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Impairments in volumetric bone mineral density, bone microarchitecture, and estimated strength in women with atypical anorexia nervosa

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While anorexia nervosa is associated with impaired skeletal integrity, less is known about the skeletal effects of atypical anorexia nervosa, in which psychological criteria for anorexia nervosa are met, but affected individuals are not low weight. Mean bone mineral density (BMD) is higher in atypical anorexia nervosa than in low-weight anorexia nervosa but lower than in healthy controls. However, it is unknown whether bone microarchitecture and strength are affected. We hypothesized that bone microarchitecture and estimated strength would be impaired in women with atypical anorexia nervosa.

This was a cross-sectional study of women ages 21-46 years (n=55): n=28 with atypical anorexia nervosa (body mass index (BMI) >18.5 kg/m^2), n=27 healthy, normal weight, eumenorrheic controls. Exclusion criteria included use of oral contraceptives. Areal BMD (aBMD) was assessed by DXA. Volumetric BMD (vBMD), microarchitecture, and failure load (a bone strength estimate) at the distal tibia and radius were assessed by high-resolution peripheral quantitative CT.

Median(IQR) BMI was lower [19.4(18.6,20.2) vs 22.2(21.5,23.0), p<0.0001] and median serum 25OH vitamin D level was higher [31(24,39) vs 22(17,25), p=0.0001] in atypical anorexia nervosa than healthy controls. In the atypical anorexia nervosa group, 89% had a history of low weight, 21% had a history of overweight/obesity, 31% had current amenorrhea, and 88% had a history of amenorrhea; median duration of anorexia nervosa was 11(5,14) years.

Median lateral spine, total hip, femoral neck, and total radius aBMD Z-scores were lower in atypical anorexia nervosa than healthy controls [lateral spine: -1.1(-2.0,-0.1) vs -0.4(-0.7,0.4), total hip: -0.8(-1.3,0.2) vs 0.2(-0.4,0.7), femoral neck: -0.9(-1.4,0.1) vs -0.1(-0.9,0.6), radius: -0.2(-0.9,0.3) vs 0.1(-0.4,0.6); p≤0.04 for all]. At the tibia, median total, cortical, and trabecular vBMD; cortical thickness; trabecular bone volume fraction; and failure load were lower in atypical anorexia nervosa than healthy controls (p<0.05). At the radius, median trabecular number was lower and trabecular separation was higher in atypical anorexia nervosa than healthy controls (p≤0.04), but there was no difference in failure load between the groups. After controlling for baseline BMI, differences at the radius but not tibia remained significant. At the tibia and radius, median total vBMD, cortical vBMD, and cortical thickness were lower in atypical anorexia nervosa subjects with amenorrhea compared to healthy controls and to atypical anorexia nervosa subjects with eumenorrhea (p≤0.04).

Conclusions: We demonstrate that, despite normal weight, women with atypical anorexia nervosa have impaired vBMD, microarchitecture, and estimated strength compared to healthy controls, with differences more pronounced at the weight-bearing tibia vs non-weight-bearing radius. Individuals with amenorrhea had additional impairments in the non-weight-bearing radius, suggesting an effect of systemic estrogen deficiency. Our data suggest that current normal weight is not protective against impaired bone structure and strength in atypical anorexia nervosa.

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