
RSNA Press Release

Fat in Organs and Blood May Increase Risk of Osteoporosis

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OAK BROOK, Ill. — Excess fat around the belly has recently been identified as a risk factor for bone loss. Now, a new study has determined that excess liver and muscle fat also may be detrimental to bone.

The study, published online in the journal *Radiology*, found that obese people with higher levels of fat in their liver, muscle tissue and blood also have higher amounts of fat in their bone marrow, putting them at risk for osteoporosis.

"Obesity was once thought to be protective against bone loss," said study lead author Miriam A. Bredella, M.D., a radiologist at Massachusetts General Hospital and associate professor of radiology at Harvard Medical School in Boston. "We have found that this is not true."

While other studies have examined the relationship between visceral fat and bone mineral density, this study looked at fat inside bone marrow, the spongy tissue inside the bones of the body that produces stem cells.

"In our study, we focused on bone marrow fat because that is where our stem cells can develop into osteoblasts—the cells responsible for bone formation—or fat cells," Dr. Bredella said. "We also wanted to look at the relationship between bone marrow fat and other fat components, such as those in the liver and muscle."

Dr. Bredella and colleagues used proton magnetic resonance spectroscopy (MRS), a technique that allows for precise measurement of fat, to examine 106 men and women, ages 19 to 45 years, who were obese based on body mass index measurements, but otherwise healthy.

At A Glance

- Researchers used proton magnetic resonance spectroscopy to examine 106 patients who were obese based on BMI, but otherwise healthy.
- Obese people with higher levels of fat in their liver, muscle and blood also have higher amounts of fat in their bone marrow, putting them at risk for osteoporosis.
- Higher levels of bone marrow fat put people at increased risk of fracture.



Miriam A. Bredella, M.D.

"MRS has no radiation, is quick to perform and can quantify the amount of fat within bone marrow, muscle and liver," Dr. Bredella said.

The MRS results showed that people with more liver and muscle fat had higher levels of fat in their bone marrow, independent of body mass index, age and exercise status. HDL cholesterol, the "good" type of cholesterol that is associated with a lower risk of heart disease, was inversely associated with bone marrow fat content.

Higher levels of bone marrow fat put people at increased risk of fracture, according to Dr. Bredella.

"Bone marrow fat makes bones weak," she said. "If you have a spine that's filled with fat, it's not going to be as strong."

Triglycerides, the type of fat found in the blood, also had a positive correlation with bone marrow fat, possibly because they stimulate osteoclasts, a type of cell that breaks up bone tissue.

More research is needed to further illuminate the mechanism behind this differentiation of stem cells. Dr. Bredella noted that cell-signaling molecules called cytokines are known to promote the conversion of stem cells into fat.

"Obesity can shift stem cell lineage, resulting in more bone marrow fat," she said.

"Ectopic and Serum Lipid levels Are Positively Associated with Bone Marrow Fat in Obesity." Collaborating with Dr. Bredella were Corey M. Gill, B.S., Anu V. Gerweck, N.P., Melissa G. Landa, B.A., Vidhya Kumar, M.A., Scott M. Daley, B.A., Martin Torriani, M.D., Karen K. Miller, M.D.

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