The number of individuals who engage in running for health and fitness has grown significantly in the last few decades.[1] Despite the positive health effects associated with running, recent literature has reported a high incidence (19% to 79%) of lower extremity running injuries, with half of the injuries occurring at the knee joint.[2] Popular running techniques (i.e. Chi and Pose running methods) advocate the utilization of trunk forward lean to unload the knee joint and reduce the risks of knee injuries.[3] Recent literature suggests the trunk posture is related to the mechanical demands on hip and knee joints during weightbearing activities.[4,5]

To date, it is unclear how subtle differences in sagittal plane trunk posture influence the biomechanical demands on hip and knee extensors during running. As such, the purpose of the current study was to examine the association between an individual’s self-selected sagittal plane trunk posture and hip and knee moments during over-ground running.

Subjects
Forty natural heel-toe recreational runners participated in this study. They did not have any current symptoms or previous surgery in low back and lower extremity.
- Sex: 20 male, 20 female
- Age: 26.6 ± 6.2 years
- Height: 1.69 ± 0.08 m
- Weight: 65.9 ± 9.1 kg
- Distance run per week: 23.5 ±15.9 km

Instrumentation
Eleven camera motion capture system (Qualisys, Inc., Gothenburg, Sweden):
- Sampling rate: 250 Hz
- Force plate (AMTI, Watertown, MA)
- Sampling rate: 1500 Hz

METHODS

Running Protocols
- Subjects were instrumented with full body marker set.
- Subjects ran overground with their self-selected trunk posture at a velocity of 3.4 m/s (SD= 0.1 m/s) (Figure 1)
- 3D trunk and knee kinematics and the ground reaction force data were collected

Data Analysis
- Trunk kinematics and hip and knee kinetics were computed by Visual 3D software (C-Motion, MD, USA)
- Trunk segment: defined by markers placed on bilateral iliac crests and acromioclavicular joints
- Trunk orientation: calculated relative to the global vertical axis
- Variables of interest: Mean trunk angle and peak hip and knee extensor moments during the stance phase of running
- Significance level = 0.05

RESULTS

On average, the High-Flex group exhibited 11.1° (SD 2.3) of trunk flexion during the stance phase of running while the Low-Flex group demonstrated 3.7° (SD 2.7°) of trunk flexion. The difference in sagittal plane trunk posture between the two groups remained similar throughout the entire stance phase (Figure 1).

Significant group differences were observed for peak hip and knee extensor moments. Individuals in the High-Flex group demonstrated greater peak hip extensor moment (+14%, 1.76 ± 0.24 vs. 1.50 ± 0.38) and lower peak knee extensor moment (-9%, 2.67 ± 0.29 vs. 2.90 ± 0.30) compared to individuals in the Low-Flex group (Figure 2).

CONCLUSIONS
Trunk posture during running affects the biomechanical demands on the hip and knee extensors. More specifically, our findings indicate that a more extended trunk posture is associated with higher biomechanical demands on the knee extensors and a reduced biomechanical demand on the hip extensors. In contrast, running with a more flexed trunk posture is associated with a higher hip extensor moment and a lower knee extensor moment.

REFERENCES