TACSM Abstract

Test-Retest Reliability of Automatic and Manual Image Analyses of Muscle Size

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ABSTRACT

Brightness-mode (B-mode) ultrasound is a non-invasive imaging modality that has risen in popularity. In research settings, B-mode ultrasound is often used to assess skeletal muscle size via the quantification of the anatomical cross-sectional area (ACSA). Typically, these images are analyzed by an experienced investigator using open-source software, though it is a time-consuming process that may introduce implicit bias into the analysis. Recently, a novel, automatic ultrasound image analysis tool has been developed which may reduce bias and increase the reliability of ultrasound ACSA image analysis. **PURPOSE**: The purpose of the project was to compare the test-retest reliability of manual and automatic ACSA quantification techniques. **METHODS**: Nine participants (mean ± SD: age = 25 ± 3 years; BMI = 23.96 ± 2.62 kg/m^2) completed one laboratory visit where each participant had non-invasive ultrasound imaging performed on their rectus femoris (i.e., RF) for two data collection trials separated by 10 minutes. For each participant, ultrasound image settings were held constant (i = 6 cm, frequency = 10 MHz, gain = 52 dB). All images were manually analyzed by an experienced technician using an open-source image analysis tool. The investigator would carefully select only the surrounding muscle fascia of the RF. Automatic analyses were performed using DeepACSA, a deep learning approach for the assessment of ACSA. Both manual and automatic analyses were conducted on all images. Analysis of variance (ANOVA) was conducted to compare differences between trials and test-retest reliability (i.e., intraclass correlation coefficients [ICC] model 2,1, standard error of measure expressed as a percentage of the mean [SEM%], and the minimal differences [MD] values needed to be considered real) were calculated from the ANOVA output. **RESULTS**: The manual analyses of ACSA (p = 0.20, ICC2,1 = 0.84, SEM (%) = 11.67%, MD = 1.75 cm^2) were more reliable than the DeepACSA analyses (p = 0.13, ICC2,1 = 0.47, SEM (%) = 30.28%, MD = 4.70 cm^2). **CONCLUSION**: The results of the present investigation suggest that the DeepACSA approach may be less reliable compared to the manual quantification of RF muscle size. Future studies should investigate using a larger sample size and additional muscle groups.