Evaluating Lower-Body Neuromuscular Fatigue and External Workload Characteristics During The Competitive Season of NCAA Division-I American Football Players

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BACKGROUND

A competitive season in American football can span anywhere between 3-5 months. During this period, practice sessions and games can elicit high demands on the body that ultimately can lead to neuromuscular fatigue and a decrease in performance (1). Previous literature has established countermovement jump (CMJ) testing as a reliable tool for measuring and monitoring neuromuscular fatigue in an athletic setting and can be useful in understanding the athlete response during the competitive season (2). Furthermore, monitoring external loads throughout the season can give greater context to the training stimulus being prescribed in relation to game demands (3). Exploring positional differences in external loads and CMJ performance may allow sports practitioners to help athletes better prepare for the specific positional demands of the sport (4).

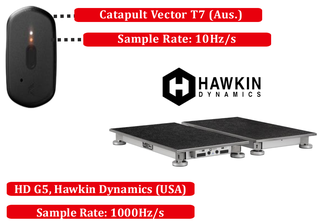
PURPOSE

The purpose of this study was to assess countermovement jump performance as a marker of neuromuscular fatigue and explore external load and CMJ differences between position groups during the competitive season.

METHODS

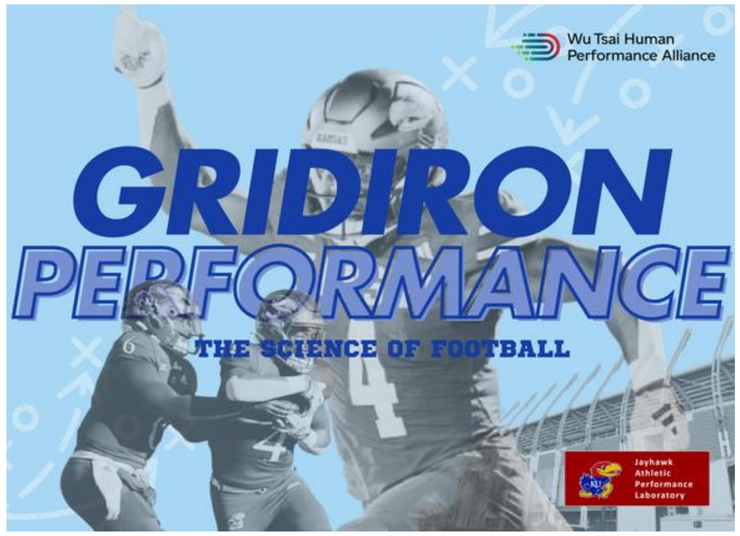
External load metrics were collected via global positioning system (GPS) units on a total of 96 American Division-I football players during two regular competitive season (2023 and 2024) that each spanned a total of 12 and 13 weeks respectively. Data was sampled at a rate of 10 Hz (Vector T7, Catapult, USA). Following a dynamic warm-up, athletes performed 2-6 repetitions and CMJ data was obtained using dual-force plate systems that were sampled at a rate of 1000 Hz (HD G5, Hawkin Dynamics, USA). The independent variables of interest included positional groups (i.e., Quarterback, Running Back, Corner Back, Safety, Defensive End, Defensive Tackle, Offensive Line, Line Backer, Tight End, and Wide Receiver) and time (in weeks). Jump height (m), countermovement depth (m), Modified Reactive Strength Index (mRSI), time to take off (s), propulsive phase duration (s), total average PlayerLoad, PlayerLoad per minute and High-Speed Distance (m) for each position group were the outcomes of interest.

INSTRUMENTATION



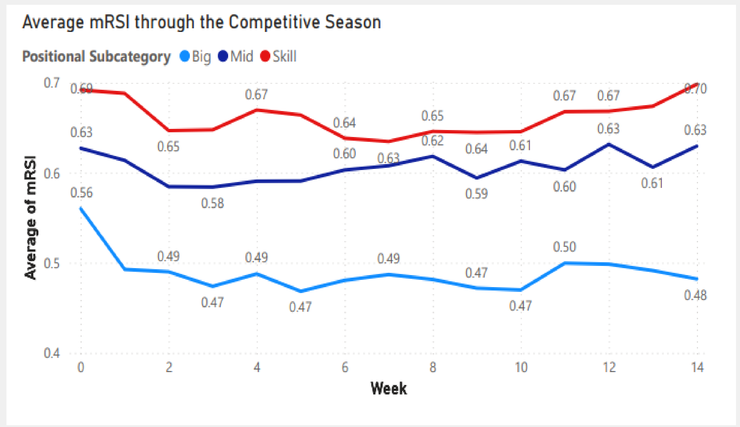
STATISTICAL ANALYSIS

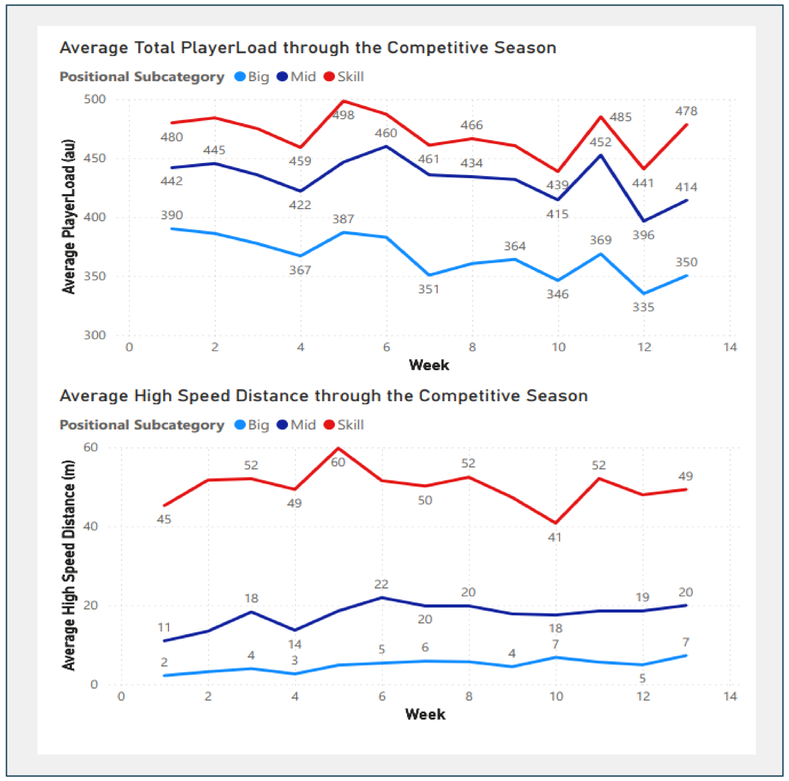
Descriptive statistics, including the mean and standard deviation for external load and CMJ metrics were calculated. To compare differences between position groups and weeks for external load and CMJ metrics, a repeated measures ANOVA was administered.



RESULTS

Both week and position groups were significantly different for total PlayerLoad ($p < 0.001$), PlayerLoad per minute ($p < 0.001$), and mRSI ($p = 0.038$, $p = 0.008$ respectively). Time in weeks was significantly different for time to take off ($p = 0.012$) but there was no significant difference in time to take off between position groups. Propulsive phase duration ($p = 0.039$), jump height ($p = 0.007$) and high-speed distance ($p < 0.001$) was found to be significantly different between position groups but not between weeks. No significant differences were found in countermovement depth across the season and across position groups. No significant interactions between week and position group were found.





CONCLUSION

Findings from this study identified differences for external load and CMJ performance that are associated with changes in the time of season and the demands of each position.

PRACTICAL APPLICATIONS

Understanding the demands of sport, position, phase of the season, and subsequent neuromuscular fatigue can help sports practitioners develop adequate training and recovery approaches prior to and after competition.

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ACKNOWLEDGEMENTS

This research investigation was funded in part by the Clara Wu and Joseph Tsai Foundation.

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