CHANGES IN FORCE-VELOCITY CHARACTERISTICS OF HEX-BAR LOADED JUMPS IN COLLEGIATE LACROSSE ATHLETES DURING A COMPETITION SEASON

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INTRODUCTION

- A proportionate reduction in time designated to resistance training is common due to tactical and technical shifts in on-field training during competitive lacrosse seasons.[1]
- Thus, monitoring potential changes in training-based performance outcomes may provide strength and conditioning practitioners and team sport coaches with helpful information concerning appropriate training stimuli necessary to enhance physical qualities underpinning performance throughout a competitive season.[2]

PURPOSE

- The purpose of this study was to examine the force-velocity (F-V) performance changes of hexagonal bar (HEX) jumps that occur in collegiate male lacrosse athletes over the course of a competition season.

METHODS

- Twenty-two male lacrosse athletes (Body mass: 85.57 + 9.74 kg) performed two maximal effort countermovement HEX jumps with five different loads (0%, 30%, 50%, 70%, 100%) relative to body mass.
- Each participant performed jump trials on bilateral force plates (Hawkin Dynamics Inc., Maine, USA) with a sampling rate set at 1000 Hz.
- The Shapiro-Wilk test was used to assess the normality of the data.
- Non-parametric Wilcoxon's signed-rank test was used for variables that violated the assumption test.
- Paired sample t-tests were used to analyze the statistical significance ($p < 0.05$) between F-V metrics before the first game and after the last regular season game.

RESULTS

- System weight significantly ($p = 0.009$) increased along with peak propulsive force ($p = 0.01$) and peak propulsive power ($p = 0.03$) with the unloaded condition.
- The non-parametric Wilcoxon signed-rank test was used, indicating non-significant differences ($p = 0.26$) in jump height but significant differences in peak propulsive force ($p = 0.01$) and reactive strength index modified (mRSI) ($p = 0.01$) yielding rank-biserial correlation effect sizes (r_B) of small-medium (0.27), large (0.62), and large (0.56), respectively.
- The relative peak propulsive force during the 0% condition, although not significant ($p = 0.06$), did increase throughout the season.
- The 30% loaded condition yielded significant increases in system weight ($p = 0.02$) and mRSI ($p = 0.01$) with significant decreases in time to takeoff ($p = 0.009$).
- The 50% loaded condition produced significant increases in system weight ($p = 0.003$), peak propulsive power ($p = 0.02$), mRSI ($p = 0.03$), and significant decreases in time to takeoff ($p = 0.02$).
- The 70% load yielded significant increases in system weight ($p = 0.003$) and propulsive impulse ($p = 0.03$), while significant decreases in braking time ($p = 0.04$) were observed.
- The 100% loaded condition yielded significant increases in system weight ($p = 0.005$), peak propulsive power ($p = 0.03$), and propulsive impulse ($p = 0.04$).
- All relevant metric data is presented in Table 1.

CONCLUSIONS

- The results of the unloaded and loaded jump assessments provide the context for baseline loading strategies, supporting the need for strength and power training during a college lacrosse season.
- All outcome performance metrics did not decline over the course of the season.
- Across the load spectrum, performance outcomes were not negatively influenced by game schedule, travel, or reduction in allocated resistance training time from pre-testing to post-testing.

PRACTICAL APPLICATIONS

- Practitioners may use the results as a potential starting point in optimizing power production with effective dosing while managing accumulated fatigue during congested practice and competition schedules to enhance the underpinning neuromuscular qualities for performance enhancement during a competition season.

Table 1: Force-Velocity Metrics

Metric	Mean: Pretest	Mean: Postest
Unloaded CMJ		
System Weight (N)	839.20 ± 95.56	850.64 ± 99.85*
Peak Propulsive Force (N)	2098.27 ± 267.75	2178.59 ± 305.51*
Peak Relative Propulsive Force (%)	250.27 ± 18.06	256.00 ± 17.74
Peak Propulsive Power (W)	5464.55 ± 680.68	5678.50 ± 882.47*
mRSI	0.45 ± 0.062	0.48 ± 0.094*
Loaded CMJ (30%)		
Time to take off pre (s)	1.05 ± 0.137	0.98 ± 0.084*
mRSI	0.29 ± 0.050	0.31 ± 0.040*
Loaded CMJ (50%)		
Time to take off (s)	1.10 ± 0.143	1.04 ± 0.108*
Peak Propulsive Power (W)	5024.99 ± 718.01	5178.44 ± 816.94*
mRSI	0.22 ± 0.038	0.24 ± 0.038*
Loaded CMJ (70%)		
Braking Phase (s)	0.33 ± 0.077	0.31 ± 0.051*
Propulsive Impulse (N.s)	893.37 ± 123.17	922.93 ± 112.84*
Loaded CMJ (100%)		
Peak Propulsive Power (W)	4574.03 ± 683.24	4681.39 ± 699.94*
Propulsive Impulse (N.s)	1072.71 ± 147.72	1103.31 ± 147.37*

* Significant differences ($p \leq 0.05$)

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NSCA National Conference 2024