TACSM Abstract

Human Spring Running Mechanics: Do Right and Left Legs Apply Equal Ground Forces?

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ABSTRACT

Introduction: A growing body of research has focused on between-leg asymmetry as a critical factor for athletic performance and dysfunction. Specifically, various measures of between-leg asymmetry during running have been investigated in both healthy and injured populations. However, while the most important factor for running performance is the magnitude and rate of ground force application, it is not known whether the right and left legs typically apply equal ground forces at faster running speeds. Objective: In a healthy population of athletic female participants, we aimed to: 1) compare the mechanics of ground force application between right and left legs during moderate and top speed running, and 2) evaluate if the right vs. left leg asymmetries observed at intermediate speeds are more pronounced at faster speeds. Hypothesis: We hypothesized that the forces applied by the right and left legs of healthy athletes would agree to within 10% or less at both moderate and top speed. Participants: Nine female intercollegiate soccer players volunteered for the study (age: 19.4 ± 1.0 years, height: 1.72 ± 0.04 m, mass: 69.0 ± 7.2 kg). Data Collection: Ground force data was acquired at 1,000 Hz using a custom high-speed, three-axis force treadmill (AMTI, Watertown, MA). Data was analyzed for trials at 5.0 m•s-1 and each individual's top speed. Top speed was defined as the fastest speed where the participant could complete eight consecutive steps on the treadmill without drifting backward more than 0.2 m. Outcome Measures: Ground contact time, vertical force, and vertical impulse were analyzed. Vertical force was normalized to body weight (Wb) and vertical impulse was calculated in body weight • seconds (Wb•s). For all trials, these variables were averaged for right vs. left footfalls, and percentage difference was calculated to quantify between-leg asymmetry. Results: Top speeds ranged from 7.21 to 8.26 m•s-1 (7.83 ± 0.38 m•s-1). At 5.0 m•s-1, the mean between-leg asymmetry was 2.3 ± 1.2 % for ground contact time, 1.9 ± 1.3 % for vertical force, and 2.3 ± 1.9 % for vertical impulse. At top speed, the mean between-leg asymmetry was 3.5 ± 2.8 % for ground contact time, 5.5 ± 3.0 % for vertical force, and 8.3 ± 4.8 % for vertical impulse. Conclusions: We conclude that the right and left legs apply ground force similarly during moderate and top-speed sprint running in healthy female athletes.