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Investigating Bilateral Asymmetries in Joint Angular Motion of the Lower Limb During Running

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Measures of bilateral symmetry are frequently employed to assess athletic performance and injury risk. When analyzing running gait, prior research has often utilized spatial-temporal variables such as stride length and stride rate. However, joint angular asymmetries during running across a range of speeds in athletic populations remains relatively unexplored. **PURPOSE:** To investigate bilateral asymmetries at the hip and knee during running in trained athletes. **METHODS:** Eleven healthy male and female intercollegiate athletes (height=1.66±0.23m, mass=67.80±18.77 kg, age=21.18±1.08 years) from a range of sports volunteered and provided written informed consent. After completing a dynamic warm-up, subjects performed a series of 40m runs in an indoor athletic facility. One or two trials were completed at each of the following self-selected speeds: jog, run, submaxim al sprint, and maximal sprint. A 3D motion capture system (OptiTrack, 200 Hz) collected kinematic data as subjects ran through the field of view from 30-38m. For each trial, angular kinematics for the hip and knee joints were analyzed for both a right and left gait cycle. Angular position vs. time data was synchronized for right vs. left hip and right vs. left knee joints. A total of 36 trials (72 steps) were analyzed, with asymmetry quantified by Root Mean Squared Error (RMSE). **RESULTS:** Paired-samples *t*-tests revealed significantly less asymmetry in bilateral hip angular motion compared to knee angular motion ($p < 0.001$, hip RMSE = 4.95 ± 1.86 degrees, knee RMSE = 7.97 ± 2.40 degrees). The relationship between hip and knee asymmetry was moderate ($R^2 = 0.38$), implying that asymmetry at the knee is not completely determined by hip angular motion. **CONCLUSION:** In addition to spatial-temporal variables, analysis of joint angular motion may provide further insight into locomotor gait asymmetries in athletic populations. In this athletic population, hip angular motion was relatively symmetrical, perhaps functioning to reduce torques about the center of mass.