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How Fermented Foods May Alter Your Microbiome and Improve Your Health

Foods like yogurt, kimchi, sauerkraut and kombucha increased the diversity of gut microbes and led to lower levels of inflammation.

By Anahad O'Connor

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Fermented foods like yogurt, kimchi, sauerkraut and kombucha have long been dietary staples in many parts of the world. Indeed, for thousands of years, different cultures relied on fermentation to produce bread and cheese, preserve meats and vegetables, and enhance the flavors and textures of many foods.

Now scientists are discovering that fermented foods may have intriguing effects on our gut. Eating these foods may alter the makeup of the trillions of bacteria, viruses and fungi that inhabit our intestinal tracts, collectively known as the gut microbiome. They may also lead to lower levels of body-wide inflammation,

which scientists increasingly link to a range of diseases tied to aging.

The latest findings come from a study published in the journal Cell that was carried out by researchers at Stanford University. They wanted to see what impact fermented foods might have on the gut and immune system, and how it might compare to eating a relatively healthy diet full of fruits, vegetables, beans, whole grains and other fiber-rich foods.

For the study, the researchers recruited 36 healthy adults and randomly split them into groups. One group was assigned to increase their consumption of fiber-rich plant foods, while a second group was instructed to eat plenty of fermented foods, including yogurt, sauerkraut, kefir, kombucha and kimchi. These foods are made by combining milk, vegetables and other raw ingredients with microorganisms like yeast and bacteria. As a result, fermented foods are often teeming with live microorganisms, as well as byproducts of the fermentation process that include various vitamins and lactic and citric acids.

The participants followed the diets for 10 weeks while the researchers tracked markers of inflammation in their blood and looked for changes in their gut microbiomes. By the end of the study, the first group had doubled their fiber intake, from about 22 grams per day to 45 grams daily, which is roughly triple the average American intake. The second group went from consuming almost no fermented foods to eating about six servings a day. Although six servings might sound like a lot, it does not take much to get there: One cup of yogurt for breakfast, a 16-ounce bottle of kombucha tea at lunch, and a cup of kimchi at dinner amounts to six daily servings.

After the 10-week period, neither group had significant changes in measures of overall immune health. But the fermented food group showed marked reductions in 19 inflammatory compounds. Among the compounds that showed declines was interleukin-6, an inflammatory protein that tends to be elevated in

diseases such as Type 2 diabetes and rheumatoid arthritis. The high-fiber group, in contrast, did not show an overall decrease in the same inflammatory compounds.

For people in the fermented foods group, the reductions in inflammatory markers coincided with changes in their guts. They began to harbor a wider and more diverse array of microbes, which is similar to what other recent studies of people who eat a variety of fermented foods have shown. The new research found that the more fermented foods people ate, the greater the number of microbial species that bloomed in their guts. Yet, surprisingly, just 5 percent of the new microbes that were detected in their guts appeared to come directly from the fermented foods that they ate.

Fresh kimchi, or Korean fermented vegetables, are an increasingly popular item at many supermarkets. Lanna Apisukh for The New York Times

"The vast majority came from somewhere else, and we don't know where," said Justin Sonnenburg, an author of the new study and a professor of microbiology and immunology at Stanford. "I think there were either low level microbes below the level of detection that bloomed, or the fermented foods did something that allowed for the rapid recruitment of other microbes into the gut environment."

Higher levels of gut microbiome diversity are generally thought to be a good thing. Studies have linked it to lower rates of obesity, Type 2 diabetes, metabolic disease and other ills. People who live in industrialized nations tend to have less microbial diversity in their guts than those living in more traditional, nonindustrialized societies. Some scientists speculate that modern lifestyle factors like diets high in processed foods, chronic stress and physical inactivity may suppress the growth of potentially beneficial gut microbes. Others argue that the correlation between diverse microbiomes and good health is overblown, and that the low levels of microbiome diversity typically seen in people living in developed nations may be suitably adapted to a modern world.

One subject on which there is usually little disagreement among nutrition experts is the benefits of a high-fiber diet. In large studies, people who consume more fruits, vegetables, nuts and other fiber-rich foods tend to have lower rates of mortality and less chronic disease. Fiber is considered good for gut health: Microbes in the gut feed on fiber and use it to produce beneficial byproducts like short-chain fatty acids, which can reduce inflammation. Some studies also suggest that eating a lot of fiber promotes a diverse microbiome.

The Stanford researchers expected that consuming a high-fiber diet would have a big impact on the makeup of the microbiome. Instead, the high-fiber group tended to show few changes in their microbial diversity.

But when the scientists looked closer, they discovered something striking. People who started out with higher levels of microbial diversity had reductions in inflammation on the high-fiber diet, while those who had the least microbial diversity had slight increases in inflammation when they ate more fiber.

The researchers said they suspect that the people with low microbiome diversity may have lacked the right microbes to digest all the fiber they consumed. One finding that supports this: The high-fiber group had unexpectedly large amounts of carbohydrates in their stool that had not been degraded by their gut microbes. One possibility is that their guts needed more time to adapt to the high-fiber diet. But ultimately this finding could explain why some people experience bloating and other uncomfortable gastrointestinal issues when they eat a lot of fiber, said Christopher Gardner, another author of the study.

“Maybe the challenges that some people have with fiber is that their microbiomes aren’t prepared for it,” said Dr. Gardner, the director of nutrition studies at the Stanford Prevention Research Center.

One question that the researchers hope to answer in the future is what would happen if people simultaneously ate more fermented foods as well as more fiber. Would that increase the variety of microbes in their guts and improve their ability to digest more fiber? Would the two have a synergistic effect on inflammation?

Suzanne Devkota, the director of Microbiome Research at Cedars-Sinai Medical Center in Los Angeles, who was not involved in the new study, said it has long been assumed that eating fermented foods had health benefits but that the new research provides some of the first “hard evidence” that it can influence the gut and inflammation. “We were always a little reluctant to make comments about fermented foods being beneficial, particularly from an inflammatory standpoint, because there was really no data behind that,” she said.

Dr. Devkota cautioned that the findings should not deter anyone from eating fiber-rich foods, because fiber has so many health benefits beyond its impact on the gut. She consumes a lot of fiber and fermented foods herself and often recommends that patients at Cedars-Sinai who have conditions like inflammatory bowel disease do the same. “This doesn’t change what I’ve been recommending,” she added. “But I’d probably switch a little more toward encouraging people to consume fermented foods because now I have data to point to that suggests there’s some anti-inflammatory properties.”

Dr. Devkota said more research was needed to better understand the links between fermented foods and overall health. But she suggested that one reason fermented foods may be beneficial is because the microorganisms they contain are constantly producing many nutrients during the fermentation process. “A jar of sauerkraut is a living food with stuff that is actively being produced, like vitamins,” she said. “When you eat a fermented food, you’re consuming all of those microbially produced chemicals that are good for you.”

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