

Reliability and Relationships between Rectus Femoris Muscle Size and Hip Flexion Maximal and Explosive Strength

MEGAN R. CRUZ, JOSE G. PINEDA, and TY B. PALMER

Muscular Assessment Laboratory; Department of Kinesiology and Sport Management;
Texas Tech University; Lubbock, TX

Category: Masters

Advisor / Mentor: Palmer, Ty (ty.palmer@ttu.edu)

ABSTRACT

Ultrasound assessments of muscle cross-sectional area (CSA) are commonly used to evaluate muscle size in young adults. It has been hypothesized that the CSA of the rectus femoris (RF) may be an important contributor to hip flexion maximal and explosive strength capacities. However, limited data exist regarding the reliability of RF CSA and how it relates to maximal and explosive strength of the hip flexors in young adults. **PURPOSE:** To examine the reliability of RF CSA and its relationships with hip flexion isometric maximal and explosive strength. **METHODS:** Nineteen young, healthy females (age = 21 ± 2 years; mass = 61 ± 7 kg; height = 163 ± 6 cm) volunteered for this study. Participants visited the laboratory 2 times, separated by 2-7 days at approximately the same time of day (± 2 hours). During each visit, participants underwent 2 diagnostic ultrasound assessments followed by 2 isometric maximal voluntary contractions (MVCs) of the hip flexors using an isokinetic dynamometer. CSA (cm^2) of the RF was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. For each ultrasound assessment, participants laid supine with the knee resting comfortably in extension near the natural resting position of 10° . All ultrasound images were taken in the transverse plane using a panoramic ultrasound imaging technique, which consisted of the investigator moving the probe manually at a slow and continuous rate along the surface of the skin from the lateral to medial sides of the muscle. For each MVC, participants laid supine and were instructed to flex the right thigh "as hard and fast as possible" for 3-4 s. Isometric MVC peak torque (PT; Nm) was determined as the highest mean 500 ms epoch during the entire 3-4 s MVC plateau. Rate of torque development (RTD; Nm s^{-1}) was determined from the linear slope of the torque-time curve over the time interval of 0-200 ms. The intraclass correlation coefficient (ICC) and standard error of measurement expressed as a percentage of the mean (SEM%) were calculated across visits to assess reliability for RF CSA and hip flexion PT and RTD. The relationships between these variables were determined by Pearson product-moment correlation coefficients (r). **RESULTS:** Mean \pm SD values (averaged across both visits) were $9.38 \pm 1.69 \text{ cm}^2$, $136.58 \pm 23.88 \text{ Nm}$, and $772.86 \pm 170.91 \text{ Nm s}^{-1}$, ICCs were 0.95, 0.90, and 0.82, and SEM% values were 5.85, 5.68, and 10.03% for the CSA, PT, and RTD data, respectively. Significant positive relationships were observed between CSA and PT ($r = 0.605$, $P = 0.006$) and RTD ($r = 0.462$, $P = 0.046$). **CONCLUSION:** These findings demonstrated that CSA, PT, and RTD may be reliable measures for assessing RF muscle size and maximal and explosive strength capacities of the hip flexors in young, healthy adults. The significant relationships observed between CSA and PT and RTD perhaps suggest that the size of the RF may play an important role in hip flexion maximal and explosive strength. As a result, practitioners may consider implementing training programs aimed at increasing the size of the RF in younger adults which may be beneficial for improving the maximal and explosive strength capacities of the hip flexors.