TACSM Abstract

Reliability of Differing Muscle Size and Quality Analysis Techniques

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ABSTRACT

Brightness-mode (B-mode) ultrasonography is a popular tool to examine anatomical cross-sectional area (ACSA) and echo intensity (EI). Muscle ACSA and EI provide valuable insight into muscle function due to their unique mechanisms which influence performance. Manually analyzing ultrasound images potentially increases variability which may increase error, thus decreasing the reliability of manual image analysis. Recently an automated program was created to improve reliability and reduce the time of ultrasound image analysis. **PURPOSE**: The purpose of this study was to investigate the reliability of manual compared to automatic ultrasound analyses of muscle cross-sectional area and echo intensity. **METHODS**: Twenty-two participants (mean ± SD age = 24 ± 4 yrs; BMI = 24.19 ± 3.26 kg/m^2) volunteered for this study. The participants completed one visit to the laboratory consisting of two data collection trials separated by 10 minutes. Ultrasound scans were taken with a B-mode ultrasound imaging device and image settings were held constant (i.e., depth = 6 cm, frequency = 12 MHz, gain = 52 dB). For each trial, participants remained supine while ACSA scans of the vastus lateralis (VL) were taken at 50% the length of the proximal to distal musculo-tendon junctions. The ACSA of the VL was manually analyzed by an experienced technician with ImageJ using the polygon tool and tracing the area of interest. Echo intensity was quantified as the mean pixel brightness of the traced portion of the image. Images were automatically analyzed with the Deep Anatomical Cross-Sectional Area (DeepACSA) program which is an algorithm that is designed to automatically trace the area of interest of an ultrasound image. Test-retest reliability statistics (i.e., intraclass correlation coefficient [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 for trials 1 and 2. One-way repeated measures analysis of variance determined differences in trial 1 compared to trial 2. **RESULTS**: Manual analyses of ACSA ($ICC_{2,1}$ = 0.98, SEM (%) = 3.39%, MD = 2.09 cm^2, p = 0.046) were more reliable than automatic analyses ($ICC_{2,1}$ = 0.87, SEM (%) = 12.33%, MD = 7.77 cm^2, p = 0.216). Manual analyses of EI ($ICC_{2,1}$ = 0.73, SEM (%) = 6.44%, MD = 10.83 cm^2, p = 0.514) had similar reliability to the automatic analyses ($ICC_{2,1}$ = 0.88, SEM (%) = 3.60%, MD = 6.30 cm^2, p = 0.003). **CONCLUSION**: These results suggest that this automated analysis program may be less reliable compared to the manual analysis of muscle ACSA of the VL. Conversely, DeepACSA displayed similar reliability for EI of the VL when compared to the manual analysis.