Medical Xpress

Novel sugar detector system in the human mouth has implications for designing tastier, healthier beverages and foods

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Most everyone understands that a major role of our sense of taste is to inform us when sugar is present in foods and beverages by eliciting sweetness on our tongues. A study led by the Monell Chemical Senses Center, published this month in *PLOS ONE*, identifies a new human sensory ability to detect sugars in the mouth with a molecular calorie detector, of sorts.

"Our mouth can identify when a sweetener has the potential to deliver calories versus a non-caloric sweetener, which cannot," said first author Paul Breslin, Ph.D., a Monell investigator and a professor of Nutritional Sciences at Rutgers University.

The paper describes the first-in-human demonstration of a pathway that uses the sugar glucose, a component of table sugar and high fructose corn syrup, to signal the presence of calories, in addition to the well-studied sweet-taste receptor in taste buds.

Glucose comprises about half of the commercial sugar sweeteners used today. Over millennia, humans have derived glucose in their diet from such sugar-rich foods as fruits and honey, and today from added sugars, such as sucrose (table sugar) from sugar beets or sugar cane and high fructose corn syrup.

"Humans love fruit and sugar, as do many other apes, which obtain most of their calories from sugar," said Breslin.

Spurred by recent data from Monell that showed taste bud cells in mice could identify when a sweetener has calories to burn for energy, the current team examined whether the ability to sense glucose in the human mouth may also involve this additional pathway. The team asked if this calorie detector is functional, and, perhaps most importantly, affects our responses to sugar in our diet.

"Now that we know this calorie-detecting taste system is operating in humans, it could help explain the overall preference for sugared beverages over non-caloric sweetener beverages," says Breslin.

In a series of three elegant human-taste experiments, the team compared oral glucose sensitivity to the ability to sense the artificial sweetener sucralose and to a special form of glucose that cannot be metabolized. "Overall, there are two sweet-sensing pathways in the mouth: one for sweet taste, and another for detecting potential energy-burning sugars," said coauthor Linda J. Flammer, Ph.D., a senior research associate at Monell.

Breslin, an experimental psychologist interested in human oral perception and its genetic basis, has long been perplexed by diet sodas never capturing a major share of the beverage market. He now has the start of an answer: "Diet drinks are not as satisfying as sugared beverages. As a public health initiative, might we get beverages and foods with lower sugar levels to be more rewarding? Now that we know there is this second glucose-sensing system in the mouth, maybe we can tap into it to make healthier beverages that people enjoy drinking."

After swallowing, calories in sugars are sensed in the gut and blood, but this study establishes that humans can also register sugars as being different from non-caloric sweeteners in the mouth. "It is remarkable that we evolved a mechanism not only to taste oral sugars as sweet, but also to sense that they have a metabolic or caloric signal," said Breslin. "This means that the mouth is much smarter than we realized and that it will be difficult to trick it by simply providing non-caloric sweeteners."

Co-authors are Anilet Tharp, Nancy E. Rawson, and Robert F. Margolskee from Monell, and Akiko Izumi, Tadahiro Ohkuri, and Yoshiaki Yokoo from Suntory.

More information: Paul A. S. Breslin et al, Evidence that human oral glucose detection involves a sweet taste pathway and a glucose transporter pathway, *PLOS ONE* (2021). DOI: 10.1371/journal.pone.0256989

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