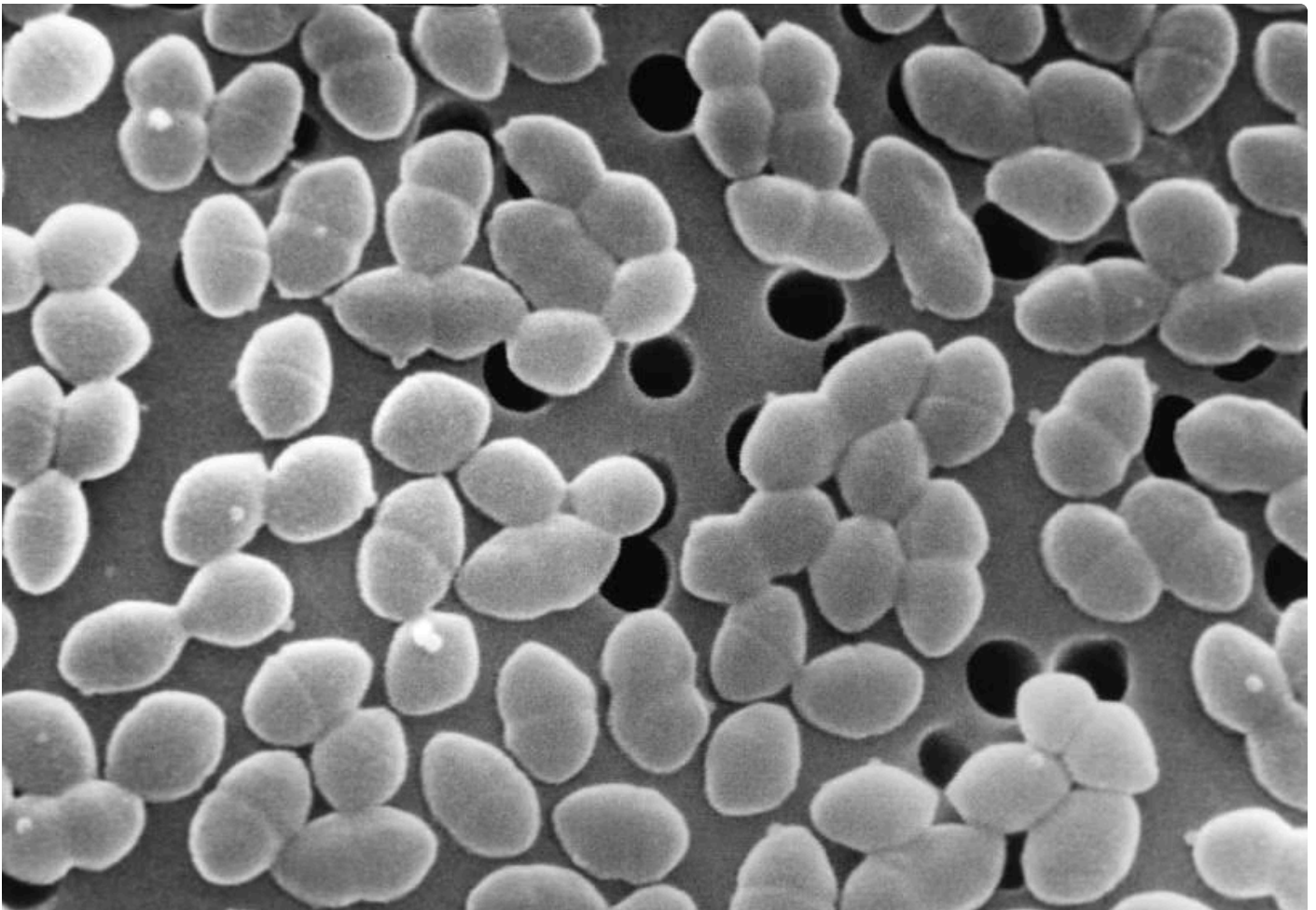
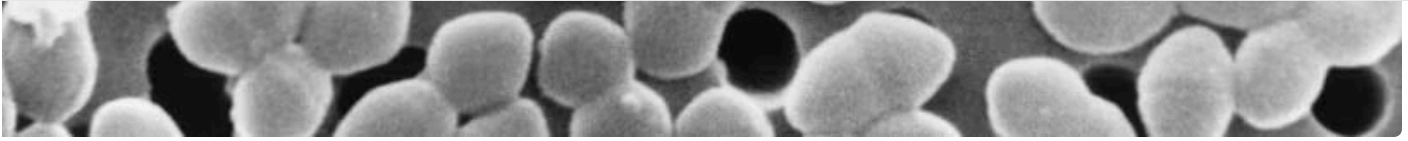






Antibiotic treatment combined with a sugary diet exacerbated and prolonged blooms of ...

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Sugary foods combined with antibiotic treatment can damage the gut microbiome in ways that could leave people vulnerable to dangerous infections, a new study shows.

The new research, published Wednesday in the journal Nature, took advantage of a natural experiment: It looked at what happened to gut bacteria in cancer patients who were hospitalized and treated with sustained antibiotics before receiving stem cell transplants. Because the patients only ate food prepared by the hospital, researchers knew exactly what and how much food they ate – a rarity in nutrition studies, which typically rely on participants to recall what they ate hours or days earlier, something people are notoriously bad at.

The gut microbiome consists of trillions of bacteria, viruses and other microbes that populate human intestines. These tiny organisms perform a host of functions including helping with digestion, making essential vitamins, and playing a role in immune function. Science has shown the microbiome also communicates with the brain to produce neurotransmitters like serotonin, which are important for sleep, mood and stress levels.

Studies have shown that the numbers and variety of bacteria that live in the gut depend largely on diet. People who eat varied, plant-based, fiber-rich diets tend to have higher diversity of organisms in the intestines compared with those who eat diets with more highly processed foods. In general, the more diverse a person's microbiome is, the healthier it is. A dense, diverse community of bugs in the gut is able to prevent bad actors – called pathobionts – from taking over and causing illness.

“One of the things that that differentiates this study from other ones that have been previously published is that the patients are having their microbiome pummeled, and they’re also having their nutritional state disrupted by the cancer treatment,” said study author Dr. Jonathan Peled, a physician scientist at Memorial Sloan Kettering.

The research, which was led by scientists at Memorial Sloan Kettering Cancer Center and NYU’s Langone Health in New York, and City of Hope Cancer Center in Los Angeles, looked at what happened after antibiotics and hospital food destabilized and disrupted normal gut flora. They used this state of disruption as a window to see the effects of certain types of foods on the composition of the gut microbiome.

“We sliced and diced the data in different ways,” Peled said.

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They looked at the relationship between broad categories of macronutrients like fat, carbohydrates and fiber, and different types of gut bacteria. They also looked at the

“And the theme that kept popping up over and over again was the more sugary foods you eat, no matter what type of sugar it is – with particularly noxious effects from added sugars – it seemed that really seemed to synergize with antibiotics in terms of damaging the microbiome,” Peled said.

The study drew its data from more than 1,000 stool samples, collected from 173 patients, who ate more than 9,400 hospital prepared meals.

Across the board, the more intense a patient’s antibiotic regimen was, the greater the loss of diversity in their microbiome.

They found most types of foods were not associated with changes to the diversity of bacteria found in the gut. Sweets, however – which the researchers defined as sugars, and sweetened foods and beverages – were a different story. For every 3.5-ounce increase in consumption of sweets while on antibiotic treatment, the diversity of a patient’s microbiome measured in their stool sample decreased by about 24%, the study showed.

The decrease in gut bacteria diversity was tied to expansions in populations of certain bad actors, such as the bacteria *Enterococcus faecium*.

Enterococcus is an opportunistic organism. It hangs around harmlessly in the gut and is kept in check by other types of bacteria that outcompete it. But when there's a disruption, such as antibiotic treatment that wipes out the other bacteria, it can start to overgrow. In some cases, it may slip through the gut wall and into the bloodstream, where it can cause sepsis.

"In bone marrow transplant specifically, we found that *Enterococcus* can make certain complications of transplant worse, something called graft versus host disease," Peled said.

In graft versus host disease, donated stem cells recognize a recipient's body as foreign and begin to attack their healthy tissues.

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human cancer patients in mice. They gave mice a single injection of a broad spectrum antibiotic and saw a small increase in Enterococcus bacteria. When they also fed the mice added sugar after the antibiotic shot, the amount of Enterococci bacteria increased 16-fold by day three and 33-fold by day six.

This increase may have real consequences, too.

Overall, patients who ate more sugar than average had about a 12% higher risk of dying after their transplants compared with those who didn't consume as much. It's a small but significant increase in risk.

"It's a modest change in their risk profile," Peled said.

The expansion of Enterococcus bacteria lasted about eight days after antibiotic treatment.

“It’s a pretty neat study,” said Dr. Anthony Maresso, professor of virology and microbiology at the Baylor College of Medicine in Houston. “I suspect it’s going to make some waves,” added Maresso, who was not involved in the research.

“This has significance for these transplant recipients because that’s the number one thing hospitals are worried about is that they’re going to get infections in the clinical care setting,” Maresso said. “Makes me wonder about whether we should change the diet of hospitals.”

The next question, he said, is whether this study has significance for people who take antibiotics outside a hospital setting. Does a high-sugar diet on antibiotics for, say, an ear infection, set you up for other infections down the road, for example?

Peled said while the study is provocative, it’s not a randomized, controlled clinical trial where researchers are able to test different diets to see which one might be most protective for people taking antibiotics.

Because it's generally a good idea to avoid eating too much sugar, he said, it's not unreasonable to considering limiting sugar during antibiotic treatment.

“What our study suggests might work is not to avoid sugar or sugary foods during your entire time, but specifically when you're on antibiotics,” Peled said.

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