



Analyzing Changes in Countermovement Jump Performance Differences Throughout the Competitive Year in NCAA D1 Male Basketball Players: A Preliminary Study



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INTRODUCTION

Athlete testing and monitoring is imperative to the sport science practitioner (5). While a variety of testing modalities exist, the countermovement jump (CMJ) test is used commonly in both research and applied settings due to its non-fatiguing nature and ability to provide a wealth of information (1-4). Specifically, the CMJ may allow practitioners to gain insight into an athlete's performance and neuromuscular status within a competitive athletic season. Researchers have previously examined CMJ characteristic changes during a competitive basketball season in NCAA Division I players (3,4); however, no researchers have compared performance changes on specific days throughout the season. Therefore, the purpose of this study was to investigate the differences in CMJ performances before and after games compared to baseline performances amongst elite college basketball players. It was hypothesized that CMJ height would be maintained while strategy metrics (i.e., time-based measurements) would change throughout the season.

METHODS

- Nine NCAA Division I male basketball athletes participated in this study (age = 21.1 ± 1.5 years, height = 202.2 ± 7.8 cm, weight = 94.1 ± 10.2 kg).
- Athletes jumped on a near daily basis in the preseason to determine baseline score.
- During the season, athletes jumped one day before the game (GD-1) and two days after gamedays (GD+2) to track their performances throughout the competitive season.
- Prior to testing, athletes underwent a warmup protocol that was part of the weightlifting session prescribed from the strength and conditioning coach.
- For testing, athletes jumped two to three times with maximum effort with their hands on their hips and were cued to jump as high and as fast as possible.
- CMJ trials were performed on dual force plates sampling at 1000 Hz and the raw force-time data were used to determine the variables in Table 1.
- Performance variables were averaged across baseline (20 sessions), GD-1 (9 sessions), and (10 sessions) and compared using a series of one-way repeated measures ANOVA with Bonferroni post hoc tests.

Table 1. Variables collected with explanations.

Jump Height (JH)	Countermovement Depth (CMD)	Braking Mean Force (BMF)	Propulsive Mean Force (PMF)	Braking Duration (BD)	Propulsive Duration (PD)	Time to Takeoff (TTT)	Reactive Strength Index Modified (mRSI)
Maximum displacement achieved between the ground and feet	Distance athlete drops during the braking phase	Average force produced during the braking phase	Average force produced during the propulsive phase	Length of time to complete braking phase	Length of time to complete propulsive phase	Time taken from the beginning of movement to take-off	Jump Height / Time to Takeoff

RESULTS

- CMJ performance and post hoc analyses are displayed in Table 2.
- Significant differences existed for time to takeoff (p = 0.002) between baseline GD-1 (g = 1.39) and GD+2 (g = 1.15).
- However, the differences between time points for the following variables were not statistically significant:
 - Jump height (p = 0.133)
 - Countermovement depth (p = 0.547)
 - Braking Mean Force (p = 0.393)
 - Propulsive Mean Force (p = 0.057)
 - Braking Duration (p = 0.926)
 - Propulsive Duration (p = 0.909)
 - Reactive Strength Index modified (p = 0.187)

Table 2. Countermovement jump performance during baseline, one day before game day (GD-1), and two days after game day (GD+2).

Variable	Baseline	GD-1	GD+2
Jump height (cm)	39.1 ± 6.1	37.5 ± 6.1	38.6 ± 6.2
CM displacement (cm)	29.4 ± 6.2	29.1 ± 2.0	29.6 ± 2.1
Braking mean force (N)	1772.6 ± 206.2	1731.9 ± 173.4	1759.5 ± 188.4
Propulsion mean force (N)	1986.0 ± 215.6	1938.6 ± 210.3	1952.9 ± 210.8
Braking duration (s)	0.15 ± 0.02	0.15 ± 0.02	0.15 ± 0.08
Propulsion duration (s)	0.24 ± 0.02	0.24 ± 0.02	0.24 ± 0.02
Time to take-off (s)	0.73 ± 0.05*	0.67 ± 0.03	0.68 ± 0.03
Modified reactive strength index	0.54 ± 0.11	0.57 ± 0.11	0.58 ± 0.10

*= significantly greater than GD-1 and GD+2 (p < 0.01)

CONCLUSIONS

- There were moderate-large decreases in TTT from baseline testing to the competitive season; however, the difference between GD-1 and GD+2 was small and not practically meaningful.
- In contrast, there were no statistical or meaningful differences in JH, CMD, BMF, PMF, BD, PD, or mRSI between the baseline, GD-1, and GD+2 testing sessions.

PRACTICAL APPLICATIONS

- A well-designed strength and conditioning program paired with appropriate practice intensity and durations and recovery may allow for a meaningful decrease in TTT from the preseason to the competitive season in Division I men's basketball players.
- From an athlete monitoring standpoint, JH, CMD, BMF, PMF, BD, PD, or mRSI may not have been sensitive enough to display meaningful changes in performance; however, further research should monitor the differences on an individual basis.
- Moreover, researchers may consider examining the differences between high-minute versus low-minute players to determine what variables are sensitive to performance changes throughout the competitive season.

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