TACSM Abstract

Relationship between Vertical Jump Height and Pennation Angle of the Rectus Femoris and Vastus Lateralis

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ABSTRACT

Ultrasound assessments of pennation angle (PA) are commonly used to examine muscle architecture in young adults. Pennation of the lower-body musculature has been suggested to be an important predictor of functional performances for strength-related activities. However, limited data exist regarding how PA is associated with performance during a vertical jump test. **PURPOSE**: The purpose of this study was to determine the relationship between vertical jump height and PA of the rectus femoris (RF) and vastus lateralis (VL) muscles in healthy, young females. **METHODS**: Seventeen healthy, young females (age = 22 ± 3 years; mass = 61 ± 8 kg; height = 162 ± 6 cm) volunteered for this study. Participants visited the laboratory two times, separated by seven days at approximately the same time of day (±2 hours). During the first visit, participants were familiarized with the jumping procedures and underwent two diagnostic ultrasound assessments of the RF and VL muscles using a portable B-mode ultrasound imaging device and linear-array probe. During the second visit, participants performed three countermovement vertical jumps using a jump mat, which measured jump height (cm) based on flight time. All ultrasound images were scanned on the right leg with the probe oriented in the longitudinal plane. RF images were taken on the line at the midpoint between the anterior superior iliac spine and the proximal border of the patella. VL images were taken on the line at the midpoint between the greater trochanter and lateral epicondyle of the femur. For each scan, participants laid supine with the knee resting comfortably in extension, while the investigator (A.C.C.) placed the probe on the marked site to capture images of muscle pennation. Muscle fiber PA (°) was determined as the intersection of the fascicles with the deep aponeurosis. Each image was assessed three times, and the average value for PA was used for analysis. Pearson product-moment correlation coefficients (r) were used to examine the relationships between RF and VL PA and vertical jump height. **RESULTS**: PA values (mean ± SD) were 13.65 ± 3.25° for the RF and 20.53 ± 2.62° for the VL. Jump height was 34.90 ± 4.14 cm. There was a significant positive relationship between jump height and VL PA (r = 0.603, P = 0.010); however, there was no relationship between jump height and RF PA (r = 0.190, P = 0.466). **CONCLUSION**: The present findings of a significant positive relationship between jump height and VL PA suggest that pennation of the muscle fibers in the VL may play an important role in vertical jump performance. Strength and conditioning coaches and other practitioners may use these findings to help predict explosive jump-related capacities in college-aged females. Moreover, these findings highlight the need for training programs focused on increasing VL PA, as this may be helpful for improving vertical jump height in younger adults.