

Fat fruit flies: High-sugar diet deadens sweet tooth; promotes overeating, obesity in flies

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Drosophila melanogaster. Credit: Wikipedia/CC BY-SA 2.5

Some research suggests that one reason people with obesity overeat is because they don't enjoy food—especially sweets—as much as lean people.

But it's not understood if [obesity](#) itself or eating certain foods causes taste changes, or how those changes impact appetite and obesity.

For clues, University of Michigan researchers turned to *Drosophila melanogaster*—[fruit flies](#)—in a study appearing May 7 in *Cell Reports*.

They discovered that after feeding fruit flies a high-sugar diet, the flies' [taste neurons](#) triggered a molecular chain-reaction that hampered their ability to taste sweets, which in turn fueled overeating and obesity. Further, eating sugar caused the taste changes, not the metabolic consequences of obesity or the sweet taste of [food](#).

The fly findings are significant because if people respond similarly to sugar, researchers are closer to understanding how too much sugar contributes to overeating and obesity. And, because these are molecular changes, it supports the idea that overeating is at least partly beyond our control.

While it's impossible to measure fruit flies' "enjoyment" of food, they certainly ate more on the high-sugar diet, said principal investigator Monica Dus, U-M associate professor of molecular, cellular, and developmental biology.

And yes—fruit flies do become obese, said Christina May, first author of the study and a doctoral student in Dus' lab. Flies and humans share other surprising similarities: Both love sugar and fat and produce dopamine upon eating it, and their [brain cells](#) use many of the same proteins and molecules humans do, for the same things.

The researchers tested their findings in several ways. First, they fed flies that were genetically obese but never exposed to high dietary sugar, and their taste didn't change. However, when they fed sugar equivalent to a cookie to flies unable to store fat, they stayed thin but still lost the ability to taste sweets.

"That's really amazing because it tells you their ability to taste sweets

changed because of what they're eating, not because they're becoming obese," May said.

To find out if the sugar or the sweet taste of food caused taste changes, the researchers fed flies a diet similar to artificially sweetened diet soda. Only the flies eating real sugar lost their sweet-tasting ability.

"We know it's something specific about the sugar in the diet that's making them lose their taste," Dus said.

The researchers identified the molecule O-GlcNAc transferase, a sugar sensor located in the flies' taste buds that keeps track of how much sugar is in the cells. OGT has previously been implicated in obesity-related conditions like diabetes and heart disease in humans.

They also manipulated flies' taste cells so that even on a high-sugar diet they wouldn't lose taste, and those flies didn't overeat despite loads of sugar.

"This means the changes in taste, at least in flies, are pretty important to drive overconsumption and weight gain," Dus said. "Do changes in taste also play a role in the overconsumption that we see when humans and other animals find themselves in food environments high in sugar?"

Study co-author Anoumid Vaziri, a doctoral student in Dus' lab, said the findings "not only shed light on sugar-diet-dependent neural mechanisms of overeating and obesity, but provide a platform to study the underlying molecular mechanisms that drive changes in neural activity."

So what's this mean for people who are overweight, dieting or feel addicted to sugar? It's possible that in the long-term, a drug or other intervention that corrects dietary sweetness and preserves the sweet taste sensation could someday help curb obesity and the associated chronic

diseases. But that is years away, May said.

More importantly, if humans respond the same way as the flies, the research suggests that changing the amount of sugar in the diet can help regulate our food intake, Dus said. Much of the sugar we eat is hidden in processed food, and it's important to keep it to a minimum, she added.

"I think if you try to keep added sugars out of your [diet](#), you'll probably be totally fine, you won't have problems with changing [taste](#) and overeating," May said. "All of us try to avoid the added sugars. That's important."

Dus said that future research will examine sugar's impact on the brain's reward circuits to learn what causes overeating, and how [sugar](#) changes the brain on a molecular level.

More information: High Dietary Sugar Diet Reshapes Sweet Taste to Promote Overconsumption in *Drosophila Melanogaster*, *Cell Reports* (2019). doi.org/10.1016/j.celrep.2019.04.027

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