Taste perception of bitter foods depends on genetics

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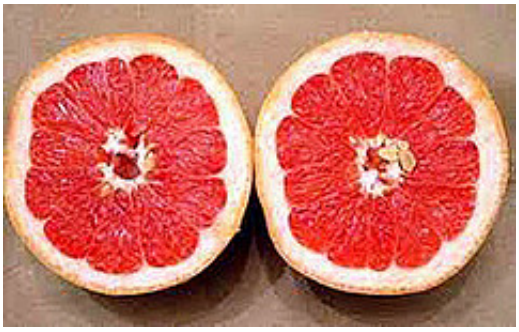

Grapefruit juice was one of the bitter foods used in taste research done by John Hayes, assistant professor of food science.

(PhysOrg.com) -- How we perceive the taste of bitter foods -- and whether we like or dislike them, at least initially -- depends on which versions of taste-receptor genes a person has, according to a researcher in Penn State's College of Agricultural Sciences.

Those genes affect dietary choices, such as whether we eat enough vegetables, drink alcoholic beverages or enjoy citrus fruits. "Just like some people are color blind, some people are taste blind and simply can't taste bitter things that others can," said John Hayes, assistant professor of food science.

In a collaborative study that began when he was still a graduate student, Hayes and his colleagues at the University of Connecticut, the University

of Florida and Brown University showed that how people perceive bitter tastes predicts their food choices. Work by the team and others suggests there is an unusually high level of variation in bitter-taste perception across people.

Published in the March issue of the journal, *Chemical Senses*, the research was funded by grants from the National Institutes of Health and the U.S. Department of Agriculture.

"In the early 1990s, researchers used bitter probes to identify individuals who experience all tastes and oral sensations more intensely, and thus the concept of supertasters was born," Hayes explained. "More recently, we have learned humans have 25 different bitter-taste genes, and it seems each one is tuned to pick up a different group of chemicals."

"This study moves us beyond the one-size-fits-all approach," he said. "It turns out that different bitter foods act through different receptors, and people can be high or low responders for one but not another. Thus, you may despise grapefruit but have no problem with black coffee."

Hayes and his colleagues tested approximately 100 healthy adults, primarily of European ancestry, in a laboratory setting. Each subject participated in two or three sessions that were each two hours long. They tasted and carefully rated the bitterness of grapefruit juice, alcohol (Scotch whiskey) and espresso coffee and provided detailed diet histories and DNA samples.

Hayes pointed out that there are good reasons why human bitter-taste receptors are so refined -- because many things that are bitter also are toxic. "Through time we wanted to avoid them," he said. "There have been thousands of years of evolutionary pressure to avoid bitter compounds, since most are dangerous for us.

"Being able to avoid bitter plant toxins gave our ancestors an evolutionary advantage."

The research showed that people can be really sensitive to the bitterness of grapefruit juice, but not at all sensitive to alcohol, and vice-versa, Hayes noted.

"Those bitter tastes are sensed through different pathways," he explained. "And this doesn't affect just bitterness. Since bitter and sweet are in opposition in the brain, if you experience more bitterness from a food, you also perceive less sweetness. This means not all foods taste the same to all people."

Previous studies have shown that variations in sensing bitter taste influence people's diet choices, and subsequently their health. For example, people who are more sensitive to bitterness eat 25 percent fewer vegetables, Hayes noted. Because they eat fewer vegetables, they are at greater risk for colon cancer.

Some of these genes also relate to alcohol abuse. "If you find alcohol to be really bitter initially, it is less likely you will become alcohol dependent," he said.

While his study did not measure finicky eating, Hayes contended it still may provide new insight into pickiness. "Some people may not be acting whiny when they say they don't like certain foods -- they actually experience those foods differently," he said.

Hayes is hoping to use bitter-taste research as a springboard to a better understanding of other aspects of food perception. "Bitterness is only one example of genetic differences that may alter sensations from food and influence liking," he said. "Our team also is interested in differences in sweetness perceptions and oral astringency -- that drying, puckering

you get from strong tea and red wine.

"We also are focusing on the burning sensations you get from spicy foods."

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