
Here's How Lemon Juice May Fend Off Kidney Stones

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Nanoparticles in the juice slowed the formation of the stones in rats.

A surprise ingredient may explain how lemon juice puts the squeeze on kidney stones.

Lemons contain nanoparticles that, when fed to rats, block stone formation, scientists report in the Feb. 22 [Nano Letters](#). If the tiny sacs do the same for humans, the nanoparticles might one day offer a way to prevent kidney stones in people, says pharmaceutical scientist Hongzhi Qiao of [Nanjing University of Chinese Medicine](#).

Lemon juice is a well-known home remedy for kidney stones, which form when minerals crystalize and clump up inside the kidney (SN: 9/21/2018). These rocky lumps can knock around in the urinary tract, slicing and dicing tissues as they eventually pass out of the body (SN: 10/31/2016). "It's so, so, so painful," says Jingyin Yan, a nephrologist at Baylor College of Medicine in Houston who was not part of the new study. Patients may feel sharp pain in their back, side or lower abdomen when they pass a stone, she says. "People describe it as worse than delivering a baby."

Though some medications can help treat kidney stones, many people end up needing surgery to remove them, says Thomas Chi, a urologist at the University of California, San Francisco, also not part of the study. People often imagine kidney stones as tiny pebbles, but sometimes they bulk up like boulders, he adds. "I've taken out stones the size of your fist."

That's why prevention is key. Scientists already knew that citric acid, which gives lemons their sour power, may do the trick by binding to the minerals that make up stones. But drinking mouth-puckering lemon juice is not so comfortable for patients, Qiao says.

A 2022 clinical trial found that kidney stone patients had trouble downing 120 milliliters — about a half cup — of lemon juice per day. Swilling loads of lemonade can cause dental problems, too. Chi has had patients drink so much that the acidic liquid ate away at their teeth.

So Qiao and colleagues looked for other, more palatable lemon-derived ingredients that might help prevent kidney stones. Inside edible and medicinal plants like ginseng, grapefruit and dandelion, his team has found extracellular vesicle-like nanoparticles, tiny sacs stuffed with molecules including fat, protein and DNA.

These nanoparticles exist in lemon juice, too — and the team fed them to rats that had also ingested a substance that promotes kidney stone growth. The zesty particles slowed stone formation, Qiao and colleagues found. The finding suggests these particles curb development of calcium oxalate crystals, the most common culprit of kidney stones. The particles can also soften the stones and make them less sticky, the team showed.

The new work challenges the conventional wisdom on how lemon juice works to combat kidney stones, Chi says. Using lemon nanoparticles to treat people is still a long way off, but the team's results hold promise, he says. "The faster you can bring a finding like this towards a human clinical trial, the better."

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