

Influence of Scanning Plane and Echo Intensity Correction on Relationships Between Muscle Size and Fitness

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ABSTRACT

B-mode ultrasonography is an accessible and reliable tool to measure muscle size and echogenicity. Measures of muscle thickness (MT), muscle cross-sectional area (mCSA), and echo intensity (EI) are commonly acquired in the sagittal or transverse planes, and with the extended field of view technique. However, whether these outcomes show unique relationships with muscle fitness across the scanning planes is unknown. **PURPOSE:** To identify the relationships between measurements of skeletal muscle size and echo intensity with muscle strength and local muscle endurance in a habitually resistance-trained population. **METHODS:** Twenty resistance-trained participants (Females: n = 10; Males: n = 10) underwent ultrasonography imaging in the sagittal and transverse planes and with the extended field of view technique. The participant's maximal dynamic strength (1RM bicep curl) and local muscle endurance (4x failure @ 50%1RM) were measured on separate days. The ultrasound-derived measures of MT, mCSA, EI, and adipose tissue thickness corrected echo intensity (cEI) in each scanning plane were examined for their associations with 1RM strength and total repetitions across the four sets with stepwise multiple linear regression. **RESULTS:** The analyses show the best predictor of 1RM strength and local muscle endurance was sagittal MT (adj. $R^2 = 0.682$) and sagittal cEI (adj. $R^2 = 0.449$), respectively. A positive relationship was demonstrated between strength and transverse MT ($R^2 = 0.661$) and the extended field of view mCSA ($R^2 = 0.643$). A negative relationship was shown between local muscle endurance and cEI in the transverse plane ($R^2 = 0.265$) and the extended field of view scan ($R^2 = 0.309$). However, no associations were shown with uncorrected EI. **CONCLUSIONS:** Overall, for the biceps brachii, sagittal plane imaging shows the strongest relationships with muscle fitness. While each scanning plane supports the muscle size - strength and echogenicity - endurance relationships, imaging in the sagittal plane is sufficient for time-restricted scenarios that are common in laboratory and allied health settings. These findings suggest that correcting EI for adipose tissue thickness should be done when inferences are being made regarding EI as an indicator of muscle quality.