

Countermovement Vertical Jump Force-Tiem Characteristics from Eight NCAA Division-I Women's College Volleyball Teams

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BACKGROUND

Volleyball is a dynamic, fast paced, high intensity sport that requires players to jump and block, express force and power, as well as sprint and change directions. The countermovement vertical jump (CMJ) is a criterion assessment of lower-body neuromuscular performance. However, limited information related to CMJ performance across volleyball teams is currently available.

PURPOSE

The purpose of this study was to assess CMJ force-time metrics within a cohort of elite collegiate female volleyball athletes.

METHODS

- Eighty-six resistance trained NCAA Division-I female volleyball athletes (height: 183.18 ± 9.81cm; weight: 77.58 ± 0.39kg) participated in this study. Following a standardized dynamic warm-up, athletes performed 2-4 CMJ on a dual force plate system (1000 Hz sampling rate; Hawkin Dynamics; Vald).
- The vertical ground reaction force of each CMJ was recorded and the best performance was utilized for final analysis. A one-way analysis of variance was performed on variables of interest and the Shapiro-Wilks test was also conducted to confirm normality.

RESULTS

- When compared the CMJ output measurements, braking power and propulsive power significantly differed among position groups (p<0.05).
- The driver and strategy measurements, braking force, propulsive force, time to takeoff, RSI-modified, braking phase duration, propulsive phase duration, countermovement depth, and impulse ratio also showed significant difference among position groups (p<0.05).
- The only measurements that did not show a significant difference when compared to each position was jump height, take off velocity, and propulsive phase percentage (p>0.05).

CONCLUSIONS

- While differences in CMJ kinematic variables were observed between position groups, specifically, designated setter, outside hitter, and opposite hitters, no differences were observed in performance variables.
- This further highlights the need for lower-body neuromuscular power development for female volleyball athletes competing at the NCAA Division-I level.



Measures of **braking force, braking power, propulsive force, propulsive power, and time to takeoff** significantly differed between position groups. However, no significant differences were observed for measures of **jump height, takeoff velocity, or propulsive phase percentage.**



Table 1. Comparisons ($\bar{x} \pm SD$) of outputs, drivers, and strategies between positions.

Variable	DS	MB	OH	OPP	S
Outputs					
Jump Height (cm)	32.33±5.33	32.71±4.83	32.71±3.38	33.90±2.25	31.83±5.33
Takeoff Velocity (m/s)	2.51±0.21	2.53±0.21	2.53±0.19	2.53±0.13	2.48±0.21
Average Propulsive Power* (W)	28.78±2.13	27.41±3.42	26.38±3.12	27.28±4.97	27.39±4.51
Average Braking Power* (W)	-14.64±2.53	-15.67±2.45	-14.91±2.31	-13.30±2.43	-15.44±3.01
Drivers					
Average Propulsive Force* (N)	210±21.41	198.77±16.57	191.47±13.97	196.94±21.31	199.70±19.66
Average Braking Force* (N)	198.86±18.07	200.75±26.41	187.65±14.95	181.79±18.21	198.68±19.96
Time to Takeoff* (s)	0.66±0.1	0.71±0.99	0.78±0.08	0.77±0.08	0.71±0.08
Strategies					
Braking Phase Duration* (s)	0.14±0.03	0.15±0.03	0.17±0.03	0.16±0.03	0.15±0.02
Propulsive Phase Duration* (s)	0.24±0.04	0.27±0.04	0.29±0.04	0.28±0.05	0.26±0.04

DS = Defensive Specialist MB = Middle Blocker OH = Outside Hitter OPP = Opposite S = Setter

* = significant difference among positions (p < 0.05)

PRACTICAL APPLICATIONS

- To the authors' knowledge, this is among the most recent analysis of this type specifically for NCAA Division-I female volleyball athletes.
- The collaboration between strength and conditioning professionals and sport scientists to support athlete health and performance contributed to the success of this project.
- These findings can be utilized to develop general and position-specific resistance training.

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