

# HIGH- AND LOW-ARCHED ATHLETES EXHIBIT SIMILAR STIFFNESS VALUES WITHIN THE LOWER EXTREMITY

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**KEY WORDS:** Arch, Kinetics, Landing

**INTRODUCTION:** Abnormal foot function has been associated with an increased propensity of injury (Kaufman *et al.*, 1999). Both high- (HA) and low-arched (LA) athletes suffer a greater incidence of injury (Kaufman *et al.*, 1999). Previous research has shown that HA compared to LA runners exhibit greater lower extremity stiffness and greater stiffness within the lower extremity joints (Williams *et al.*, 2004). The purpose of the current study was to examine lower extremity stiffness as well as hip, knee and ankle joint stiffness in HA and LA athletes. It was hypothesized that the HA athletes would have greater stiffness values than the LA athletes within the lower extremity.

**METHODS:** Ten HA (arch index > 0.356) and 10 LA (arch index < 0.290) female athletes participated in the current study. Each subject performed five trials of landing from a 30cm box while three-dimensional kinematics (240Hz, Vicon Motion Systems Ltd., Oxford, UK) and ground reaction forces (1200, OR-6, AMTI, Watertown, MA) were collected simultaneously. Lower extremity stiffness was calculated as the peak vertical ground reaction force divided by the change in vertical height of the pelvis. Lower extremity joint stiffness was calculated as the joint moment divided by the joint angle. A 2x3 analysis of variance was used to determine significant differences between the HA and LA groups.

**RESULTS & DISCUSSION:** The HA and LA athletes exhibited similar lower extremity stiffness values ( $p=0.061$ ). Additionally, no differences in hip ( $p=0.912$ ), knee ( $p=0.869$ ) or ankle stiffness ( $p=0.198$ ) were observed between the HA and LA athletes. These data show that the HA and LA athletes exhibited similar stiffness values suggesting that unique injury patterns during dynamic tasks are not caused by differences in lower extremity stiffness.

**CONCLUSIONS:** Lower extremity injury patterns are different between HA and LA athletes, however these differences are not due to differences in lower extremity stiffness. Further research should examine differences in lower extremity joint moments between HA and LA athletes which may provide greater insight into these different injury patterns.

## REFERENCES:

Kaufman, K.R., et al (1999). The effect of foot structure and range of motion on musculoskeletal overuse injuries. *Am J Sports Med*, 27(5), 585-93.

Williams, D.S., et al (2004). High-arched runners exhibit increased leg stiffness compared to low-arched runners. *Gait Posture*, 19(3), 263-9.