Joslin study identifies 'good' energy burning fat in lean adults

April 8 2009

Researchers at the Joslin Diabetes Center have demonstrated that adult humans still have a type of "good" fat previously believed to be present only in babies and children. Unlike white fat, which stores energy and comprises most body fat, this good fat, called brown fat, is active in burning calories and using energy. The finding, reported in the April 9th issue of The *New England Journal of Medicine*, could pave the way for new treatments both for obesity and type 2 diabetes.

Scientists had thought that brown fat only existed in humans during childhood and was mostly gone by adulthood. The paper shows that brown fat not only exists in adult humans, but also for the first time, that the fat is metabolically active.

"The fact that there is active brown fat in adult humans means this is now a new and important target for the treatment of obesity and type 2 diabetes," said C. Ronald Kahn, M.D., senior author and Head of the Joslin Section on Obesity and Hormone Action and the Mary K. Iacocca Professor of Medicine at Harvard Medical School.

Obesity is a major risk factor for type 2 diabetes. According to the researchers, the idea behind a new therapy would be to find a way to stimulate brown fat growth to both control weight and improve glucose metabolism.

"Not only did we find active brown fat in adult humans, we found important differences in the amount of brown fat based on a variety of

factors such as age, glucose levels and, most importantly, level of obesity," said lead author Aaron Cypess, M.D., Ph.D., a Research Associate and Staff Physician at Joslin.

Not surprisingly, the study found that younger patients were more likely to have larger amounts of brown fat, and the brown fat was more active during colder weather, keeping with its role of burning energy to generate heat. Brown fat was also more common in adults who were thin and had normal blood glucose levels.

"What is of particular interest is that individuals who were overweight or obese as measured by higher Body Mass Index (BMI) were less likely to have substantial amounts of brown fat," said Kahn. "Likewise, patients taking beta-blockers and patients who were older were also less likely to have active brown fat. For example, individuals both over age 64 and with high BMI scores were six times less likely to have substantial amounts of brown fat."

The findings, particularly those having to do with BMI, suggest a potential role for brown fat in regulating body weight metabolism, the paper says, suggesting that higher levels of brown fat may protect against age-related obesity.

According to the paper, the researchers are hopeful that an increased ability to measure brown fat mass and activity in vivo in humans will lead to a better understanding of its role in physiology and its potential as a target for therapy of obesity and other metabolic disorders.

This study answered those questions thanks to the use of modern imaging technology.

The researchers analyzed a database of 1,972 patients who had undergone positron emission tomography/computed tomography

(PET/CT) scans for a variety of reasons over a three-year period. They identified substantial brown fat deposits in 7.5 percent of the female patients and over 3 percent of males.

"These numbers clearly represent an underestimate, since PET/CT can only detect collections of brown fat cells of a certain size and activity, and could miss smaller and less active deposits," Kahn explained.

In addition, the researchers identified 33 other patients whose pathology records had indicated the presence of brown fat in their necks in the same places where the PET/CT scans had identified the largest concentrations of brown fat. They tested the tissue of two of those patients and detected the presence of a special heat-generating protein called UCP-1 that is unique to brown fat.

"These findings suggest that there is previously unrecognized, heat-generating brown fat in many adults," Dr. Cypess said.

"This study, by demonstrating the presence and physiological activity of brown fat in adult humans, shows that this tissue may provide a novel and valuable target for interventions, pharmacological and environmental, to modulate energy expenditure," said Francesco Celi, M.D., of the Clinical Endocrinology Branch, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, who wrote an accompanying editorial but was not involved in the Joslin study.

Dr. Kahn said there is a good possibility that brown fat may be present in significant amounts in much higher percent of the population, but that it may be more spread out and not as easily seen on imaging in many cases. Most of the deposits found on the scans were located in the neck region.

"In the real world, there has been a long debate as to whether brown fat

exists in adult humans and whether it was important physiologically," he said. "This study demonstrates that it is both present and appears to be physiologically important in terms of body weight and glucose metabolism. We hope this opens up a new therapeutic area for obesity and type 2 diabetes by modifying the activity of brown fat."

In a study published in August 2008, Dr. Kahn and others showed that a protein, BMP-7, known for its role in inducing bone growth, can also help promote the development of brown fat in rodents. And, a 2007 study led by Dr. Kahn found clusters of brown fat cells dispersed between bundles of muscle fibers in strains of mice resistant to obesity and diabetes.

Source: Joslin Diabetes Center