Control Your Hunger? Study Shows Men Can, Women Can't

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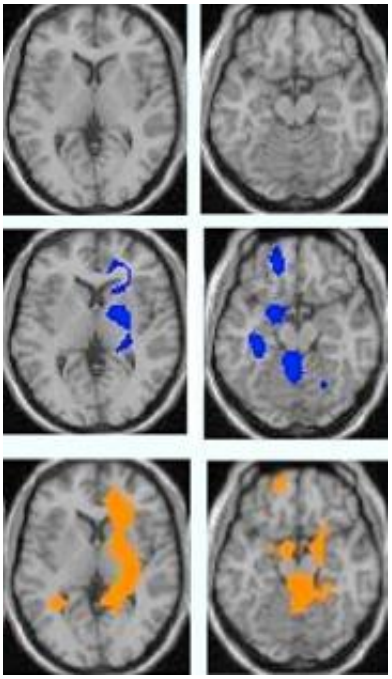

Each brain image shows the change in brain metabolism when subjects were asked to inhibit their response to food during food stimulation compared with when they were not told to inhibit their response. Two brain sections at different levels of the brain are shown for each group (women, men, and women vs. men). Top row, women: No color indicates that women had no significant differences in brain activity between the two conditions. Middle row, men: Blue colored areas were significantly less active when men were told to inhibit their response to food than they were without inhibition. Third row, women vs. men: Orange color indicates areas where men showed greater decrements with inhibition than women. These brain regions are involved in emotional regulation, conditioning, and the motivation to eat.

(PhysOrg.com) -- A ground-breaking brain-imaging study at the U.S. Department of Energy's Brookhaven National Laboratory shows that men, but not women, are able to control their brain's response to their own favorite foods. The study, which will be published online by the Proceedings of the National Academy of Sciences the week of January 19, 2009, may help explain why rates of obesity and eating disorders are higher among women than men, and why women typically have more difficulty losing weight.

"Our findings may help us understand the neurobiological mechanisms underlying the ability to control food intake, and suggest new pharmacological methods or other interventions to help people regulate eating behavior and maintain a healthy weight," said Gene-Jack Wang, lead author on the study. "The surprising finding of a difference between genders in the ability to inhibit the brain's response to food and hunger will certainly merit further study."

The scientists used positron emission tomography (PET) scanning to monitor brain activity in 13 female and 10 male volunteers. In this method, a form of glucose "tagged" with a radioactive tracer molecule is injected into the blood stream while subjects lie in the PET scanner. The scanner tracks the tracer's signal to monitor the uptake and use of the glucose by various regions of the brain. All study subjects were of normal body weight and had fasted for nearly 20 hours before each of three separate scans, performed in random order.

On one scan day, subjects were presented with their favorite foods — from bacon-egg-and-cheese sandwiches to pizza, cinnamon buns, barbecue ribs, and chocolate cake — warmed, if appropriate, to enhance the enticing aromas and taste. During the scan, subjects were asked to smell, taste, observe, and react to the food, but not eat it. On another day, they were instructed to inhibit their desire for food prior to being tempted with the same foods. A control scan with no food was

performed on another day.

The volunteers were also asked to rate the foods and describe their feelings of hunger and their desire to eat during the scans when food was presented.

In both men and women, a variety of brain areas associated with emotional regulation, conditioning, and motivation “lit up,” indicating increased metabolic activity in those regions, in response to the tempting foods when compared with the no-food scans — a finding consistent with earlier work using the same setup at Brookhaven Lab. When asked to inhibit their response to food, both men and women described themselves as less hungry and less interested in eating than when they weren’t trying to inhibit their response. But only the men showed a relative decrease in activity in the food-activated brain regions during the scan when they were asked to inhibit their response.

“Even though the women said they were less hungry when trying to inhibit their response to the food, their brains were still firing away in the regions that control the drive to eat,” Wang said. “In contrast, men’s brain activity decreased along with their self-reports of hunger during the scan when they were asked to keep their hunger in check.”

The researchers believe this is the first study to document such a gender-specific disconnect between subjective reports of an emotional or motivational state and the associated pattern of brain activity.

“This may indicate a difference between the genders in the ability to perceive and respond to internal body signals,” Wang said.

“The finding of a lack of response to inhibition in women is consistent with behavioral studies showing that women have a higher tendency than men to overeat when presented with palatable food or under emotional

distress," Wang said. "This decreased inhibitory control in women could be a major factor contributing to the observed differences in the prevalence rates of obesity and eating disorders such as binge eating between the genders, and may also underlie women's lower success in losing weight while dieting when compared with men."

Differences in sex hormones, such as estrogen, may underlie these gender differences and merit further exploration. Sex hormones are known to directly influence food intake, body weight, and fat distribution, as well as the signaling of other molecules involved in regulating eating behavior, the researchers said. This study did not control for variations in the menstrual cycle of the female research subjects.

"A woman's menstrual cycle can be an important factor in responsiveness to reward and in successful quit attempts for smoking," said National Institute on Drug Abuse (NIDA) Director Nora Volkow, who was a collaborator on this study. "Its role in inhibiting food-related brain activation will be important to address in future studies."

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Provided by Brookhaven National Laboratory

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