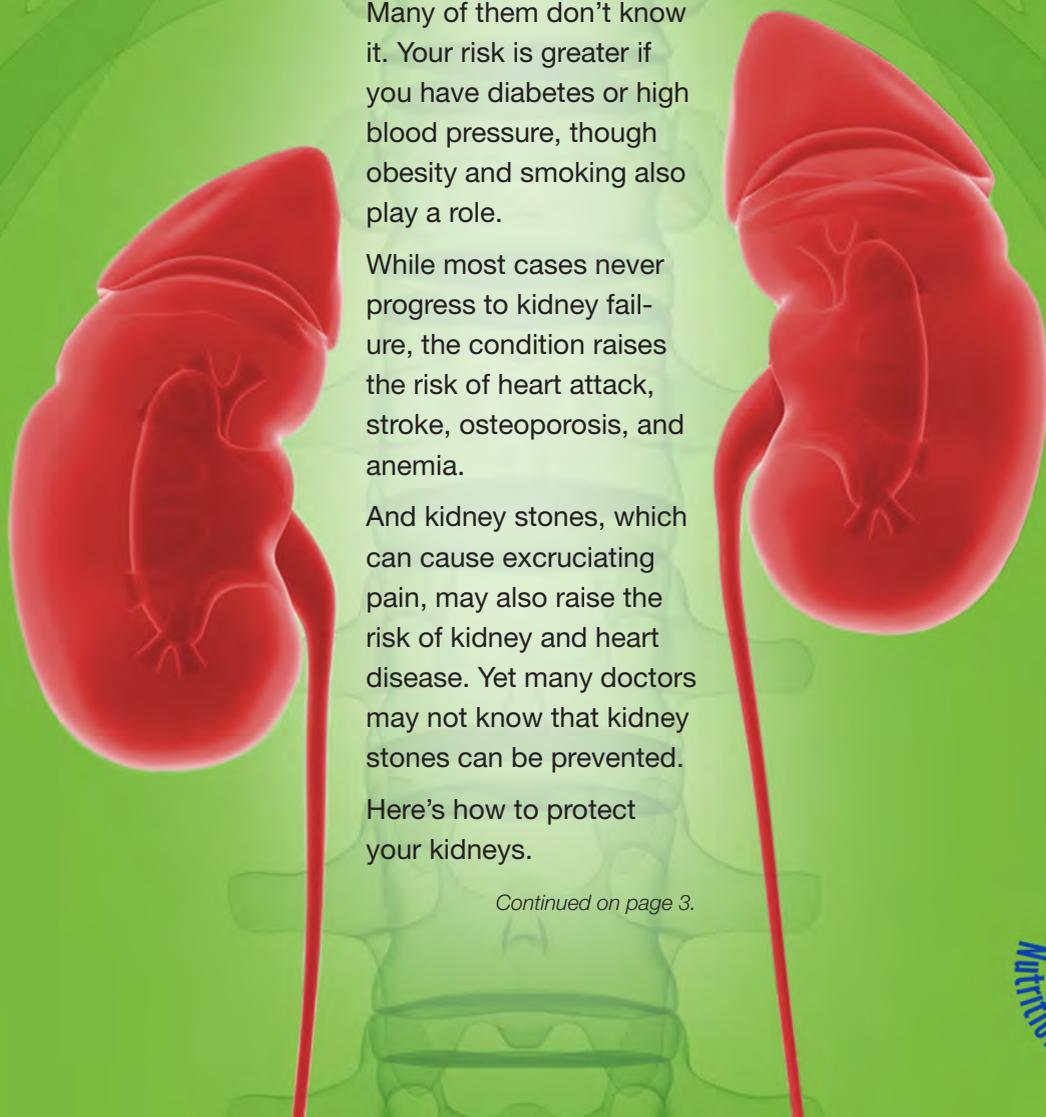
An estimated one out of five adults in their 60s—and nearly half of those 70 or older—have chronic kidney disease. Many of them don't know it. Your risk is greater if you have diabetes or high blood pressure, though obesity and smoking also play a role.

While most cases never progress to kidney failure, the condition raises the risk of heart attack, stroke, osteoporosis, and anemia.

And kidney stones, which can cause excruciating pain, may also raise the risk of kidney and heart disease. Yet many doctors may not know that kidney stones can be prevented.

Here's how to protect your kidneys.

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# BE KIND TO YOUR KIDNEYS



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## CHRONIC KIDNEY DISEASE

### **Q: Is chronic kidney disease an under-recognized public health problem?**

**A:** Absolutely. It's much more common than people had appreciated. That's partly because the population is aging. We know that there is some naturally occurring decline in kidney function with age.

But that doesn't mean that chronic kidney disease is an inevitable part of normal aging. Recent reports from the Nurses' Health Study found that in many healthy people, kidney function didn't change meaningfully over five to ten years.

### **Q: So it's not just aging, but that people are more likely to have risk factors for kidney disease as they age?**

**A:** Yes. Two common conditions—high blood pressure and diabetes—increase the risk of developing kidney disease, and people are more likely to get both if they gain weight and as they age.

Some studies estimate that 10 percent of U.S. adults have chronic kidney disease, but it may occur in up to 40 percent of people with diabetes and 18 percent of people with prediabetes. And some studies find reduced kidney function in 28 percent of people with hypertension

and 17 percent of those with prehypertension.

### **Q: Those numbers are striking.**

**A:** Yes, though if you were recently diagnosed with hypertension or diabetes, you are not going to have kidney disease right away. It takes years, sometimes decades, for the disease to show up, and treating somebody for those conditions can make kidney disease much less likely.

### **Q: Why is kidney disease harmful?**

**A:** Chronic kidney disease can lead to end-stage kidney disease.

Your kidneys stop working, and you need either dialysis or a kidney transplant to survive.

Kidneys are important for maintaining optimal health. For example, as your kidney function deteriorates, you're at increased risk for fractures and anemia.

But kidney disease is also a risk factor for heart attack and stroke. In fact, that's what most people with kidney disease die of. And people with kidney disease are also more likely to develop hypertension.

### **Q: Kidney disease causes hypertension and hypertension causes kidney disease?**

**A:** Yes, it works both ways. If there is some damage to

the kidney, you're much more likely to develop high blood pressure. And high blood pressure can harm the kidney.

### **Q: How?**

**A:** High blood pressure damages the small blood vessels of the kidney, which then damages the glomerulus—the basic filtering unit of the kidney. Each kidney can have up to a million glomeruli.

Kidneys filter about 200 quarts of blood a day. So they are filled with blood vessels, and anything that impairs the blood flow through the kidney reduces the kidney's ability to clean the blood.

### **Q: Do the kidneys keep blood pressure from getting too low?**

**A:** Yes. If blood pressure starts to drop, the kidneys will try to raise it. In the short term, raising blood pressure is a good thing, because if it's too low, oxygen can't reach the brain. But in the

## What a Kidney Does

**WATER.** Ensures that there's not too much or too little water in the body.

**BLOOD PRESSURE.** Makes sure that pressure isn't too high or too low.

**WASTES.** Gets rid of urea, uric acid, toxins, and other wastes via urine.

**BONES.** Activates vitamin D, which helps the body absorb calcium.



**ACID-BASE BALANCE.** Makes sure that the body isn't too acidic or too alkaline.

**HEART.** Maintains a balance of electrolytes (like potassium, sodium, and calcium), which is critical for heart rhythm.

**BLOOD.** Releases erythropoietin, which tells bone marrow to make red blood cells.



long term, high pressure can damage the kidney's blood vessels.

**Q: Does diabetes harm the kidneys in the same way?**

**A:** Not exactly. Diabetes damages not only the small blood vessels in the glomerulus, but also something called the mesangium, which helps support the glomerulus.

**Q: How does kidney disease cause heart attacks and strokes?**

**A:** It's not completely known. It is likely due in part to higher blood pressure, since even small increases in blood pressure can have a dramatic impact on the risk of cardiovascular disease.

But there are other possibilities. One hypothesis is that with reduced kidney function there is an alteration in calcium and phosphorus metabolism, causing calcium deposits in blood vessels or in the heart muscle itself. And the calcification may lead to heart attacks, strokes, or heart failure.

**Q: Do kidneys do more than clean blood and control blood pressure?**

**A:** Yes. Kidneys maintain the internal environment. If you drank a lot of water and your kidneys didn't remove it from the blood, you would basically drown in fluid. And it's the kidneys' job to get rid of almost anything that you ingest that gets absorbed into the bloodstream and that the body doesn't need—say, extra salt, calcium, or phosphorus. Maintaining that balance is critical.

**Q: How do kidneys protect against anemia and bone fractures?**

**A:** The kidney produces a hormone—erythropoietin—that leads to the production of red blood cells. And the kidney has an enzyme that activates vitamin D.

When you consume vitamin D or it's made in the skin, it goes to the liver and then to the kidney, where it becomes the active form. The active form is important for absorbing calcium in the intestines, which helps to maintain bone health.

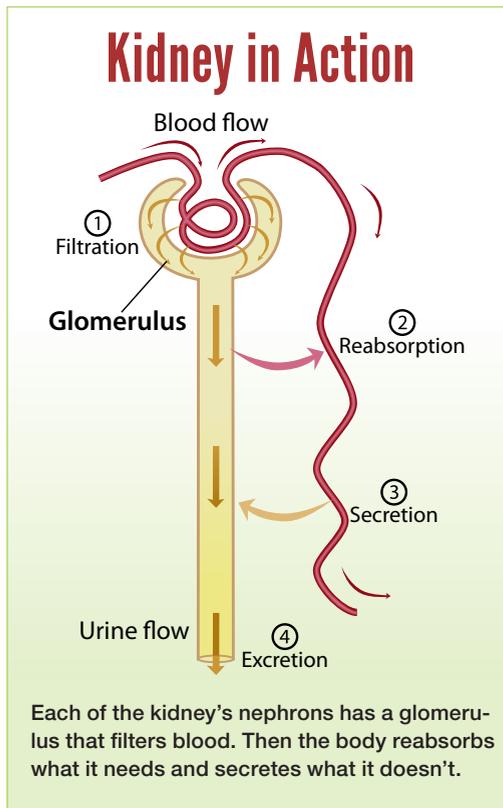
**Q: Why is obesity bad for kidneys?**

**A:** Obesity raises blood pressure and the risk of diabetes. Also, as people gain weight, the kidneys have to work harder.

You can imagine that the amount of waste products that need to get removed

is far greater for a 250-pound person than for a 150-pound person, especially after we eat a large meal.

So the kidney has to adapt. As people gain weight, the kidney can't make more glomeruli, so the existing ones may start to enlarge and the kidney may start to filter blood at a greater rate, which puts



an additional demand on the kidney.

That may lead to damage and the eventual loss of some glomeruli. So the remaining glomeruli have to work that much harder, which leads to more lost glomeruli. It's a vicious cycle.

**Q: Does excess salt harm kidneys?**

**A:** Yes. It can raise blood pressure, and it's possible that excess sodium itself may be harmful.

**Q: Is too much protein harmful?**

**A:** I wouldn't want someone who already has kidney disease on a diet that's very high in animal protein. But there's still disagreement about whether high-protein diets raise the risk of developing kidney disease. In moderate amounts, it's probably not harmful.

I'd rather that people stop smoking, do more exercise, lose weight, and eat a

healthy diet than worry only about how much protein they eat.

**Q: What else can harm kidneys?**

**A:** A number of toxins in the environment—lead, mercury, cadmium.

Excessive, long-term use of over-the-counter analgesics like acetaminophen and ibuprofen can also increase the risk of chronic kidney disease, possibly by raising blood pressure and/or by damaging the kidney directly. Studies about aspirin have been inconsistent.

If you take those analgesics on a regular basis, ask your healthcare provider about alternatives. Just because these drugs are available over the counter doesn't mean they're safe.

**Q: Is exercise good for kidneys?**

**A:** Exercise helps keep blood vessels healthy, lowers blood pressure, reduces the risk of diabetes, and helps people lose weight. So even without conclusive evidence, I would encourage people to be active to protect their kidneys.

**Q: Does early kidney disease have symptoms?**

**A:** Most of the time there are none. It's like high blood pressure. The best way to get people diagnosed is by screening people at higher risk for developing kidney disease—those with diabetes or hypertension. We do a blood test for creatinine and check urine for protein.

But there's not enough convincing data to demonstrate that we should screen everyone.

**Q: Can we protect our kidneys?**

**A:** Yes. Many of the conditions that affect the kidney are preventable. The message is quite similar to what you would do to protect your heart. Lowering your cardiovascular risk goes a long way toward protecting your kidneys.

And kidneys are another reason for people to try to control their blood pressure and blood sugar if they have high levels. The best thing would be to avoid developing high blood pressure and diabetes in the first place.

## KIDNEY STONES

**Q: What are kidney stones?**

**A:** Urine is water with a bunch of waste products dissolved in it. As long as they

## The Minor Leaks



Exercise like walking may help.

An estimated 30 to 40 percent of middle-aged and 50 percent of older women experience urinary leakage. (The problem is less common in men.) But it's a don't ask, don't tell issue.

"Even in our study of nurses, less than 50 percent of the women who had incontinence reported it to their doctors," says Mary Townsend, an epidemiologist at Brigham and Women's Hospital in Boston.

Leaks are more common in women who are older, heavier, or smokers, and in those who have had more children, diabetes, or a hysterectomy.<sup>1</sup>

Caffeine may also play a role.

"We found a moderate increased risk of developing at least weekly incontinence, but only in women who consumed at least 450 milligrams of caffeine a day," says Townsend.<sup>2</sup> (You'd get 420 mg in one Starbucks venti coffee and 520 mg in two tall coffees.)

"Caffeine was only related to urgency incontinence—leaks that occur with a sudden need to go to the bathroom—not with stress incontinence," she notes. That's a leak that typically occurs with coughing or exercise.

How might caffeine cause trouble?

It may be a diuretic. "And in animal studies, caffeine increases the force of muscle contractions in the bladder," says Townsend. "So the combination may lead to urgency."<sup>3</sup>

Other leads have come up empty. "It's a common belief that acidic fruit and tomatoes are bladder irritants," says Townsend.<sup>3</sup> "But we didn't see any association with incontinence."

What may help? Training women to contract their pelvic-floor muscles—using Kegel exercises—makes a difference.<sup>4</sup> So does losing excess weight.<sup>5</sup>

And walking or other moderate exercise may lower the risk, especially of stress incontinence, says Townsend, "in part by maintaining a healthy weight and possibly also by strengthening the pelvic-floor muscles."

<sup>1</sup> *Am. J. Obstet. Gynecol.* 194: 339, 2006.

<sup>2</sup> *J. Urol.* 185: 1775, 2011.

<sup>3</sup> *Int. Urogynecol. J.* 24: 605, 2013.

<sup>4</sup> *Cochrane Database Syst. Rev.*: CD005654, 2010.

<sup>5</sup> *N. Engl. J. Med.* 360: 481, 2009.

stay dissolved, it's not a problem. But sometimes crystals form in the kidney and grow into a stone.

The lifetime risk of kidney stones in U.S. men is now about 20 percent. In women it's about 10 percent. The risk has increased substantially over time.

### Q: Why?

**A:** Obesity, a higher salt intake, higher sugar and high-fructose corn syrup intake, and maybe higher animal protein intake are associated with a greater risk of forming stones.

In contrast, a diet that's rich in calcium, potassium, fruits, and vegetables is protective. Also, the more you drink, the higher the urine volume and the less concentrated your urine is, so the lower your risk of a stone.

### Q: More calcium is good?

**A:** Yes. Even though the vast majority of stones are made of calcium oxalate, we found out 20 years ago that higher calcium intakes from food are associated with a lower risk. However, individuals who take calcium supplements seem to have a higher risk of stones.

### Q: Why are supplements different?

**A:** When you eat food, some of its calcium will stick to some of its oxalate, and that will keep the oxalate from getting absorbed into the blood and eventually getting into the urine. The calcium and oxalate form a crystal in the intestine and are excreted in the stool, so they don't hurt.

Calcium supplements probably would do the same thing as calcium from foods if people took the supplements with

meals, but many people don't. So the calcium gets absorbed into the bloodstream.

If any excess calcium is absorbed, the kidneys remove it from the blood and excrete it in the urine. So you have more calcium in the urine and that would

increase the calcium oxalate in the urine, which increases the risk of a stone.

### Q: Where do we get oxalate?

**A:** Oxalate comes from some foods we eat, and the body also produces oxalate.

Spinach has a huge amount. We advise people who have formed calcium oxalate stones not to eat spinach.

Potatoes are probably the least appreciated source of oxalate. They're important because Americans eat a lot of potatoes.

Wheat bran and some nuts are also high in oxalate, though the amount differs by type (see "Oxalate on Your Plate," p. 6). But nuts and bran have health benefits, so I tell my patients to eat them in moderation unless they have a very high urine oxalate.

### Q: Are other greens high in oxalate?

**A:** No. There is so much misinformation about the oxalate content of foods. People think, "Spinach is a leafy green so I shouldn't eat anything that is leafy or green." But that's not the case.

### Q: Why does obesity lead to stones?

**A:** People who are overweight or obese have a higher risk of forming uric acid stones. It's not clear why, but larger people generally produce more uric acid, and obesity makes urine more acidic, which is a major driver for forming uric acid stones.

Being overweight may also increase the risk of calcium oxalate stones, but the reason is not clear.

### Q: What harm do stones cause?

**A:** Passing a stone can cause excruciating pain. And in a recent study in Alberta, Canada, researchers found that people who had kidney stones were at higher risk for subsequently developing chronic kidney disease. It seems that in some

individuals, crystals get deposited in the kidney and that leads to inflammation and some damage. But it's still very early in that story.



## Oxalate on Your Plate

Never had a calcium oxalate stone? Enjoy your spinach. If you *have* had one, try other leafy greens instead. And go easy on high-oxalate foods like these.

Food	Oxalate (mg)
Spinach (½ cup, cooked)	755
Spinach (1 cup, raw)	656
Rhubarb (½ cup, cooked)	541
Almonds (1 oz., 23 nuts)	122
Miso soup (1 cup)	111
Baked potato with skin (1)	97
Beets (½ cup, cooked)	76
Navy beans (½ cup, cooked)	76
Dates (3)	72
Okra (½ cup, cooked)	57
Post Wheat'n Bran Shredded Wheat Spoon Size (1¼ cups)	53
French fries (4 oz., 1½ cups)	51
Cashews (1 oz., 18 nuts)	49
Wheat berries (½ cup, cooked)	49
Kellogg's Raisin Bran (1 cup)	46
Post Original Shredded Wheat Spoon Size (1 cup)	45
Bulgur (½ cup, cooked)	43
Lentil soup (1 cup)	39
Chocolate syrup (2 Tbs.)	38
Snickers bar (1 bar, 1.86 oz.)	38
Post Bran Flakes (¾ cup)	36
Kellogg's All-Bran Complete Wheat Flakes (¾ cup)	34
Walnuts (1 oz., 14 halves)	31
Orange (1)	29
Kellogg's Original Frosted Mini-Wheats Bite Size (1 cup)	28
Peanuts (1 oz., 32 nuts)	27
Kellogg's All-Bran Original (½ cup)	26
Peanut butter (2 Tbs.)	26
Raspberries (½ cup)	24
Potato chips (1 oz.)	21
Kellogg's Müeslix (⅔ cup)	17
Tomato sauce (½ cup)	17
Red kidney beans (½ cup, cooked)	15
Pistachios (1 oz., 49 nuts)	14
Brown rice (½ cup, cooked)	12
Pecans (1 oz., 19 halves)	10

Adapted from Oxalate Content of Foods.xls (regepi.bwh.harvard.edu/health/Oxalate/files).



### Q: Do people with stones have a higher risk of heart disease?

**A:** Yes, but the reasons are still being explored. People who form stones and those who have heart attacks or strokes may share risk factors like differences in calcium metabolism. A significant portion of people with kidney stones have high urine calcium that we can't explain.

And whatever is causing that underlying abnormality may also put those people at higher risk for, say, calcification in the blood vessels. But stone disease itself may cause inflammation. Perhaps that's what increases the risk of heart disease.

### Q: Can stones be prevented?

**A:** Yes. That's important for patients and physicians to recognize. My practice is limited to people who have kidney stones. I see people who have had 20, 50, or even more stones, and nobody had ever told them that stones could be prevented.

They were told, "It just happens" or "It's in your genes." Genes do contribute to stone disease, but the vast majority of stones can be prevented.

### Q: How?

**A:** It depends on the type of stone. We ask patients to collect their urine for 24 hours to measure what's in there, and then we make recommendations.

For the most common type, calcium oxalate, avoiding spinach is beneficial. If people have too much calcium in their urine, eating less salt might help, because if your salt intake is very high, that can lead to high calcium in the urine. And eating more fruits and vegetables can help prevent calcium oxalate stones.

### Q: And uric acid stones?

**A:** I recommend eating less meat, poultry, and fish. They contain purines that are metabolized by the body into uric acid, which is then excreted in the urine. And those foods also result in the generation of acid. Acidic urine is a strong risk factor for uric acid stones.

### Q: Are liquids critical?

**A:** It's very important for anyone who's had any kind of stone to drink enough fluid to produce at least two liters of urine a day. Drinking eight cups of liquid a day may be enough, but many patients need more. And some people also need medication.

### Q: Will any liquids do?

**A:** Some are better than others. In general, the more you drink, the higher your urine volume, but sugar-sweetened beverages are actually associated with a higher risk of stones. People shouldn't drink them anyhow, because they're linked to a higher risk of weight gain and diabetes. I recommend fluids without calories.

Some of my patients have been told to avoid alcoholic beverages. While I don't prescribe them, they may help prevent stone formation. And people are often told, "Don't drink coffee or tea because they will dehydrate you." But both decaf and caffeinated coffee and tea are associated with a lower risk of stones. ☕

## The Bottom Line

### To lower your risk of kidney disease:

- Lose (or don't gain) excess weight.
- Minimize sodium and sugar (sucrose and fructose).
- Fill half your plate with vegetables or fruit.
- Exercise for 30 to 60 minutes a day.
- If necessary, take medicine to lower your blood pressure and blood sugar.
- Eat a diet based on the OmniHeart and DASH studies (see *Nutrition Action*, Oct. 2009, cover story). Some features of a 2,000-calorie diet:
  - 2 servings of low-fat dairy (milk, yogurt, or cheese)
  - 2 servings of beans, tofu, or nuts
  - 1 small serving of fish, poultry, or lean meat

### If you've had a kidney stone, also:

- Drink at least 8 cups of water or other (not sugar-sweetened) beverages a day.
- If you take a calcium supplement, take it with food.
- Limit high-oxalate foods (see "Oxalate on Your Plate").