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Effect of Fatigue on Lumbopelvic-Hip Complex Muscle Activation and Lower Extremity Biomechanics

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OBJECTIVE
Instability of the lumbopelvic-hip complex (LPHC) is linked to lower extremity injury. Fatigue has shown to alter LPHC muscle activity and function. Our purpose was to examine the effect of fatigue on LPHC stability, lower extremity biomechanics, and LPHC muscle activation.

DESIGN AND SETTING
Descriptive study.

PARTICIPANTS
Twenty-two healthy, active individuals (12 females, 10 males; 23.5±3.1yrs; 1.73±0.09m; 76.1±10.7kg).

INTERVENTION
Participants completed a Seated Trunk Control Test (STCT) involving balancing on a wobble board placed on a raised surface while the researcher counted errors occurring in 30 seconds. Participants completed the STCT and single leg squats (SLS) before and after a 35-minute full-body fatiguing protocol.

MAIN OUTCOME MEASUREMENT
LPHC stability was measured using time to first error (TTE) and number of errors (NE) in the STCT. Activity of the rectus abdominis (RA), external oblique, internal oblique (IO), erector spinae, gluteus medius vastus lateralis, and vastus medialis during the tasks was recorded using wireless electromyography (EMG) and normalized to peak activation. Frontal and sagittal plane kinematics of the trunk, hip, and knee during SLS were assessed using 2D video analysis. Paired t-tests measured differences between pre- and post-fatigue measurements.

RESULTS
TTE significantly decreased (pre: 13.44±9.54seconds, post: 8.47±8.11seconds, p=0.03) and NE significantly increased (pre: 5.73±4.99, post: 8.30±5.47, p=0. 016) when fatigued. RA activity increased in the STCT (pre: 15.31±15.73, post: 28.70±31.11, p=0.047) and SLS (pre: 7.43±6.03, post: 16.83±19.97, p=0.014) when fatigued. Knee flexion angle increased (pre: 98.7±14.2; post: 102.1±15.5, p=0.042) when fatigued, indicating less knee flexion movement during the SLS. No significant changes happened in frontal plane movement.

CONCLUSION
Full-body fatigue influences LPHC stability and activation of superficial musculature used in the task. The trunk rigidity necessary to achieve stability and complete a functional task requires increased muscle activation in a fatigued state, mimicking findings in studies evaluating walking gait after exercise. Fatigue alters muscle activity of the LPHC during a SLS; however, the impact fatigue has on the quality of movement and biomechanics should be further investigated. Clinicians can use these findings to consider training the LPHC in a fatigued state.

KEY WORDS: *Core, Stability, Risk Factors*