TACSM Abstract

Bioimpedance Spectroscopy Compared to Ultrasound-derived Measures of Quadriceps Muscle Quality

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ABSTRACT

Muscle quality is often measured using ultrasound-derived echo intensity (EI). Recent works have shown tissue frequency-dependent electrical impedance from bioimpedance spectroscopy may be a modality for assessing tissue quality. **PURPOSE**: The purpose of the project was to examine the association between ultrasound-derived EI of the quadriceps muscles (i.e., vastus lateralis [VL], vastus medialis [VM], vastus intermedius [VI], rectus femoris [RF]) and measures of thigh tissue frequency-dependent electrical impedance (i.e., R0, R1, *C*, *a*, fp). **METHODS**: Twenty-four participants (13 women; mean ± SD; age: 22 ± 4 years; BMI: 25.47 ± 3.26 kg/m2) were recruited. Participants completed one laboratory visit where quadriceps tissue quality was assessed via ultrasound and bioimpedance spectroscopy (BIS). Participants laid supine on a portable exam table to undergo imaging of the dominant leg VL using ultrasound in conjunction with a multi-frequency linear array probe (L4 – 12t – RS, 4.2-13 MHz, 47.1mm field of view). The VL was marked at the proximal and distal musculo-tendon junctions determined via ultrasound and the length was measured with a tape measure. Participants had cross-sectional scans of the VM, VL, VI, and RF at 25, 50, 75% of the length of the VL. Images were analyzed using the polygon tool in ImageJ to trace the muscles and provide EI values. Subcutaneous fat width was measured using the straight-line tool. Echo intensity was calculated using ImageJ gray-scale analysis and histogram function as well as corrected for subcutaneous fat. For statistical analyses, the average corrected EI for each muscle was created across scan sites. For BIS, participants were seated in a chair with Ag/AgCl electrodes placed above the patella and below the hip. Electrodes were placed 6cm apart and the Cole-impedance model was used to represent frequency-dependent thigh tissue data. Signals were analyzed using a custom-written software program. Pearson's correlation coefficient (r) was used to determined associations between the VL, VM, VI, RF and BIS variables (R0, R1, C, a, fp). An alpha level of $p \leq 0.05$ determined statistical significance. **RESULTS**: The results suggest that VL, VM, VI and RF echo intensity was significantly related to R0 (r = 0.65 – 0.81; $p < 0.01$). For VI and RF, they were significantly related to *a* (r = -0.51 – -0.50; p = 0.01), but not for VL or VM (r = -0.39 - -0.22; $p > 0.06$). Lastly, R1, *C*, and fp were not significantly correlated to the quadriceps muscles (r = -0.38 – 0.33; $p > 0.07$). **CONCLUSION**: Our findings suggest that BIS-derived R0 may be a metric of muscle quality of the quadriceps as it was significantly related to ultrasound-derived measures of echo intensity of the VL, VM, VI, and RF. Further investigation of other muscle groups may be warranted.