Active brown adipose tissue protects against 'pre-prediabetes'

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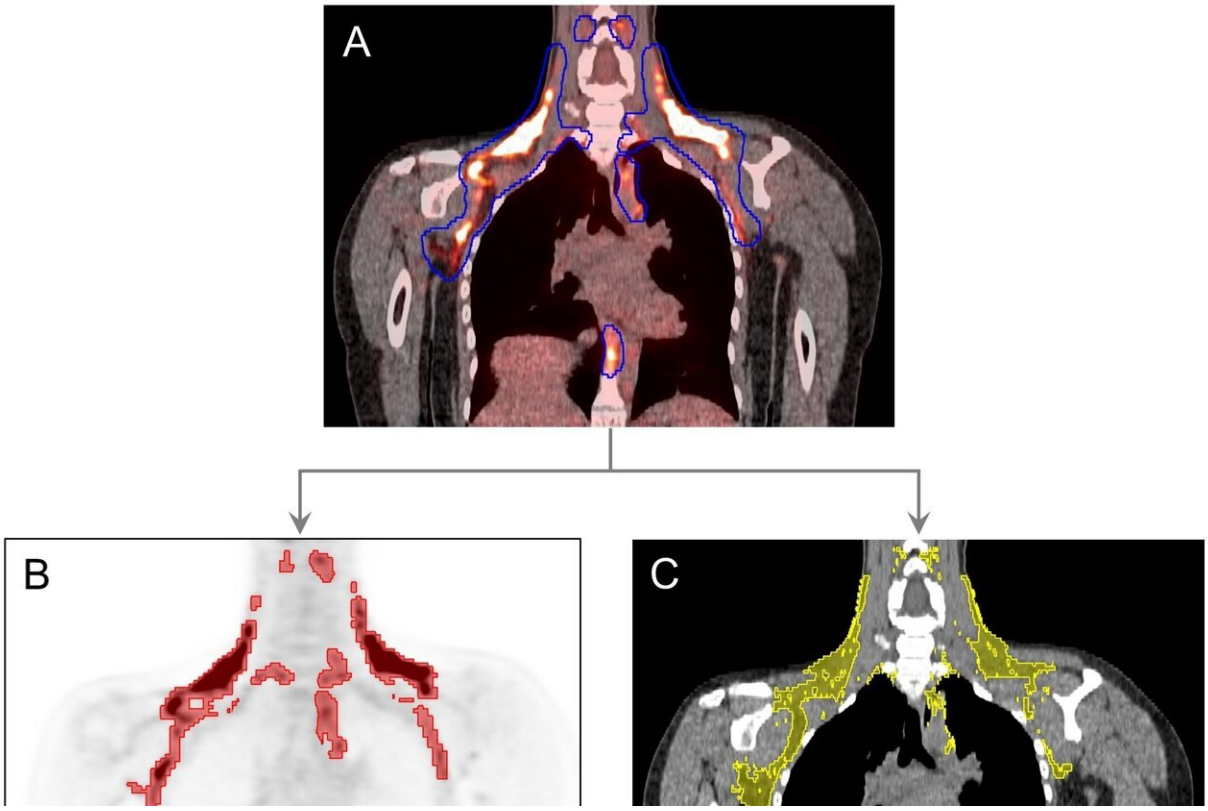

Images showing detection and segmentation of brown adipose tissue on FDG PET in order to measure total brown adipose tissue volume. Credit: *Journal of Nuclear Medicine*

In a prospective study of young, lean adults, PET/CT imaging revealed that higher levels of active brown adipose tissue (also known as "brown

fat") are more prevalent in individuals who exhibit very early indications of metabolic disorders. Published ahead of print in the *Journal of Nuclear Medicine*, the study suggests that active brown fat is recruited to counteract "pre-prediabetic" states, potentially serving as a first-line protective mechanism against very early metabolic or hormonal abnormalities.

Brown fat is a type of fat that is activated when a person gets cold, producing heat to warm the body. The presence of brown fat was initially recognized on oncologic FDG PET/CT scans, which are now the most commonly used technique for the in vivo detection of brown fat. Studies using PET with FDG and/or other fatty-acid tracers have demonstrated that brown fat consumes glucose and fatty acids, making it a potential target for the treatment of obesity and other metabolic disorders.

"The primary aim of this study was to assess if there are differences in baseline glucose, insulin, lipid, and other metabolite levels between subjects with varying amounts of brown fat. We also examined patient blood samples and lifestyles to assess their association with brown fat levels," noted John P. Crandall, BS, clinical research coordinator at the Mallinckrodt Institute of Radiology at Washington University School of Medicine in St. Louis, Missouri.

Thirty-four healthy adult volunteers between the ages of 18 and 35 and with a body mass index (BMI) between 18 and 25 were enrolled in the study. Blood samples were taken, and lifestyle interviews were performed. To activate the brown fat, participants wore cooling suits to bring their body's temperature to just above the shivering point. After two hours, subjects removed the cooling suits and were imaging with FDG PET/CT. Post-cooling blood samples were also taken after removal of the cooling suits.

Activated brown fat was analyzed for each subject, and glucose, insulin, lipid and other metabolite levels were correlated with volume and intensity of the active brown fat. Using a median cut-off, participants were classified as having high brown fat levels or low brown fat levels.

A higher level of activated brown fat was associated with early metabolic dysfunction. Pre-cooling glucose, insulin, thyroid stimulating hormone and triglyceride levels were significantly higher in the high brown fat group than the low brown fat group. In addition, a significant difference in BMI was found, with subjects with high brown fat levels having a higher BMI than subjects with low levels of brown fat. Those with low brown fat levels were more likely to report observing a controlled diet and exercising regularly.

"Our study suggests brown adipose tissue may considerably influence (and be influenced by) overall metabolic health. Molecular imaging with FDG remains the most useful non-invasive method for studying brown fat in humans," said Richard L. Wahl, MD, FACR, director of the Mallinckrodt Institute of Radiology and chair of the Department of Radiology at Washington University School of Medicine. "Our findings show that molecular imaging potentially may be useful for identifying patients who are at risk of developing metabolic disorders and suggests activation of brown fat is a metabolic coping mechanism in 'pre-pre-diabetes.' Further studies in larger populations are warranted to confirm and expand upon our findings."

More information: John Crandall et al, Brown adipose tissue: a protective mechanism in "pre-prediabetes"? *Journal of Nuclear Medicine* (2022). DOI: 10.2967/jnumed.121.263357

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