Muscular Power Characteristics Of The Countermovement Vertical Jump In Collegiate American Football Athletes, Starter Vs. Non-starter

Y. Yang[1], Q. Johnson[1], C. Frels[2], D. Sealey[2], S. Stock[2], D. Gleason[2], K. Akehi[2], D. Cabarkapa[1], A. Fry[1]

[1] Jayhawk Athletic Performance Laboratory, University of Kansas; [2] University of Nebraska at Kearney

INTRODUCTION & PURPOSE

Muscular power is a key performance indicator for the American football athlete. An athlete's ability to transfer ground reactive forces effectively and efficiently can be seen on display in common sport-specific movements such as blocking, tackling, and sprinting. The countermovement jump (CMJ) test is one such method of measuring muscular power. However, limited data exists regarding muscular power differences between starters and non-starters in American football using the CMJ as a mean of measurement. **Thus, this study aims to assess differences in collegiate American football athletes' muscular power characteristics between starters and non-starters.**

METHODS & MATERIALS

Eighteen National Collegiate Athletic Association Division II American football athletes volunteered for the study and were divided into the starter group (n=6, $\bar{x}$±SD; height=187.11±3.08 cm; weight=109.77±20.92 kg) and the non-starter group (n=12, $\bar{x}$±SD; height=183.73±4.64 cm; weight=92.27±11.40 kg). Following a standardized dynamic warm-up, athletes performed two maximal effort CMJ on a 1000 Hz sampling rate dual force plate system. The vertical ground reaction force of each CMJ was recorded. Means and standard deviations were calculated for all variables recorded. An independent samples T-test was performed on all variables recorded by the dual force plate system, and the Shapiro-Wilks test was also conducted to confirm normality. The a priori alpha level was set at 0.05 for all analyses. Hedge's *g* was used for effect sizes.

American football athletes heavily rely on power development for proper performance. **Muscular power characteristics** captured from **CMJs** using **force plates** can accurately differentiate **starters** from **non-starters.**

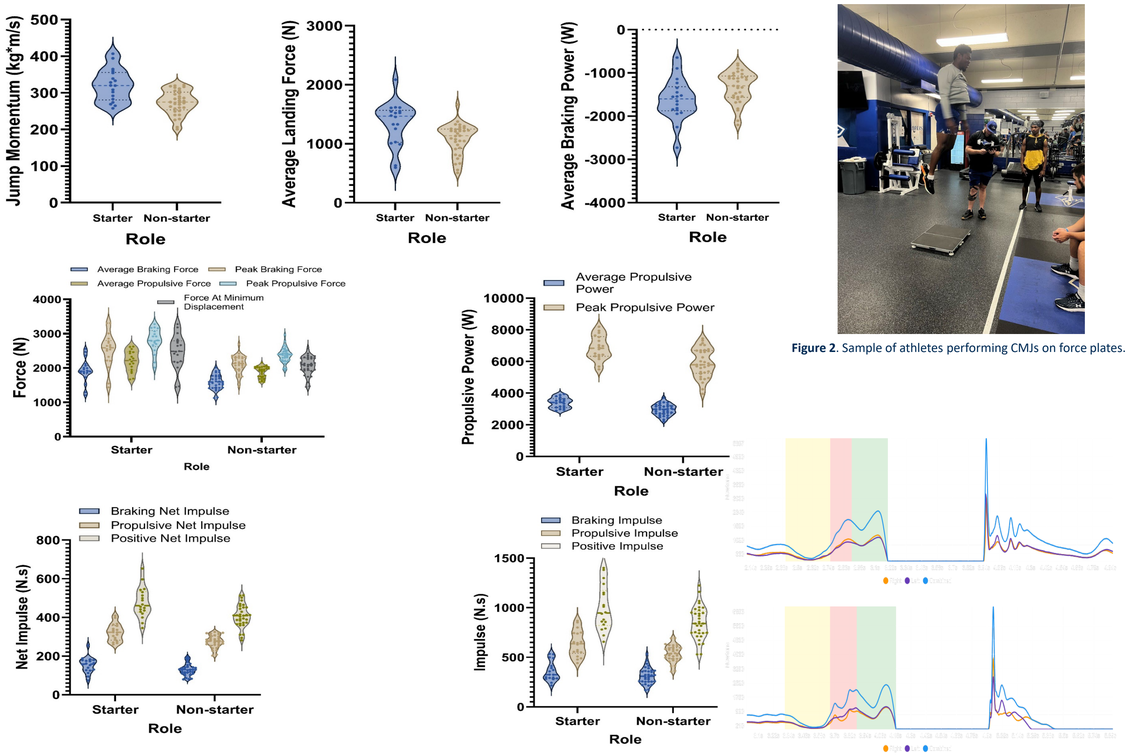

Figure 1. Violin plots for metrics showed significant differences between starters and non-starters.

Figure 2. Sample of athletes performing CMJs on force plates.

Figure 3. Comparison of two CMJ force-time curves generated by the force plates.

RESULTS

Jump momentum ($p < 0.001$, $g = 1.24$), average braking force ($p < 0.001$, $g = 1.20$), peak braking force ($p < 0.001$, $g = 1.12$), average propulsive force ($p < 0.001$, $g = 1.41$), peak propulsive force ($p < 0.001$, $g = 1.51$), and force at minimum displacement ($p < 0.001$, $g = 1.07$) significantly differed between groups. Additionally, impulse metrics ($p < 0.045$, $g = 0.50$-1.05), average landing force ($p = 0.002$, $g = 0.85$), average propulsive power ($p < 0.001$, $g = 1.27$), peak propulsive power ($p < 0.001$, $g = 1.08$), and average braking power ($p = 0.010$, $g = -0.70$) showed significant differences between groups.

CONCLUSIONS

Based on the observations of this investigation, the starter group outperformed the non-starter group in all measures of muscular power performance. If interested in preparing non-starters for starting roles, sports performance professionals should adapt training programs to emphasize muscular power development following the adequate development of muscular strength.

PRACTICAL APPLICATIONS

With the utilization of force plate technology, the CMJ assessment provides detailed information in regard to muscular power characteristics in American football athletes. This information can be utilized by sports performance professionals to enhance athletic development, progression, and performance. Additionally, this approach can be utilized to develop performance profiles and to create athlete benchmarks.

ACKNOWLEDGEMENT

This project was funded in part by the University of Nebraska at Kearney's INSpRE Instrumentation Core and by the Clara Wu and Joseph Tsai Foundation.

hses.ku.edu/research/labs/jayhawk-athletic-performance

humanperformancealliance.org