SWACSM Abstract

Effect of Lead Leg and Fatigue on Ground Reaction Forces in Front Lunges

JASMYNE HOLLIDAY, & MICHELE LEBLANC, FACSM

Biomechanics Laboratory; Exercise Science Department; California Lutheran University; Thousand Oaks, CA

Category: Undergraduate

Advisor / Mentor: LeBlanc, Michele (mleblanc@callutheran.edu)

ABSTRACT

Front lunges are a beneficial exercise that are frequently used for rehabilitation and strength training. In the studies previously conducted, only vertical ground reaction force (GRF) data for the preferred lead leg was analyzed and only male subjects were included (Gao et al., 2022, Park et al., 2021). **PURPOSE**: The aim of this study was to determine the effect of lead leg and fatigue on lead leg anterior/posterior (Fy) and vertical (Fz) GRFs during the eccentric and concentric phases of the front lunge. **METHODS**: Ten recreationally active women were recruited and performed front lunges with an assigned step length (trochanter to lateral malleolus length) and cadence (15 repetitions/minute). Two sets of five lunges were completed for each lead leg before and after a jumping lunge fatigue protocol. Two Kistler force plates (1200Hz) collected GRFs. Average and peak Fy and Fz values were obtained using BioWare software with the maximum lead leg knee flexion determining the transition between the two phases. Paired t-tests were performed to determine differences associated with lead leg before and after fatigue, as well as the effect of fatigue for each lead leg ($p < 0.05$). **RESULTS**: There were no differences in Fy values due to lead leg or fatigue. Prior to fatigue, the right lead leg produced smaller peak Fz values than the left leg during both the eccentric and concentric phases (91.6 ± 10.4 %BW vs 100.1 ± 5.4 %BW, $p = 0.020$ and 97.5 ± 9.0 %BW vs 109.4 ± 9.3%BW, $p= 0.001$, respectively). Additionally, the average Fz values were significantly smaller for the right lead leg lunges during both phases ($p < 0.001$). After the fatigue protocol, the right lead leg continued to create a smaller peak Fz value during the concentric phase ($p = 0.001$) and a smaller average Fz value during both phases ($p < 0.001$). Additionally, the time spent in the eccentric phase decreased for left lead leg lunges (1.064 ± 0.137 s vs 0.956 ± 0.129 s, $p = 0.018$) with a trend towards less time for right lead leg trials. Fatigue did not alter any of the Fz values for the left lead leg trials, but the right lead leg trials had larger average eccentric values ($p=0.031$) and smaller peak concentric forces ($p=0.019$). **CONCLUSION**: The lead leg affected the vertical GRFs with the left lead leg producing greater forces. However, only four of the ten participants indicated left lead leg preference.