mechanostat stimulation. Lean soft tissue mass is mostly water found in both adipose and muscle. We ask the question, are there other measures of functional mass, such as total body protein, that drive bone density more than just weight alone?

**Methods:** Whole body DXA scans were taken of 25 subjects (14 female, mean age 37.6) using a Hologic QDR4500W (Hologic, Bedford, MA). Twenty-two participants were healthy and three had amyotrophic lateral sclerosis (ALS). Total body volume was estimated from the DXA scans using density estimates of the lean, fat, and bone masses. Total body water (TBW) was measured using deuterium dilution techniques and taking saliva samples at baseline, 3 and 4 hours. Total body protein (TPB) as well as arms, legs, and trunk protein indices were calculated using a validated 4C model. Associations of the protein and other body composition measures to BMD and BMC were investigated using SAS program 9.2 (SAS Institute Inc., Cary, NC) and correlation measures derived.

**Results:** BMC was highly correlated to TBW, LSTM, and TPB (r = 0.90, 0.88, and 0.72 respectively.) BMD was correlated to the same variables to a lesser degree (r = 0.78, 0.64, and 0.68 respectively.) The highest correlation between lean variables was LSTM to TBW and then to a lesser degree TPB (r = 0.98 and 0.77 respectively.) Weight was less correlated to both BMC and BMD than any of the lean mass measures (r = 0.71 and 0.52 respectively.)

**Conclusions:** In a mostly healthy adults, bone mass and density are most highly correlated to lean mass measures with the highest correlation to TBW. We also found that LSTM is essentially just a measure of water mass. Future work will explore if these associations are the same in disease states and aged populations where protein and water mass are less coupled.

### 123 Peripheral Measurements: Bone Density and Ultrasound at the Radius

**The Axial Dependence of Bone Density and Ultrasound at the Radius**

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**Introduction:** Bone mineral density (BMD) is a key component of bone strength and for evaluating an individual’s risk for fracture. Dual energy X-ray absorptiometry (DXA) at the forearm has been well-studied and can be a useful site for osteoporosis screening. Ultrasound has been proposed as a proxy for BMD that is radiation free and simple to implement and use. The purpose of this study was two-fold. The first was to determine the variation of BMD along the radius, and the second was to evaluate the ability of a new ultrasound device to track these axial variations in radial BMD.

**Methods:** Nine subjects with no history of fragility fracture were measured at the forearm (all except two had both forearms measured) using DXA (QDR-4500, Hologic) to obtain their BMDs. The BMD of the radius was measured from the 1/3rd (33%) location to the 10 percent location in 5 mm steps, using a rectangle of 5 mm constant height and a length that varied with the width of the radius. Three of the 9 subjects were also measured using a thru-transmission ultrasound device (UltraScan 650, CyberLogic, Inc., NY, NY). The left and right forearms of each of the three subjects were measured starting at the 1/3rd location (Fig. 1) in steps distally of 3.33 mm, ending at the 10% location. The received ultrasound signals were processed to obtain two net time delay (NTD) parameters. The square root of the product of the two NTD parameters was used in a linear regression to compute an ultrasound-based estimate, BMDUS, of radial BMD.

**Results:** Fig. 2 displays the radial BMD vs. percent location along the forearm for 16 radii of the 9 subjects and shows a relatively constant rate of decrease for most subjects. In particular, BMD decreases at an average rate of 0.01 g/(cm^2·yr) from the 1/3rd (mean BMD = 0.75 g/cm^2) to the 10% (mean BMD = 0.58 g/cm^2) locations. The ultrasound data (consisting of 98 points) is shown in Fig. 3, and there is excellent correlation between the actual BMD and the ultrasound estimate, BMDUS, (r = 0.9, P < 0.0001).

![Figure 1. The UltraScan 650 ultrasonic forearm scanner.](image-url)