Multiple genes manage how people taste sweeteners

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Genetics may play a role in how people's taste receptors send signals, leading to a wide spectrum of taste preferences, according to Penn State food scientists. These varied, genetically influenced responses may mean that food and drink companies will need a range of artificial sweeteners to accommodate different consumer tastes.

"Genetic differences lead to differences in how people respond to tastes of foods," said John Hayes, assistant professor, food science and director of the sensory evaluation center.

Based on the participants' genetic profile, researchers were able to explain the reactions of subjects in a taste test when they sampled Acesulfame-K—Ace K—in the laboratory. Ace K is a man-made non-nutritive sweetener commonly found in carbonated soft drinks and other products. Non-nutritive sweeteners are sweeteners with minimal or no calories.

While some people find Ace K sweet, others find it both bitter and sweet.

The researchers, who reported their findings in the recent issue of the journal, *Chemical Senses*, said that variants of two bitter taste receptor genes —TAS2R9 and TAS2R31—were able to explain some of the differences in Ace K's bitterness.

These two taste receptor genes work independently, but they can combine to form a range of responses, said Alissa Allen, doctoral student in food science, who worked with Hayes.

Humans have 25 bitter-taste receptors and one sweet receptor that act like locks on gates. When molecules fit certain receptors like keys, a signal is sent to the brain, which interprets these signals as tastes—some pleasant and some not so pleasant, Allen said.

In another study recently published in the journal *Chemosensory Perception*, Allen had 122 participants taste two stevia extracts, RebA—Rebaudioside A—and RebD—Rebaudioside D. Stevia is a South American plant that has served as a sweetener for centuries, according to the researchers. While the plant is becoming more popular as a natural non-nutritive sweetener, consumers have reported of tastes from stevia-based sweeteners, including bitterness.

The researchers found that RebA and RebD bitterness varies greatly across subjects, but this was not related to whether or not participants found Ace K bitter. Likewise, variation in the TAS2R9 and TAS2R31 genes did not predict RebA and RebD bitterness. They also found that of the stevia extracts, the participants considered RebD to be much less bitter than RebA.

While stevia is growing in acceptance as a natural replacement for other sweeteners, manufacturers do not use the whole leaf. Instead, the leaf is ground up and certain parts of it are extracted and blended to make the sweetener.

"Our work suggests ingredient suppliers may want to consider commercializing RebD, as it provides similar sweetness to RebA with much less bitterness," said Hayes.

Hayes also said that researchers are just beginning to understand the molecular basis of taste perception.

"We've known for over 80 years that some people differ in their ability to taste bitterness, but we have only begin to tease apart the molecular basis of these differences in the last decade," Hayes said.

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