

Youth at risk for obesity show greater brain activity in response to food

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Do people overeat because they experience less reward from eating or because they experience more reward from eating? In the March 23, 2011 issue of *The Journal of Neuroscience* Oregon Research Institute (ORI) senior scientist Eric Stice, Ph.D. and colleagues, including Dana Small, Ph.D. from the J.B. Pierce Laboratory in New Haven Connecticut, provide possible answers to the chicken or egg dilemma of overeating.

Food intake produces dopamine release and the degree of pleasure from eating correlates with the amount of dopamine release. Studies have found that obese relative to lean humans have fewer dopamine (D2) receptors in the brain and it is thought that obese individuals overeat to compensate for this reward deficit.

However, a recent study from Stice and colleagues found that weight gain produced a blunted response to intake of palatable food (chocolate milkshake), suggesting that overeating may lead to reduced reward from food, rather than represent an initial vulnerability factor.

In a novel study using [functional Magnetic Resonance Imaging](#) (fMRI) Stice's team compared the [neural response](#) to food and monetary reward in lean adolescents at risk for obesity relative to lean adolescents not at risk for obesity. Results suggest that the initial vulnerability that gives rise to obesity may be elevated rather than blunted sensitivity of the brain's reward circuitry.

Study participants were 60 lean adolescents. The high-risk teens were children of two obese or overweight parents. The low-risk teens had two lean parents. Adolescent children of obese versus normal-weight parents show a fourfold increase in risk for obesity onset.

Using a brain imaging paradigm, investigators examined the extent to which reward circuitry (e.g., the dorsal striatum) was activated in response to the individual's consumption and anticipated consumption of chocolate milkshake. The team also used another paradigm to assess [brain activation](#) in response to receipt and anticipated receipt of money. Monetary reward is a general reinforcer and has been used frequently to assess reward sensitivity. High-risk youth showed greater activation in reward circuitry to receipt of both food and monetary reward, as well as greater activation in somatosensory regions in response to receipt of food.

"The findings are surprising," noted Stice. "They suggest that the initial vulnerability for overeating may be hyper-responsivity of reward circuitry to food intake. The fact that the same reward regions showed greater response to monetary reward is novel and implies that individuals at risk for obesity show greater responsivity to reward in general. These findings seem to challenge the widely accepted theory that it is a reward deficit that increases vulnerability to overeating."

Stice and his team also found that at-risk youth showed hyper-responsivity of somatosensory regions to [food intake](#), which plays a key role in sensing the fat content of food. These results suggest that individuals who are particularly sensitive to detecting high-fat foods may be at unique risk for overeating.

Provided by Oregon Research Institute

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