

MEASUREMENT OF THIGH MUSCLE SIZE USING TAPE OR ULTRASOUND IS A POOR INDICATOR OF THIGH MUSCLE STRENGTH

Kieran O'Sullivan¹, David Sainsbury¹ and Richard O'Connor¹

¹Physiotherapy Department, University of Limerick, Ireland

KEY WORDS: ultrasound, isokinetics, muscle, size, strength, tape measurement

INTRODUCTION: Although commonly used, the validity of measures of thigh circumference and ultrasound measurements of muscle thickness as indicators of muscle strength is unclear (Maylia et al 1999). This study aimed to determine the relationship of these two simple measures of muscle size to the concentric isokinetic quadriceps and hamstrings strength of a group of Irish Gaelic footballers.

METHOD: Thigh circumference was measured using a tape measure. Linear ultrasound measurements of quadriceps and hamstring muscle thickness were also obtained. A pilot study on 15 subjects was performed in advance to determine the reliability of these measures. Twenty five senior and intermediate male gaelic footballers were recruited (mean age 20.74 years, mean BMI 24.78 kg/m²) Concentric muscle strength was determined using the Biodex system 3 isokinetic dynamometer. Three commonly used speeds were used; 60°/sec, 180°/sec, and 300°/sec. Reliability was assessed using intra-class correlation coefficients and Bland & Altman methods. Muscle size measurements were correlated with torque values using Pearsons correlation. The alpha level was set at $p < 0.05$.

RESULTS: Both tape and ultrasound demonstrated moderate to excellent reliability at measuring quadriceps and hamstrings muscle size (ICC's 0.69-0.99). Hamstrings were significantly stronger on the dominant limb at 60°/sec ($p=0.046$) and 180°/sec ($p=0.005$), but not at 300°/sec ($p=0.092$). There was no significant difference in quadriceps strength at any speed (all $p > 0.05$). Dominant limbs were significantly larger using the tape measure (10cm level: $p=0.005$, mid-thigh level: $p=0.003$). The dominant hamstrings ($p < 0.001$), but not the dominant quadriceps ($p=0.399$), were significantly larger on ultrasound. There were statistically significant correlations between muscle strength and muscle size measurements, especially for the tape measurements. However, despite the fact that the dominant limb muscles were both stronger and larger, the strength of these correlations was only weak to moderate ($r = 0.176-0.526$).

DISCUSSION: Although reliable, gross anthropometric measures of thigh muscle thickness using tape and ultrasound correlate poorly with isokinetic muscle strength. This may be related to the strong influence of neural factors on muscle strength (Deschenes et al 2002).

CONCLUSION: Simple measures of muscle size are poor indicators of muscle strength.

REFERENCES:

- Maylia, E, Fairclough, J, Nokes, L & Jones, M. (1999) Can Muscle Power Be Estimated From Thigh Bulk Measurements? A Preliminary Study. *Journal of Sports Rehabilitation* 8, 50-59.
- Deschenes, MR, Giles, JA, McCoy, RW, Volek, JS, Gomez, AL & Kraemer, WJ (2002). Neural factors account for strength decrements observed after short-term muscle unloading. *American Journal Of Physiology. Regulatory, Integrative And Comparative Physiology* 282, R578-83.