Mid Atlantic Regional Chapter
of the
American College of Sports Medicine

Annual Scientific Meeting, November 1st – 2nd, 2019
Conference Proceedings
International Journal of Exercise Science, Volume 9, Issue 8

Association Between DXA and HR-pQCT Measurements of Bone Characteristics in Recreationally Active, Recruit-Aged Men

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Dual-energy x-ray absorptiometry (DXA) two-dimensional areal bone mineral density (aBMD) measurements are commonly employed to evaluate fracture risk but lack the resolution to distinguish between cortical and trabecular bone. In contrast, high-resolution peripheral quantitative computed tomography (HR-pQCT) provides three-dimensional volumetric BMD (vBMD) measurements of total, trabecular, and cortical bone. It is unclear whether aBMD accurately reflects vBMD of specific bone compartments in the distal tibia, a common injury site for military personnel. **Purpose:** To determine if lower leg aBMD correlates with distal total (Tt), trabecular (Tb) and cortical (Ct) vBMD in healthy, recruit-aged men. **Methods:** Forty-three recreationally active men (26.4±0.8 yrs.), free of any musculoskeletal conditions that could influence BMD, completed two HR-pQCT (XtremeCT; Scanco Medical, Brüttisellen, Switzerland) and a total body DXA (Lunar iDXA; GE Healthcare, Illinois, US) scan.Total body DXA excluding the head (Lunar iDXA; GE Healthcare, Illinois, US) and non-dominant tibial HR-pQCT (XtremeCTII; Scanco Medical, Brüttisellen, Switzerland) scans at the metaphysis (4% site) and diaphysis (30% site) were obtained. Lower leg aBMD was assessed in DXA scans with custom region of interest (ROI) analysis between the ultradistal tibia and the tibial plateau. Associations between variables were analyzed with Pearson's correlations; alpha was set at $p \leq 0.05$. **Results:** aBMD positively correlated with Tt vBMD at both the 4% ($r^2=0.42$; $p<0.0001$) and 30% site ($r^2=0.16$; $p=0.0078$). aBMD positively correlated with Tb vBMD at the 4% site ($r^2=0.35$; $p<0.0001$), but not at the 30% site ($r^2=0.0002$; $p=0.9369$). aBMD was not correlated with Ct vBMD at the 4% site ($r^2=0.05$; $p=0.1680$) but was negatively correlated with Ct vBMD at the 30% site ($r^2=-0.12$; $p=0.0315$). **Conclusions:** There is poor to moderate association between lower limb aBMD and tibial vBMD at both metaphyseal and diaphyseal sites. Regional aBMD is unlikely to provide a suitable assessment of lower leg bone health. aBMD and tibial vBMD should, therefore, not be used interchangeably to examine the bone response to interventions or for the prediction of fracture risk.

Supported by UK Ministry of Defence (WGCC 5.5.6-Task 0107).