

# Increases in Hamstrings to Quadriceps Peak Torque Ratios with Increasing Angular Velocity in Healthy Female Collegiate Lacrosse Athletes

LINDSEY A. SMITH, PAIGE J. SUTTON, MEGHAN N. REA, PETEY W. MUMFORD, KYLE L. SUNDERLAND  
 Exercise and Performance Nutrition Laboratory, Lindenwood University, St. Charles, MO 63301

## Introduction

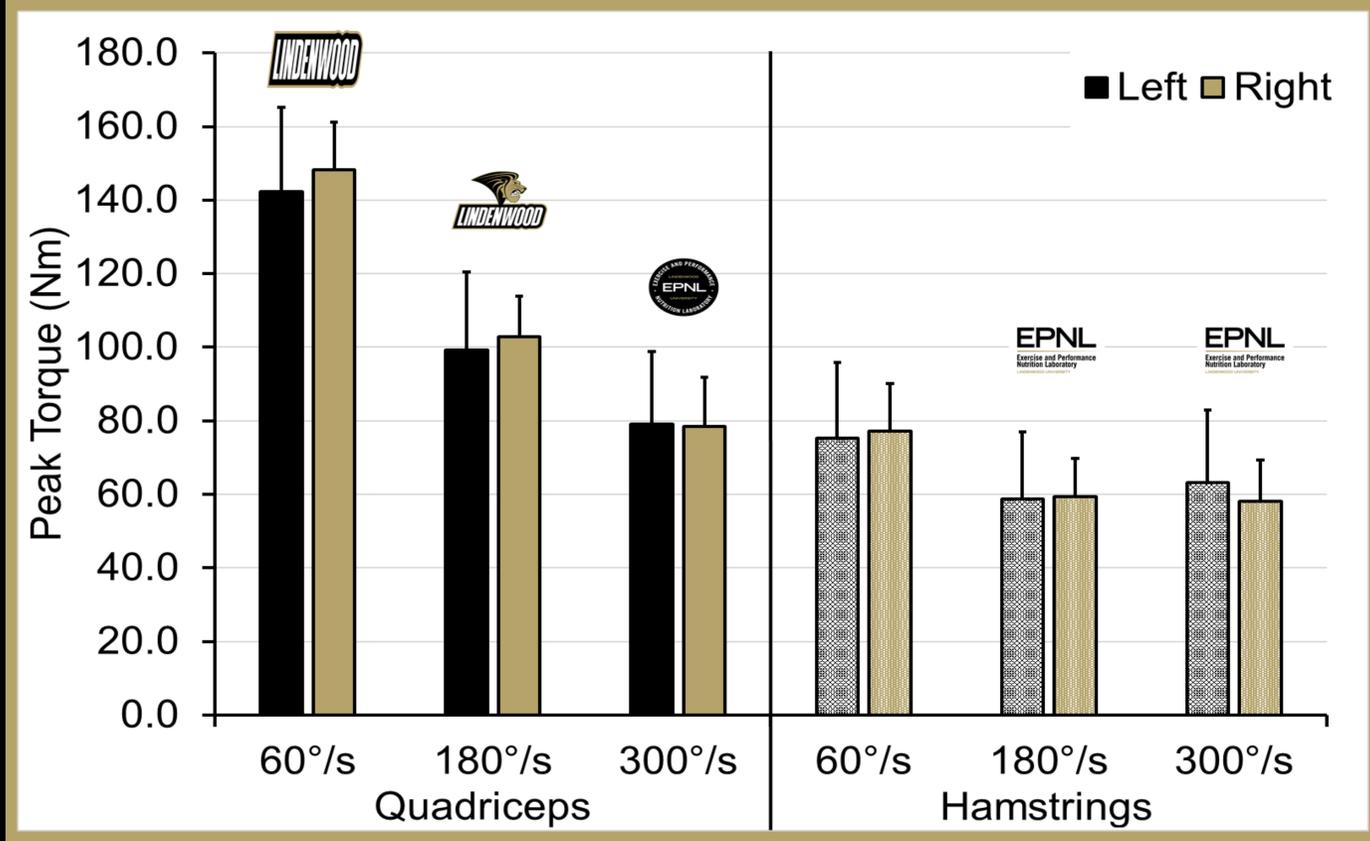
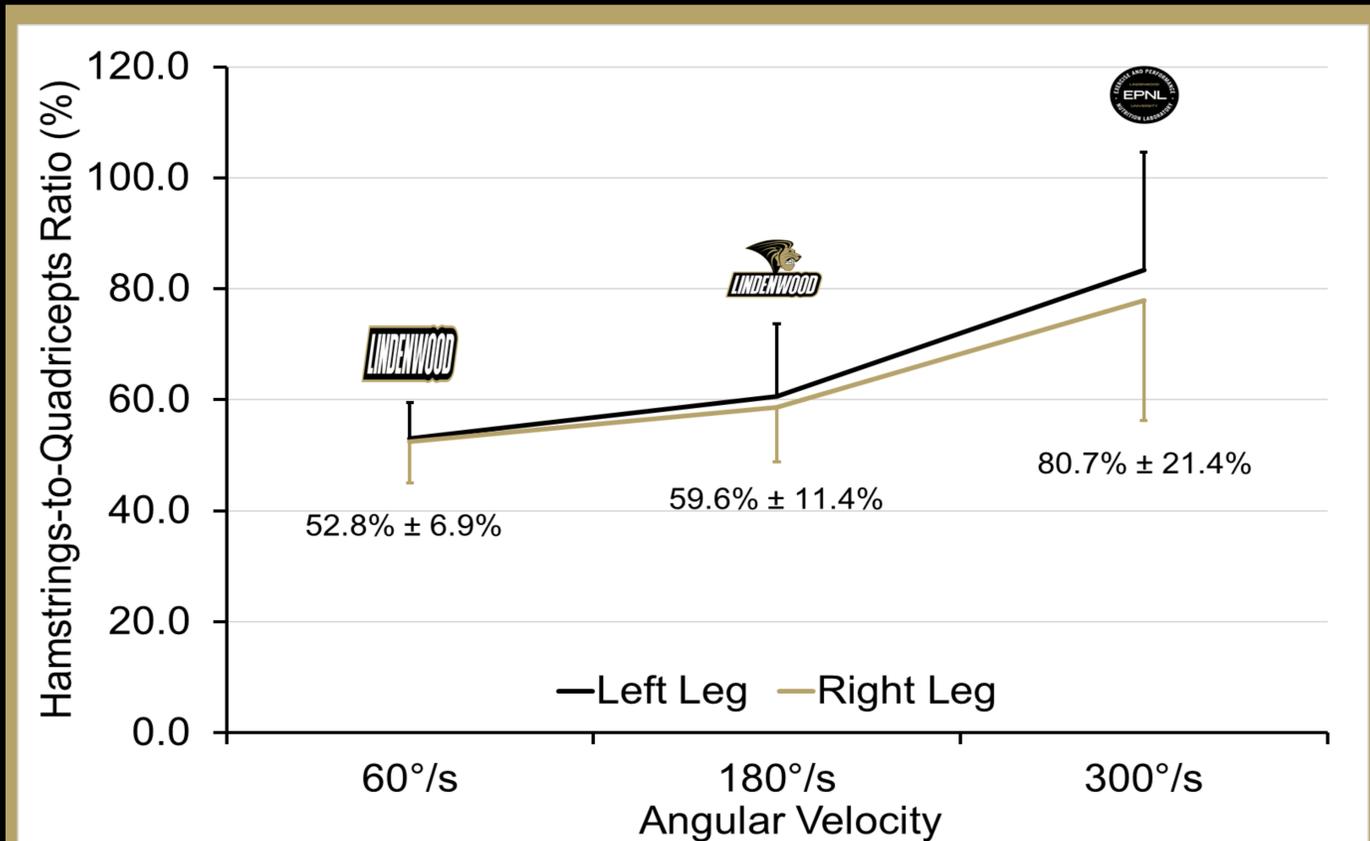
- Female athletes playing high-risk sports suffer anterior cruciate ligament (ACL) injuries at a 4- to 6-fold greater rate than male athletes.
- ACL injuries likely happen due to muscular force production not adequately dampening the load on the knee joint during high velocity movements such as cutting and jump landing.
- Quadriceps and hamstrings co-contract during dynamic movements to assist in stabilizing the knee joint.
- The quadriceps and hamstrings act as antagonists and agonists, respectively, to the ACL in anterior knee shear loading.
- Decreased hamstrings strength relative to quadriceps strength (H:Q) is a potential risk factor for lower extremity injuries including ACL injuries.
- Female collegiate athletes with lower H:Q at higher angular velocities have been shown to experience higher incidence of ACL injuries.
- The incidence of ACL injuries has been shown to be relatively high in female collegiate lacrosse athletes.

## Purpose

- To determine the hamstrings to quadriceps ratio at varying angular velocities in healthy female collegiate lacrosse athletes.

## Methods

- Twenty-three female collegiate lacrosse athletes (20±1 years, 168.2±5.6 cm, 65.7±6.5 kg) volunteered for this study.
- Concentric knee extensors and flexors strength was determined for both legs by isokinetic dynamometry at 60°/s, 180°/s, and 300°/s.
- Peak torques for knee extensors and flexors of each leg were determined at each angular velocity
- Hamstrings-to-quadriceps (H:Q) peak torque ratios were determined for each leg at each angular velocity.
- Two-way repeated measures ANOVA was utilized to examine differences between the legs across the angular velocities.



Different logos signify significant differences between angular velocities

## Results

- There was no significant interaction effect for H:Q between legs at different angular velocities (p=0.353) and no significant main effect between the legs (p=0.076)
- There was a significant main effect for angular velocity (p<0.001)
  - 300°/s greater than 60°/s and 180°/s
  - 180°/s greater than 60°/s
- There was no significant interaction for quadriceps peak torque between legs at different angular velocities (p=0.078)
- There was a significant main effect for angular velocity (p<0.001)
  - 60°/s greater than 180°/s and 300°/s
  - 180°/s greater than 300°/s
- There was no significant interaction for hamstrings peak torque between legs at different angular velocities (p=0.060)
- There was a significant main effect for angular velocity (p<0.001)
  - 60°/s greater than 300°/s and 180°/s

## Conclusions

- Hamstrings peak torque relative to quadriceps increased significantly across as angular velocities increased in female collegiate lacrosse athletes.
- Therefore, as angular velocity approached those of sporting activities, H:Q was improved in female collegiate lacrosse athletes.
- This may result in lower ACL injury risk during those sporting activities.
- The variety of movements and velocities required by the demands of the sport may simultaneously increase the ACL injury risk and improve neuromuscular imbalances in these athletes.
- Therefore, it is important for practitioners to evaluate H:Q across multiple angular velocities as the risk assessment may vary.

LINDENWOOD  
UNIVERSITY

REAL EXPERIENCE. REAL SUCCESS.