Red pandas reveal an unexpected (artificial) sweet tooth

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Researchers from the Monell Center report that the red panda is the first non-primate mammal to display a liking for the artificial sweetener aspartame. This unexpected affinity for an artificial sweetener may reflect structural variation in the red panda's sweet taste receptor.

The findings may shed light on how taste preferences and diet choice are shaped by molecular differences in taste receptors.

"The red panda's unique taste receptor gives us a tool to broaden our understanding of how we detect sweet taste," said the paper's senior author, Joseph G. Brand, PhD, a biophysicist at Monell. "Greater insight into why we like artificial sweeteners could eventually lead to the development of more acceptable sugar substitutes, potentially benefiting diabetics and other individuals on sugar-restricted diets."

Many species like sweet-tasting foods, but there are some exceptions. In an earlier study, Brand and Monell comparative geneticist Xia Li, PhD, reported that cats - both domestic and wild - can not taste sweets due to a defect in one of the genes that codes for the sweet taste receptor.

The current research extended those findings by relating sweet preferences to genetic analyses of sweet receptor structure in six related species. Like the cat, each of the species tested -- red panda, ferret, genet, meerkat, mongoose, and lion -- belongs to the Order Carnivora.

The species, although closely related, vary widely with regard to the types of foods they eat. For example, lions, like other cats, are obligate carnivores, meaning that they eat almost exclusively meat. Meerkrats are mainly insectivores, while red pandas are primarily herbivores that almost exclusively eat bamboo leaves and shoots.

By studying the structure and function of the sweet receptor gene across species and how this relates to differences in taste preferences and diet selection, the researchers seek to provide a framework to increase understanding of individual differences in human taste function, food choice and nutritional health.

"The taste world of every species, and even every individual, is unique, defined in part by the structure of their taste receptors," said Li. "We need to know more about these differences and how they influence our diet."

In the study, published online in the *Journal of Heredity*, preferences for six natural sugars and six artificial sweeteners were tested in a zoo setting. For each sweet molecule, the animal was given access to both the sweet solution and water for 24 hours. The animal was said to prefer the sweet solution when it drank much more sweet fluid than water.

DNA samples from each species were used to examine the structure of the sweet receptor gene Tas1r2, which codes for the T1R2 sweet taste receptor. T1R2 is one of two taste receptors that join together to recognize sweetness.

The sweet taste receptors contain binding sites for a variety of natural sugars and artificial sweeteners. However, species vary regarding which sites they possess, due to subtle differences in receptor structure.

As expected from the previous findings, the lion did not prefer any of the sweet solutions. This could be explained by its defective Tas1r2 gene, which prevents the lion from expressing a functional sweet taste receptor. With no sweet receptor, the lion is unable to detect - or prefer - sweet-tasting compounds.

Each of the remaining species preferred at least some of the natural sugars. Consistent with having a functional sweet receptor, Tas1r2 genes from these species did not show the defect found in lion and other cats.

Because only primates were believed to be able to taste aspartame, the researchers predicted that none of the Carnivore species tested would show a preference for the artificial sweeteners.

This indeed was the case for five of the species. However, the sixth species - the red panda - drank large amounts of the artificial sweeteners aspartame, neotame, and sucralose.

Seeking to explain this unexpected behavior, the researchers compared Tas1r2 genes from various species that can and cannot taste aspartame. They were surprised to find no consistent differences between aspartame tasters and nontasters.

However, the genetic analysis did reveal that the red panda's sweet receptor has a unique structure that is different from any of the other species examined.

"This may explain why the red panda is able to taste artificial sweeteners," said Li, who is the paper's lead author. "What we don't know is why this particular animal has this unusual ability. Perhaps the red panda's unique sweet receptor evolved to allow this animal to detect some compound in its natural food that has a similar structure to these sweeteners."

The findings suggest that the receptor mechanisms for sweet taste are more complex than previously suspected. "This is the essence of molecular science," remarked Brand, "Asking a behavioral question and getting a molecular answer."

Future studies will explore how protein structure of taste receptor genes predicts stimulus binding and ultimately provide insight into how variations in taste receptor genes affect taste perception, food choice and nutritional status.

Taste tests for the red panda and other animals in the study were conducted at two zoos in Switzerland by Dieter Glaser, PhD, from the University of Zurich. Also contributing to the study were Monell scientists Gary Beauchamp and Weihua Li, along with Warren Johnson and Stephen O'Brien from the National Cancer Institute.

Source: Monell Chemical Senses Center (news : web)