

Overweight people may not know when they've had enough

January 9 2008

Researchers at the U.S. Department of Energy's Brookhaven National Laboratory have found new clues to why some people overeat and gain weight while others don't. Examining how the human brain responds to "satiety" messages delivered when the stomach is in various stages of fullness, the scientists have identified brain circuits that motivate the desire to overeat. Treatments that target these circuits may prove useful in controlling chronic overeating, according to the authors. The study is published online and will appear in the February 15, 2008 issue of *NeuroImage*.

"By simulating feelings of fullness with an expandable balloon we saw the activation of different areas of the brain in normal weight and overweight people," said lead author Gene-Jack Wang of Brookhaven Lab's Center for Translational Neuroimaging. The overweight subjects had less activation in parts of the brain that signal satiety in normal weight subjects. The overweight subjects were also less likely than normal weight subjects to report satiety when their stomachs were moderately full. "These findings provide new evidence for why some people will continue to eat despite having eaten a moderate-size meal," said Wang.

Wang and colleagues studied the brain metabolism of 18 individuals with body mass indices (BMI) ranging from 20 (low/normal weight) to 29 (extremely overweight/borderline obese). Each study participant swallowed a balloon, which was then filled with water, emptied, and refilled again at volumes that varied between 50 and 70 percent. During

this process, the researchers used functional magnetic resonance imaging (fMRI) to scan the subjects' brains. Subjects were also asked throughout the study to describe their feelings of fullness. The higher their BMI, the lower their likelihood of saying they felt "full" when the balloon was inflated 70 percent.

One notable region of the brain - the left posterior amygdala - was activated less in the high-BMI subjects, while it was activated more in their thinner counterparts. This activation was turned "on" when study subjects reported feeling full. Subjects who had the highest scores on self-reports of hunger had the least activation in the left posterior amygdala.

"This study provides the first evidence of the connection of the left amygdala and feelings of hunger during stomach fullness, demonstrating that activation of this brain region suppresses hunger," said Wang. "Our findings indicate a potential direction for treatment strategies - be they behavioral, medical or surgical -- targeting this brain region."

The scientists also looked at a range of hormones that regulate the digestive system, to see whether they played a role in responding to feelings of fullness. Ghrelin, a hormone known to stimulate the appetite and cause short-term satiety, showed the most relevance. Researchers found that individuals who had greater increases in ghrelin levels after their stomachs were moderately full also had greater activation of the left amygdala. "This indicates that ghrelin may control the reaction of the amygdala to satiety signals sent by the stomach," said Wang.

Source: Brookhaven National Laboratory

Citation: Overweight people may not know when they've had enough (2008, January 9) retrieved

22 September 2024 from <https://medicalxpress.com/news/2008-01-overweight-people-theyve.html>

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