

Comparison of Hamstring and Quadriceps Muscle Activity in Men and Women Performing a Body Weight Squat

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ABSTRACT

Multiple studies support the idea that women use a more quadriceps dominant activation pattern at the knee during stabilizing movements which may predispose them to a greater risk of ACL injury. A body weight squat is a common exercise used to strengthen knee musculature in attempt to minimize the risk of ACL injury. However, it is not clear whether this exercise activates the knee musculature in a manner that would not exacerbate the quadriceps dominance often observed in women. **PURPOSE:** To determine if women are more quadriceps dominant than men when performing a two-legged body weight squat.

METHODS: Seven male and seven female Division III collegiate athletes (20.5±1.0 yrs, 176.2± 12.6 cm, and 79.7± 16.6 kg) provided informed consent and participated in this study. Surface EMG collected at 1000 Hz was used to measure the muscle activity of the vastus lateralis (VL) and the biceps femoris (BF), and normalized to the respective maximum voluntary isometric contraction (MVIC) for each muscle.

Participants performed eight repetitions of a two-legged body weight squat at a cadence of 54 bpm. RMS EMG was computed across a 200 ms window and analyzed for the middle six repetitions at 15°, 45° and 60° of knee flexion during the movement. Hamstrings and quadriceps activity for the concentric phase of movement were evaluated separately, with two 2x3 (gender x joint position) mixed model ANOVAs.

RESULTS: No interaction was observed between gender and joint position for either quadriceps ($F(1,11) = 0.64, p = 0.54$) or hamstring activity ($F(1,11) = 1.24, p = .31$). As knee flexion decreased, both quadriceps and hamstrings activity significantly decreased. Quadriceps activity, decreased from 41.7± 24.9%MVIC at 60° to 37.6± 21.7% at 45° to 34.2± 22.7% at 15° ($F(1,11) = 5.74, p = 0.01$). Likewise, hamstring activity decreased from 26.7± 28.9%MVIC at 60° to 20.6± 20.6% at 45° and to 18.2± 19.1% at 15° ($F(1,11) = 3.92, p = 0.04$). **CONCLUSION:** Gender-specific muscular imbalances do not occur during the performance of a bodyweight squat suggesting that such an exercise is appropriate as a part of strength training program designed to reduce ACL risk in women. However, knee angle is a relevant factor to consider when examining muscular characteristics of dynamic movements and injury mechanisms.

Keywords: knee angle, concentric, muscular imbalance