

Relationships between Walking Speed and Lower Extremity Muscle Quality and Strength in Elderly Females

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ABSTRACT

The link between walking speed, rectus femoris (RF) muscle quality [echo intensity (EI)], and maximal and rapid strength in older adults is not well understood. **PURPOSE:** To examine the relationships between walking speed, RF EI, and maximal and rapid isometric torque characteristics of the leg extensors in elderly females. **METHODS:** Twenty elderly females (age = 67 ± 4 years; height = 159 ± 6 cm; mass = 68 ± 7 kg) underwent one diagnostic ultrasound assessment followed by three isometric maximal voluntary contractions (MVC) of the leg extensors and a 6-min walk test. RF EI was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. Walking speed was determined as the average speed during the 6-min walk test. For each MVC, participants sat in an upright position and were instructed to push "as hard and fast as possible" against a load cell for 3-4 s. Isometric MVC peak torque (PT) was determined as the highest mean 500 ms epoch during the entire 3-4 s MVC plateau. Peak rate of torque development (RTD) was calculated during each MVC as the highest slope value for any 50 ms epoch that occurred over the initial 200 ms of the torque-time curve. Pearson correlation coefficients (r) were used to examine the relationships between walking speed, EI, PT, and RTD. A partial correlation was used to examine the relationship between walking speed and RTD when controlling for EI. **RESULTS:** Mean \pm SD values were 1.55 ± 0.23 m/s for walking speed, 144.16 ± 19.48 AU for EI, 107.62 ± 23.79 Nm for PT, and 872.35 ± 365.16 Nm/s for RTD. There were significant relationships between walking speed and RTD ($r = 0.451$; $P = 0.046$) and EI ($r = -0.497$; $P = 0.026$). There was a significant negative relationship between EI and RTD ($r = -0.469$; $P = 0.037$). No significant relationships were observed between PT and walking speed ($r = 0.394$; $P = 0.085$) or EI ($r = -0.413$; $P = 0.071$). With EI as a control variable, there was no significant relationship between walking speed and RTD ($r = 0.285$; $P = 0.238$). **CONCLUSION:** We found a significant positive relationship between walking speed and RTD of the leg extensors in elderly females. Although the reason for this is uncertain, partial correlation analysis suggested that this relationship may be explained by the variance shared (collinearity) between walking speed and RF EI. From a functional standpoint, an age-related decrease in RTD due to its apparent collinearity with RF EI, may significantly impact the quality of life among older adults by impairing their ability to perform important time-dependent movement tasks (i.e., walking fast to catch the bus or train, quickly crossing the street to avoid oncoming traffic, etc.). Consequently, given the influence of EI on RTD, it is possible that training programs used to improve muscle quality may also be used to help improve rapid strength, which could be beneficial for increasing walking speed as well as a multitude of other functional performance abilities in the elderly.