

# Quantity of sugar in food supply linked to diabetes rates, study says

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Does eating too much sugar cause diabetes? For years, scientists have said "not exactly." Eating too much of any food, including sugar, can cause you to gain weight; it's the resulting obesity that predisposes people to diabetes, according to the prevailing theory.

But now the results of a large epidemiological study suggest sugar may also have a direct, independent link to [diabetes](#). Researchers from the Stanford University School of Medicine, the University of California-Berkeley and the University of California-San Francisco examined data on sugar availability and diabetes rates from 175 countries over the past decade. After accounting for obesity and a large array of other factors, the researchers found that increased sugar in a population's food supply was linked to higher diabetes rates, independent of obesity rates. Their study will be published Feb. 27 in [PLOS ONE](#).

"It was quite a surprise," said Sanjay Basu, MD, PhD, an assistant professor of medicine at the Stanford Prevention Research Center and the study's lead author. The research was conducted while Basu was a medical resident at UCSF.

The study provides the first large-scale, population-based evidence for the idea that not all calories are equal from a [diabetes-risk](#) standpoint, Basu said. "We're not diminishing the importance of obesity at all, but these data suggest that at a [population level](#) there are additional factors that contribute to diabetes risk besides obesity and total [calorie intake](#), and that sugar appears to play a prominent role."

Specifically, more sugar was correlated with more diabetes: For every additional 150 calories of sugar available per person per day, the prevalence of diabetes in the population rose 1 percent, even after controlling for obesity, physical activity, other types of calories and a number of economic and social variables. A 12-ounce can of soda contains about 150 calories of sugar. In contrast, an additional 150 calories of any type caused only a 0.1 percent increase in the population's diabetes rate.

Not only was sugar availability correlated to diabetes risk, but the longer a population was exposed to excess sugar, the higher its diabetes rate after controlling for obesity and other factors. In addition, diabetes rates dropped over time when sugar availability dropped, independent of changes to consumption of other calories and physical activity or [obesity rates](#).

The findings do not prove that sugar causes diabetes, Basu emphasized, but do provide real-world support for the body of previous laboratory and experimental trials that suggest sugar affects the liver and pancreas in ways that other types of foods or obesity do not. "We really put the data through a wringer in order to test it out," Basu said.

The study used food-supply data from the United Nations Food and Agricultural Organization to estimate the availability of different foods in the 175 countries examined, as well as estimates from the International Diabetes Foundation on the prevalence of diabetes among 20- to 79-year-olds. The researchers employed new statistical methods derived from econometrics to control for factors that could provide alternate explanations for an apparent link between sugar and diabetes, including overweight and obesity; many non-sugar components of the food supply, such as fiber, fruit, meat, cereals and oils; total calories available per day; sedentary behavior; rates of economic development; household income; urbanization of the population; tobacco and alcohol

use; and percentage of the population age 65 or older, since age is also associated with diabetes risk.

"Epidemiology cannot directly prove causation," said Robert Lustig, MD, pediatric endocrinologist at UCSF Benioff Children's Hospital and the senior author of the study. "But in medicine, we rely on the postulates of Sir Austin Bradford Hill to examine associations to infer causation, as we did with smoking. You expose the subject to an agent, you get a disease; you take the agent away, the disease gets better; you re-expose and the disease gets worse again. This study satisfies those criteria, and places sugar front and center."

"As far as I know, this is the first paper that has had data on the relationship of sugar consumption to diabetes," said Marion Nestle, PhD, a professor of nutrition, food studies and public health at New York University who was not involved in the study. "This has been a source of controversy forever. It's been very, very difficult to separate sugar from the calories it provides. This work is carefully done, it's interesting and it deserves attention."

The fact that the paper used data obtained over time is an important strength, Basu said. "Point-in-time studies are susceptible to all kinds of reverse causality," he said. "For instance, people who are already diabetic or obese might eat more sugars due to food cravings."

The researchers had to rely on food-availability data for this study instead of consumption data because no large-scale international databases exist to measure food consumption directly. Basu said follow-up studies are needed to examine possible links between diabetes and specific sugar sources, such as high-fructose corn syrup or sucrose, and also to evaluate the influence of specific foods, such as soft drinks or processed foods.

Another important future step, he said, is to conduct randomized clinical trials that could affirm a cause-and-effect connection between sugar consumption and diabetes. Although it would be unethical to feed people large amounts of sugar to try to induce diabetes, scientists could put participants of a study on a low-sugar diet to see if it reduces diabetes risk.

Basu was cautious about possible policy implications of his work, stating that more evidence is needed before enacting widespread policies to lower sugar consumption.

However, Nestle pointed out that the findings add to many other studies that suggest people should cut back on their sugar intake. "How much circumstantial evidence do you need before you take action?" she said. "At this point we have enough circumstantial evidence to advise people to keep their [sugar](#) a lot lower than it normally is."

**More information:** [dx.plos.org/10.1371/journal.pone.0057873](https://dx.plos.org/10.1371/journal.pone.0057873)

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