

# ALTERED SAGITTAL PLANE HIP BIOMECHANICS IN ADOLESCENT MALE DISTANCE RUNNERS WITH A HISTORY OF LOWER EXTREMITY INJURY

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## ABSTRACT

**Background:** Lower extremity overuse injuries, including bone stress injuries (BSI), are common in runners and may result in prolonged recovery and time off from running. Identifying risk factors for running-related overuse injuries may have a clinically relevant role in prevention of these injuries.

**Purpose:** The purpose of this study was to compare an adolescent and young adult population of male runners known to have a history of BSI with an injury-free cohort and retrospectively assess for kinematic differences that may differentiate the two cohorts

**Study Design:** Controlled laboratory case control investigation

**Level of Evidence:** Level 3

**Methods:** 25 male high school and collegiate cross-country runners were enrolled. Ten self-reported a prior history of BSI consisting of lower extremity stress fracture or shin splints/medial tibial stress syndrome and were categorized as injured (INJ). Fifteen self-reported no prior history of lower extremity injury and were categorized as uninjured (UNINJ). All runners were pain-free at time of testing. Runners ran at a self-selected speed on a treadmill with retro-reflective markers attached to thorax, pelvis, and each lower extremity segment. Three-dimensional kinematic calculations were made during stance phase (initial treadmill heel contact to toe off) and averaged over 20 steps. One-way ANCOVA was used to compare kinematic differences at the hip and knee between the INJ and UNINJ cohort.

**Results:** Runners in the INJ group demonstrated greater peak hip flexion during stance phase on both the right limb [INJ = 32.5° (± 3.8°) vs. UNINJ = 26.9° (± 4.6°);  $p < 0.01$ ] and the left limb [INJ = 31.2° (± 4.8°) vs. UNINJ = 26.8° (± 3.1°);  $p = 0.01$ ] when compared to the UNINJ group. No significant difference in step length or step rate between the INJ and UNINJ cohorts was noted when normalized to height and weight ( $p = 0.39$  and  $0.39$ ).

**Conclusions:** The results of this study demonstrate increased peak stance phase hip flexion in a population of young adult male runners with a previous history of BSI. This association may represent an important preliminary finding in the development of a clinically relevant tool to identify risk of BSI. Due to the retrospective nature of this study, future prospective investigations are warranted to validate these findings to determine if these alterations are compensatory following an injury or predictive of a future injury.

**Keywords:** Bone stress injury, kinematics, running

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