Monitoring Neuromuscular Performance: Seasonal Trends and Workload Influences On Countermovement Jump Metrics in Collegiate Women's Soccer

Kyle L. Sunderland, Harry P. Cintineo
Department of Kinesiology, Lindenwood University, St. Charles, MO 63301

Introduction

- ➢Monitoring neuromuscular performance offers insight into athlete readiness, fatigue, and training adaptations across a season.
- ➢The countermovement jump (CMJ) is a reliable, non-invasive tool that uses metrics like modified reactive strength index (mRSI), jump height (JH), and time to takeoff (TTT) to assess neuromuscular function and fatigue.
- ➢External workload, particularly total distance (TD) and high-speed distance (HSD), influences neuromuscular status and guides training decisions.
- ➢Tracking CMJ changes over time may clarify how workload impacts athlete development, fatigue, and injury risk.

Purpose

- ➢To examine season-long changes in countermovement jump (CMJ) performance and the influence of weekly external workload on collegiate women's soccer athletes.

Methods

- ➢Twenty collegiate women's soccer athletes (forwards=7, midfielders=7, defense=6) participated in this study.
- ➢CMJs on dual force platforms (Hawkin Dynamics) and GPS (Polar Team Pro) data were collected across an entire competitive season of 13 weeks.
  - ➢Average of two CMJs performed prior to training every Tuesday following an off-day.
  - ➢GPS metrics represent the 7-day cumulative total for each variable in the week immediately preceding each CMJ test.
- ➢Linear mixed-effects models assessed changes in CMJ performance and relationships with workload metrics, with load as fixed effects and athlete as a random intercept ($\alpha = 0.05$).

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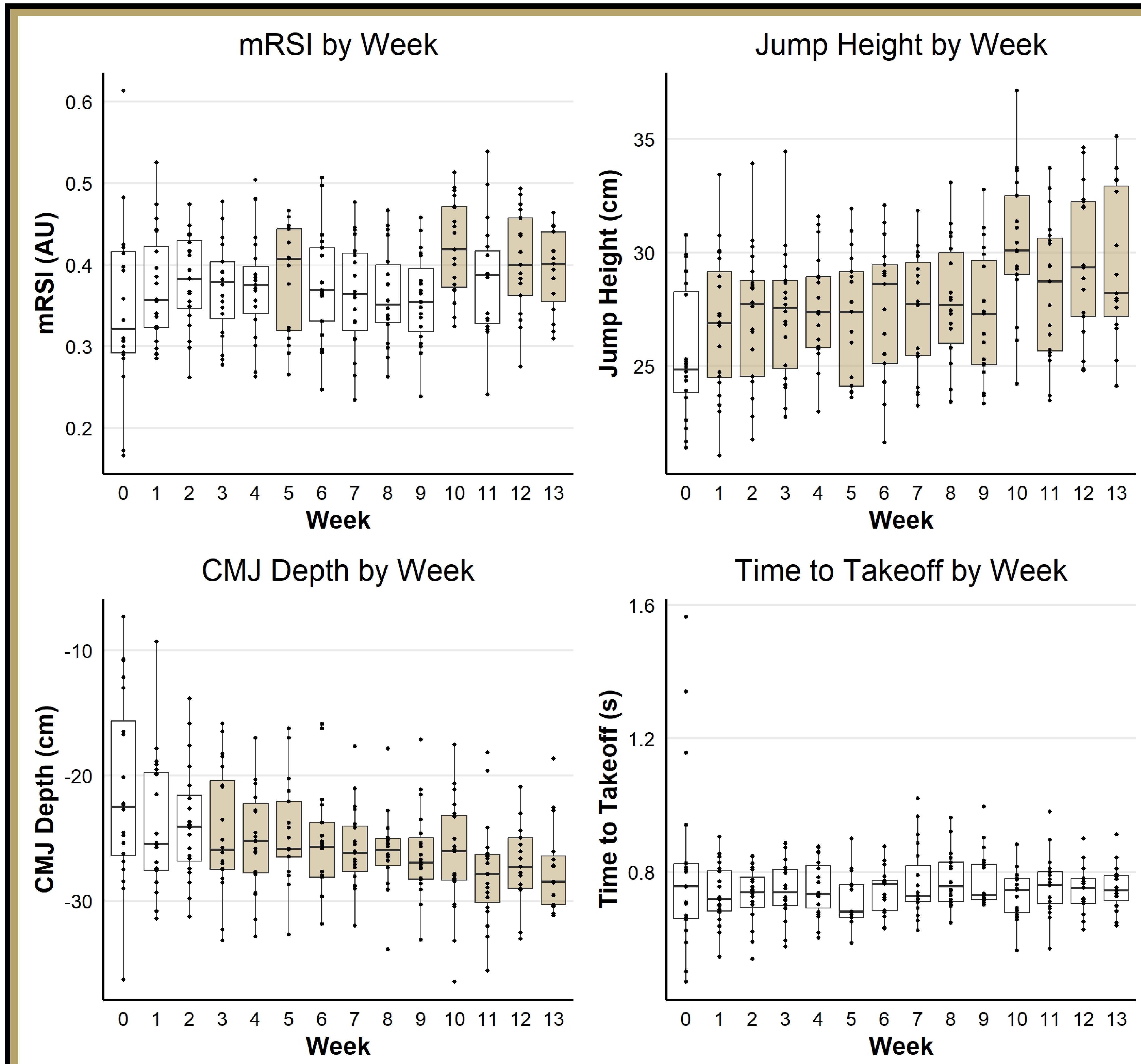

Different color indicates significant difference from Week 0

Practical Applications

- ✓ **Use CMJ metrics weekly to monitor neuromuscular readiness and seasonal adaptations**
- ✓ **Incorporate consistent high-speed running to enhance lower-body power (↑ HSD → ↑ JH, deeper CMJs)**
- ✓ **Manage weekly total distance to avoid volume-related fatigue and shallower countermovement**

Results

- ➢ mRSI increased significantly across the season ($p < 0.001$), with improvements at Weeks 5, 10, 12, and 13 compared to baseline.
  - ❖ No external workload metric significantly influenced mRSI.
- ➢ Jump height (JH) increased after Week 1 and remained elevated throughout the season ($p < 0.001$).
  - ❖ High-speed distance (HSD) was positively associated with JH ($p = 0.003$).
- ➢ CMJ depth became significantly deeper (more negative) starting from Week 3 ($p < 0.01$).
  - ❖ Total distance (TD) was positively associated with CMJ depth ($p = 0.011$).
  - ❖ High-speed distance (HSD) was negatively associated with CMJ depth ($p = 0.001$).
- ➢ However, no significant changes were observed in time to takeoff (TTT) across the season ($p = 0.159$).

Conclusions

- ➢ Neuromuscular performance improved across the season, reflected by increases in mRSI, higher jump heights (JH), and progressively deeper CMJs. Time to takeoff (TTT) remained unchanged.
- ➢ Weekly workloads did not significantly influence mRSI, indicating that reactive strength adaptations may be more sensitive to factors beyond simple volume or intensity.
- ➢ Greater high-speed distance (HSD) was positively associated with increased JH and deeper CMJs, suggesting potential benefits of high-speed exposures for neuromuscular outputs.
- ➢ In contrast, higher total distance (TD) was linked to shallower CMJs and slower TTT, indicating volume-related fatigue effects that may suppress explosive performance.

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