Molecular imaging finds link between obesity and low estrogen levels

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A new study presented at SNM's 58th Annual Meeting could throw open the door to a recently established area of obesity research. Investigators have developed a novel molecular imaging agent that targets estrogenic mechanisms in the brain to find out what effect an enzyme called aromatase has on body mass index (BMI), a measurement of body fat based on height and weight. Aromatase is crucial for the production of estrogen in tissues throughout the body, including the brain.

According to the World Health Organization, worldwide obesity has more than doubled since 1980. As of 2008, an estimated 1.5 billion adults were overweight, and in 2010 nearly 43 million children under the age of five were overweight.

"We used this imaging agent to evaluate the amount of aromatase activity in the brain regions related to eating behaviors, such as the hypothalamus and amygdala, in both overweight and normal weight subjects. We were really surprised to see the highest correlation between aromatase availability and BMI happening in the amygdala, which controls emotional memory," says Gene-Jack Wang, MD, senior scientist and chair of the medical department at Brookhaven National Laboratory, Upton, N.Y. "Our eating is not only controlled by the hunger centers in the brain. It is also related to memory, and that could have a big impact on a person's eating behavior. This agent could potentially translate into a number of new studies evaluating estrogen and obesity, food intake and appetite suppression."

For this study, five healthy overweight subjects and 13 normal-weight subjects of the same age were chosen to undergo positron emission tomography, a molecular imaging technique that provides digital representations of physiological functions of the body. Subjects were injected before imaging with the novel imaging agent (C-11)vorozole, which is composed of a medical isotope bound with an aromatase inhibitor that binds strongly with the active sites of the enzyme in the brain. This allowed investigators to track and quantify the availability of this enzyme to selected areas of the brain associated with hunger and feeding behavior.

A significant correlation was found between high BMI of subjects and decreased uptake of the aromatase inhibitor. Imaging agent uptake was decreased in the hypothalamus (25 percent less), thalamus (27 percent less) and amygdala (30 percent less) in subjects with high BMI. This means that there was less availability of the enzyme in these selected brain regions. There was also a strong inverse correlation between low BMI and imaging agent uptake in the amygdala, meaning BMI was less in subjects showing higher aromatase availability. These findings suggest that there is decreased availability of aromatase in the brains of overweight subjects, conceivably leading to reduced availability of estrogen and potentially less control over appetite and food intake, resulting in weight gain; however, further studies need to be conducted to validate the relationship between estrogen synthesis and high BMI.

Future studies could be introduced to screen eating behaviors of obese subjects in order to further validate the correlation between BMI and estrogen availability in the brain. Based on the current research, theoretically the less estrogen available to the brain, the less control patients may have over their appetite. Studies moderating estrogen and feeding behavior could result in novel drugs for appetite suppression and perhaps even reduction of BMI. This is just the first step toward discovering the mechanisms behind appetite, BMI and estrogen

availability.

More information: Scientific Paper 340: G. Wang, A. Biegon, F. Telang, J. Logan, S. Won Kim, M. Jayne, N. Volkow, J. Fowler, Brookhaven National Laboratory, Upton, N.Y.; National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD; "Decreased brain aromatase availability in overweight humans," SNM's 58th Annual Meeting, June 4-8, 2011, San Antonio, TX.

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