

Sugar substitutes not so super sweet after all

4 September 2014



The taste of common sugar substitutes is often described as being much more intense than sugar, but participants in a recent study indicated that these non-nutritive sugar substitutes are no sweeter than the real thing, according to Penn State food scientists.

In the study, participants compared the taste of non-nutritive sweeteners that are often used as low- or no-calorie [sugar substitutes](#) with those of nutritive sweeteners, such as sugar, maple syrup and agave nectar. The participants indicated they could perceive the non-nutritive sweeteners—such as aspartame, marketed as NutraSweet; acesulfameK, often called AceK; and RebA, a compound found in the stevia plant—at lower concentrations than real sugar, but the intensity of these sensations was no sweeter than sugar and other nutritive sweeteners.

"While you can detect non-nutritive sweeteners at lower levels than sugar, that doesn't really tell us anything about the perceived intensity of that sweetness," said John Hayes, assistant professor, food science and director of the sensory evaluation center.

The assumption that these sweeteners are excessively sweet may be the result of confusing potency and intensity, said Hayes, who worked

with Rachel Antenucci, a graduate student in food science.

"In terms of receptor biology, the potency of a substance describes the lowest concentration that activates a taste receptor, but this does not predict the intensity, or magnitude, of the response," said Hayes.

The ability to detect sweetness of non-nutritive sweeteners at low levels, then, is related to their potency, but not their intensity, he added. Sugar, on the other hand, is less potent but causes more intense sensations of sweetness.

"These ingredients are often marketed or described as 'high-intensity' sweeteners, but that's misleading," said Hayes. "Our data confirm other work showing the maximal sweetness of low-cal sweeteners is often much lower than that of table sugar or other natural sweeteners, like maple syrup."

The researchers, whose findings are available online in the *International Journal of Obesity*, said these sweeteners did not seem to act as supernormal stimuli—a term first used by Nobel laureate Niko Tinbergen to describe exaggerated stimuli that serve as triggers for innate behaviors.

Some psychologists have suggested that supernormal stimuli and the responses they provoke could be a factor in the obesity epidemic, said Hayes.

"We have evolved to like sweetness from before birth, so some people assume so-called 'high intensity' sweeteners hijack or over-stimulate our natural drive to consume sweet foods, causing us to overeat," said Hayes. "However, this view assumes that foods we eat today are more intense than those we would have been exposed to evolutionarily, and our data imply this isn't the case."

Hayes also said the availability of highly desired foods may play a more important role in the obesity epidemic.

The researchers recruited 401 participants to take part in a series of taste tests held at the Sensory Evaluation Center at Penn State. Once the subjects were briefed on the study, they tasted between 12 and 15 separate samples that contained [maple syrup](#), agave nectar and sucrose, as well as various concentrations of aspartame, sucralose, AceK and RebA. Participants indicated that the [caloric sweeteners](#) all had higher sweetness ratings than the non-nutritive sweeteners.

Provided by Pennsylvania State University

APA citation: Sugar substitutes not so super sweet after all (2014, September 4) retrieved 28 October 2021 from <https://medicalxpress.com/news/2014-09-sugar-substitutes-super-sweet.html>

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