

Anorexics found to have excess fat-- in their bone marrow

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Boston, Mass.-- People with anorexia nervosa, paradoxically, have strikingly high levels of fat within their bone marrow, report researchers at Children's Hospital Boston. Their findings, based on MRI imaging of the knees of 20 girls with anorexia and 20 healthy girls of the same age, appear in the February issue of the *Journal of Bone and Mineral Research*.

"It's counter-intuitive that an emaciated young woman with almost no subcutaneous fat would be storing fat in her marrow," says endocrinologist Catherine Gordon, MD, MSc, director of the Bone Health Program at Children's and the study's senior investigator.

In the study, the knee MRI images were read by radiologists who were unaware of the patient's clinical status. Compared with controls, the patients with anorexia had markedly increased fat content-- visualized as "yellow marrow"-- and less than half as much healthy red marrow in their knees; this was seen both in the lower thigh bone (femur) and upper shinbone (tibia). The findings in these girls and young women, averaging 16 years of age, confirm previous observations in mice with clinical signs similar to anorexia nervosa, reported by study co-author Clifford Rosen, MD, of the Maine Medical Center.

Previous work has shown that hormonal alterations, which are common in states of malnutrition, trigger the bone marrow's [mesenchymal stem cells](#) to differentiate into [fat cells](#) (adipocytes) rather than bone-forming cells (osteoblasts). Together, the mouse and human studies may explain

why people with anorexia nervosa lose bone mass, sometimes to the point of developing osteoporosis and fractures.

"[Bone formation](#) is very low in girls with anorexia, and that's a particular problem because they are growing adolescents who should be maximally forming bones," says Gordon. "But because of the hormonal alterations induced by malnutrition, the [bone marrow](#) stops yielding the needed cells to form bone. Instead the stem cells are pushed toward fat formation."

Gordon is planning follow-up studies to find out why this happens. One speculation is that it's the body's attempt to store energy and preserve warmth. Anorexics often develop hypothermia because of a lack of insulating fat, and are often hospitalized with extremely low body temperatures.

Gordon also wants see how closely fat in the bone marrow correlates with bone density, and whether measuring fat with noninvasive MRI scans might serve as one way of testing the efficacy of hormonal therapies aimed at improving bone mass. Gordon has several studies testing such therapies in anorexia and other conditions that lead to bone loss, such as inflammatory bowel disease.

Kirsten Ecklund, MD, of Children's Department of Radiology, was the study's first author. The study was funded by the National Institutes of Health and the Children's Hospital Radiology Foundation, Inc.

More information: Ecklund K et al. "Bone marrow changes in adolescent girls with anorexia nervosa." *J Bone Min Res* Feb 2010.

Provided by Children's Hospital Boston

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