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Boosting neural pathway from gut to brain could play part in weight control

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A Purdue University study found an increase in sensory nerve fibers that send signals from the gut to the brain reduces the time spent eating a meal, which could help regulate body weight.

"By increasing the nerve fibers that send messages to the brain, we found less food was consumed during a meal," said Edward Fox, a professor of psychological sciences who focuses on behavioral neuroscience. "How the gastrointestinal tract communicates with the brain about food eaten during a meal can help us better understand the factors related to the quantity of food consumed in obesity and eating disorders such as anorexia. Through the vagus nerve, the brain taps the body for what kinds of foods are in the stomach and upper intestine and the quantity."

The study is published in The *Journal of Neuroscience* and was funded by the National Institutes of Health's National Institute of Neurological Disorders and Stroke. Fox, director of the Behavioral Neurogenetics Lab, collaborated with former graduate student Jessica E. Biddinger on the study.

The researchers studied a mouse model with a targeted knockout of the brain-derived neurotrophic factor gene that decreases levels of this nerve growth factor in the gastrointestinal tract. Suprisingly, they found these mice had an increase in vagal sensory innervation of the gastrointestinal tract and ate small meals.

"The small meals likely resulted because the increased innervation led

to an increase in neural signals telling the brain the stomach is full," Fox said.

Brain-derived neurotrophic factor is involved in controlling the development of sensory pathways of the vagus nerve. This nerve feeds the brain sensory information related to the types of nutrients present in the gastrointestinal tract as well as to muscle contractions and distensions associated with digestion.

Fox said the possible implication for humans someday is stimulation of the vagus nerve to reduce the amount people eat, but more research and clinical work is needed. Electrical stimulation of the vagus nerve used to treat epilepsy and depression in patients that don't respond to medications has been found to reduce body weight in some of them, and the current study suggests this effect might result in part from eating smaller meals as opposed to only eating fewer meals or increasing metabolism.

"Treating people so they eat smaller meals is just one component of addressing obesity and may not be enough in itself," said Fox, who is affiliated with Purdue's Ingestive Behavior Research Center. "With lack of exercise and strong environmental factors such as a wide variety of great-tasting foods, overeating, and obesity may be too much to overcome by reducing meal size on its own. But if we can use this model and similar ones we have developed involving other genes to understand how vagal sensory information gets integrated with the brain areas that control eating, we can better address how meal behavior and other factors interact to control our body weight."

More information: "Reduced Intestinal Brain-Derived Neurotrophic Factor Increases Vagal Sensory Innervation of the Intestine and Enhances Satiation." Jessica E. Biddinger and Edward A. FoxThe *Journal of Neuroscience*, 30 July 2014, 34(31): 10379-10393; DOI:

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