

ORAL PRESENTATION OP5

Lower Limb Kinematics and Non-Dimensional Spatiotemporal Parameters During Walking Between Individuals with Chronic Low Back Pain and Healthy Populations

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ABSTRACT

Background: Chronic low back pain (CLBP) impairs walking ability and quality of life. However, lower limb kinematic alterations throughout the gait cycle and the influence of non-dimensional normalization (NDN) on spatiotemporal gait parameters remain insufficiently understood. **Objective:** To compare lower limb kinematics and NDN spatiotemporal gait parameters between individuals with CLBP and healthy controls. **Methods:** Seventy participants (CLBP = 35; Healthy = 35) underwent three-dimensional gait analysis using a Vicon Motion Capture System while walking barefoot along a 10-m walkway at a self-selected speed. Statistical Parametric Mapping (SPM) compared continuous lower limb kinematics across the gait cycle to identify phases with significant between-group differences. Spatiotemporal parameters were normalized using non-dimensional normalization (NDN) to account for body size and leg length differences. Independent t-tests compared normalized spatiotemporal parameters ($p < 0.05$). **Results:** SPM revealed significant kinematic differences across multiple joints. Pelvic frontal plane differences occurred during approximately 37% of the gait cycle, while hip kinematics differed during 22–29% of the gait cycle across all three planes. Knee kinematics showed the greatest differences during the late stance-to-mid-swing phase (47.52–70.30%), whereas ankle sagittal kinematics differed during early stance, terminal stance, and terminal swing. Compared with healthy controls, individuals with CLBP demonstrated shorter normalized step and stride lengths, longer step and stride times, lower cadence, and slower walking speed (all $p < 0.01$). **Conclusion:** Individuals with CLBP demonstrated altered lower limb kinematics and poorer normalized spatiotemporal performance, indicating reduced gait efficiency. These findings support incorporating gait analysis into physiotherapy assessment and rehabilitation targeting pelvic and hip neuromuscular control, stance-to-swing transition mechanics, and gait efficiency.

Keywords: Low back pain; Gait; Lower extremity; Walking; Biomechanical phenomena

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