Research Shows Zero-Calorie Sweeteners Can Raise Blood Sugar

They Can Alter the Population of Gut Bacteria and Trigger Unwanted Changes

By GAUTAM NAIK

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The artificial sweeteners in diet sodas, yogurt and other foods can raise blood-sugar levels, according to a new study. WSJ's Gautam Naik reports. Photo: iStock

The artificial sweeteners in diet soda, yogurt and other foods consumed by millions can raise the blood sugar level instead of reducing it, according to new experiments in mice and people.

The provocative finding—made possible through a new avenue of research—is likely to stoke the simmering controversy over whether artificial sweeteners help or hinder people's ability to lose weight and lower their risk of diabetes.

The research shows that zero-calorie sweeteners such as saccharin, sucralose and aspartame can alter the population of bacteria in the gut and trigger unwanted changes such as higher blood glucose levels—a risk factor for diabetes.
"The scope of our discovery is cause for a public reassessment of the massive and unsupervised use of artificial sweeteners," said Eran Elinav, a physician and immunologist at Israel’s Weizmann Institute of Science and lead author of the study, which appeared Wednesday in the journal Nature.

Though many people consume artificial sweeteners instead of sugar to control their weight, the scientific evidence that they work is mixed. Some studies have indicated that the sweeteners can help lead to weight loss, while others suggest they contribute to weight gain.

One reason is that it isn’t clear whether people who consume artificial sweeteners are overweight because of what they eat—or whether overweight people are the ones who typically gravitate to such products.

Based on existing evidence, guidelines jointly published in 2012 by the American Heart Association and the American Diabetes Association noted that artificial sweeteners "when used judiciously...could facilitate reductions in added sugar," and thus influence weight loss.

The new Nature study marks a significant advance because it brings together two separate areas of research—the role of sweeteners in raising blood sugar levels, and the complex workings of the vast colonies of bacteria that inhabit the gut. Individuals can have differing bacterial colonies in their gut, meaning people respond differently to what they consume.

In one experiment, the researchers found that mice whose diets included sugar, sucralose or aspartame had significantly higher blood-glucose levels than mice whose diet included sugar, or no sugar at all. They next wanted to test whether the fake sweeteners caused that metabolic change by altering the balance of microbes in the animals’ gut.

They transplanted bacteria from artificial-sweetener-fed mice or sugar-fed mice into other mice that were bred to have no gut bacteria of their own and that had never consumed a sweetener product. They found that the bacterial transfer from the sweetener-fed mice raised the blood sugar levels in the transplant recipients—suggesting that the gut microbes had triggered the higher sugar levels in mice fed fake sweeteners.

Was the same link true for people? Dr. Elinav and his colleagues examined the relationship between long-term consumption of artificial sweeteners and various metabolic measurements in some 380 nondiabetic people.

They found that the bacteria in the gut of those who regularly ate fake sweeteners were notably different from those who didn’t. In addition, there was a correlation between the sweetener consumption and a susceptibility to glucose intolerance, which is a disturbance in the blood glucose level. Correlation, however, doesn’t necessarily mean causation. In the next experiment, seven volunteers
who normally didn’t consume fake sugar were asked to consume products high in the sweeteners. After four days, four of them had significantly higher blood-sugar levels as well as altered populations of bacteria in their gut—an outcome similar to what was seen in mice.

“This susceptibility to sweeteners [can now] be predicted ahead of time by profiling the microbes in the people,” said Eran Segal, a co-author of the study and computational biologist at the Weizmann Institute.

The results need to be corroborated through a study with many more participants.

In a statement, the Calorie Control Council, a trade group that represents makers of artificial sweeteners and other food products, said the Nature study suffered from several limitations. It said the results from the mouse experiments may not apply to humans, while the human experiments had a small sample size. It said further research was needed.

Researchers aren’t sure about the exact mechanisms causing the imbalance in the gut bacteria populations. But they found that several types of bacteria that changed after the consumption of artificial sweeteners previously had been associated with Type 2 diabetes in humans.

The results appears to demonstrate that for some people, artificial sweeteners can alter the composition of gut bacteria in such a way that it may contribute to—rather than reduce—certain metabolic conditions related to obesity, such as glucose intolerance.

"We've been wondering why people who consume [artificial] sweeteners don't always lose weight," said Judy Wylie-Rosett, a nutrition expert at Albert Einstein College of Medicine in New York, who wasn't involved in the Nature research. "This is a very intriguing study because it's the first one that looks at gut microbes."

Artificial sweeteners have been around for more than a century. But no one thought to embark on this type of study before because scientists' understanding of how gut microbes respond to different foods and the metabolic changes they induce is still in its infancy.

Some 100 trillion microbes live in the human body. Together, they have at least 100 times as many genes as we do. Unlike the genes we are born with, those microbes can be easily manipulated via drugs or changes in diet. This knowledge has sparked a big push to understand the role of microbes in regulating human health.

The authors of the Nature study are now recruiting hundreds of volunteers for a much more ambitious study that will try to establish a link between gut bacteria, their responses to hundreds of common food products and the physical changes they induce in connection with obesity, diabetes and other diseases.

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Corrections & Amplifications

Judy Wylie-Rosett is a nutrition expert at Albert Einstein College of Medicine. An earlier version of this article misspelled her surname as Wylie-Rosette. (Sept. 17, 2014)