Counter Movement Jump Positional Analysis in Collegiate Baseball Players

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Introduction

- The countermovement jump (CMJ) has previously been implemented as a tool for assessing lower body neuromuscular characteristics in both collegiate and professional baseball players.
- CMJ metrics have been significantly associated with hitting and pitching performance outcomes providing evidence for its ecological validity.
- Identifying potential differences in CMJ metrics by position would provide useful insight into specific metrics that should be monitored.
- *The purpose of the current investigation was to conduct a position-specific analysis of CMJ profiles in a cohort of collegiate baseball players.*

Methods

- Forty-five (age: 20.9 ± 1.3 yrs; height: 184 ± 5.8 cm; body mass: 88.7 ± 8.3 kg) Division 1 collegiate baseball players participated in the current investigation.
- Participants were classified as Catchers (CATs), Infielders (IFs), Outfielders (OFs), and Pitchers (PITs).
- All athletes completed a standard warm-up before performing two maximal effort CMJs (i.e., hands on hips) with a rest interval of 15-seconds.
- All testing was performed using a dual uniaxial force plate system (ForceDecks Max, VALD Performance, Brisbane, Queensland Australia) sampling at 1,000 Hz with data averaged across the two jumps.
- CMJ metrics were chosen based on previous investigations and to gain additional insight into neuromuscular characteristics of each position
- A one-way analysis of variance (ANOVA) was used to detect statistically significant differences ($p < 0.05$) in CMJ metrics between positions.

Results

Table 1. Descriptive data (mean ± SD) and comparison for countermovement jump metrics across baseball positions.

Variable (unit)	Catcher (n = 3)	Infielder (n = 8)	Outfielders (n = 8)	Pitcher (n = 24)	p-value
Contraction time (ms)	678.3 ± 136.1	761.3 ± 94.4	804.6 ± 147.0	764.2 ± 77.3	0.330
Vertical jump height (cm)	44.3 ± 0.3	43.7 ± 4.8	42.3 ± 3.7	44.9 ± 5.1	0.596
RSI-modified (ratio)	0.67 ± 0.12	0.58 ± 0.17	0.54 ± 0.09	0.59 ± 0.08	0.189
Countermovement depth (cm)	-33.2 ± 7.1	-34.6 ± 6.8	-35.6 ± 7.1	-39.0 ± 4.0	0.092
Concentric					
Concentric impulse (n•s)	261.7 ± 10.1	249.3 ± 23.6	251.6 ± 32.1	266.8 ± 22.4	0.240
Concentric duration (ms)	239.3 ± 58.7	252.8 ± 35.6	271.6 ± 48.7	265.8 ± 22.9	0.420
Concentric peak velocity (m/s)	3.1 ± 0.1	3.0 ± 0.2	3.0 ± 0.1	3.1 ± 0.2	0.613
Concentric peak force (N)	2483.6 ± 515.9	2238.1 ± 310.7	2203.7 ± 313.3	2358.5 ± 263.5	0.389
Concentric mean force (N)	2003.7 ± 311.7	1834.5 ± 192.4	1794.8 ± 208.1	1892.3 ± 188.7	0.404
Concentric peak power (W)	5577.3 ± 435.2	5280.6 ± 471.4	5176.6 ± 503.6	5589.1 ± 532.4	0.182
Concentric mean power (W)	3218.3 ± 568.2	2895.5 ± 399.3	2796.1 ± 390.4	3033.9 ± 361.7	0.300
Eccentric					
Eccentric braking phase duration (ms)	261.3 ± 73.6	311.6 ± 59.4	332.9 ± 70.4	311.5 ± 54.3	0.379
Eccentric braking impulse (n•s)	73.5 ± 16.5	16.5 ± 18.3	59.2 ± 11.5	73.3 ± 16.6	0.119
Eccentric duration (ms)	439.0 ± 78.2	508.5 ± 64.3	533.0 ± 103.1	498.5 ± 63.0	0.298
Eccentric peak velocity (m/s)	-1.5 ± 0.1	-1.3 ± 0.2	-1.3 ± 0.2	-1.5 ± 0.2	0.017*
Eccentric peak force (N)	2454.7 ± 507.8	2082.5 ± 405.7	2056.5 ± 387.2	2309.5 ± 320.3	0.156
Eccentric mean force (N)	874.0 ± 35.4	840. ± 70.4	858.6 ± 98.6	888.3 ± 85.4	0.522
Eccentric peak power (W)	2269.3 ± 534.3	1616.1 ± 570.1	1559.0 ± 473.7	2085.7 ± 502.0	0.022*
Eccentric mean power (W)	654.7 ± 59.3	572.1 ± 124.6	574.1 ± 111.1	698.2 ± 115.4	0.017*

RSI = reactive strength index. * = statistically significant ($p < 0.05$)

Conclusions

- The current analysis indicates that non-pitching positions display similar neuromuscular characteristics.
- The differences observed in eccentric CMJ metrics for PITs may be due to the greater eccentric loading that is experienced by the lower limbs during the different phases of a pitch. Future longitudinal studies should assess changes in these metrics.

Practical Applications

- CMJ metrics solely may not be able to differentiate between non-pitching positions.
- However, the current analysis may provide insight into the different CMJ characteristics for power production that maybe unique to PITs and potentially influence pitching outcomes.

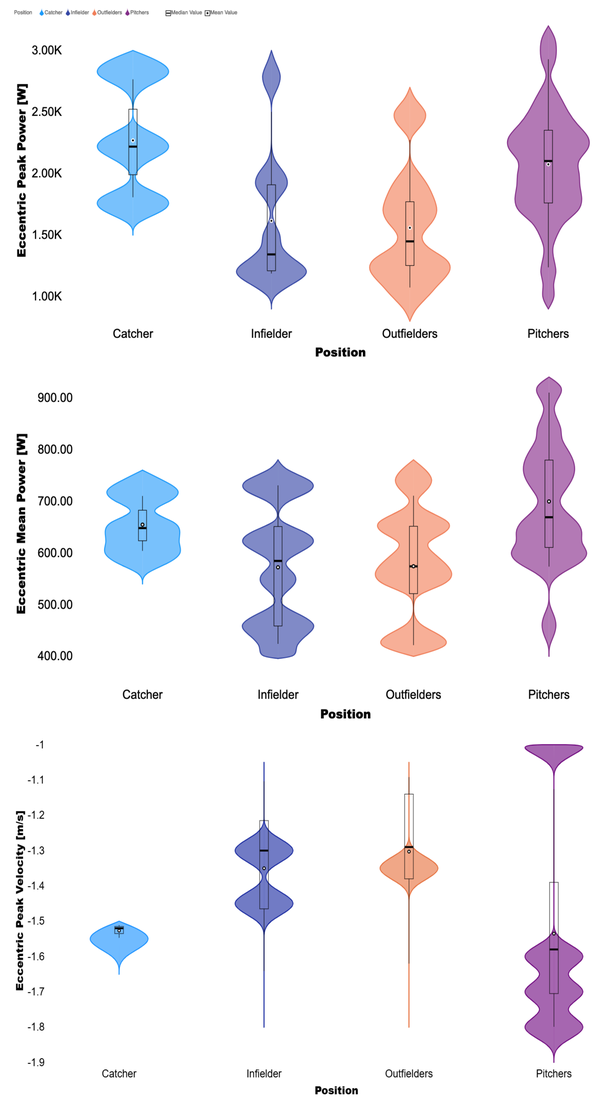

Figure 1. Violin plots for counter movement jump metrics that showed significant differences between positions.

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