Intra-Rater Reliability and Measurement of MRI-Functional Cross-Sectional Area in Healthy Sedentary Individuals

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Introduction

Intramuscular adipose tissue (IMAT) is defined as visible adipose tissue beneath the muscle fascia and between muscle groups and has been linked with metabolic abnormalities (5). Previous research has shown that people with obesity, diabetes and peripheral neuropathy have significant greater amounts of IMAT then compared to a non-obese control group (7). Magnetic resonance imaging (MRI) provides a highly detailed image of muscle tissue that can be analyzed and used to determine muscle size (cross-sectional area) (1). MRI images have also been used for functional cross sectional area (FCSA) measurements (2, 4). FSCA is the area of muscle isolated from adipose tissue beneath the muscle fascia and between muscle groups and has been linked with metabolic abnormalities (5).

There were two purposes of this study, first was to evaluate the intra-rater reliability of FCSA using MRI measured by greyscale thresholding of the knee extensor (KE) and plantar flexor (PF) muscles using ImageJ software (National Institutes of Health, Bethesda, MA, USA). Second was to evaluate FCSA and IMAT in younger and older healthy sedentary individuals (Fig 1).

Methods

49 sedentary individuals in groups of younger (n = 25, age = 26.3 ± 4.7 years) and older adults (n = 24, age = 57.9 ± 4.5 years) were imaged with serial axial plane MRI scans from a 3.0 T Siemens Skyra Interia whole body scanner. The MRI settings were as follows: repetition time = 3730 ms, 10 mm slice-to-slice interval, 420-500 mm x 328-390 mm field of view. Intra-rater reliability was done with images from 10 subjects that were analyzed on two separate occasions.

Results

For the intra-rater reliability paired sample T-tests were used with a 95% confidence interval. Test-retest reliability for FCSA and IMAT was analyzed using intraclass correlation coefficients (ICC). One-way analysis of variance (ANOVA) was used to compare differences in %IMAT KE, %IMAT PF, between the younger and older groups (P < 0.05).

Discussion

The reliability of FCSA for the KE and the PF using ImageJ shows excellent agreement and internal consistency. This suggests that the greyscale thresholding protocol is a reliable method to derive IMAT. The analysis of the FCSA in sedentary individuals showed higher proportion of IMAT for the KE and the PF in older adults as well as in PF vs KE.

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References