



ARE PHASES AFTER A COUNTERMOVEMENT JUMP IMPACTED AFTER PLAYING SOCCER?

Lauren E. Piper, Avery M. Bass, Eric C. Conchola
University of Central Oklahoma



INTRODUCTION

Neuromuscular fatigue (NMF) can have negative effects on human performance. Previous literature has assessed NMF with controlled fatigue protocols and volume fatigue. While overall fatigue rates can vary, previous research has found dissimilar outcomes in post-exercise jump performance. Most of the previous literature addresses anaerobic resistance training, while few have addressed in-game volume on jumping performance, specifically countermovement jump (CMJ) performance. The purpose of this study was to assess CMJ metrics before and after a soccer scrimmage with Division II female soccer players.

METHODS

Fifteen healthy female soccer players (age = 19.20 ± 1.01 years, height = 166.77cm ± 5.62cm, mass = 63.60 kg ± 6.90 kg) volunteered to participate in this study. Any lower extremity injuries resulted in exclusion from this study. Three CMJs were completed by each participant with fifteen to thirty seconds of rest between each trial. The best pre and post jumps per athlete were included for analysis. A wireless uniaxial dual force plate system sampling at 1,000 Hz was used to measure CMJ performance. Jumping performance measured the eccentric phase (breaking phase duration, eccentric braking mean velocity, eccentric braking peak velocity, eccentric braking mean force, eccentric braking peak force), concentric phase (takeoff velocity, jump momentum, concentric phase duration, concentric propulsive mean velocity, concentric propulsive peak velocity, concentric propulsive mean force, concentric propulsive peak force), and other variables (vertical jump height, RSI-modified). A Paired Sample t-test was used to assess pre and post CMJ performance and an alpha of 0.05 was used as level of significance.



Figure I. Pictures of the countermovement jump (CMJ) during the lowering (braking) and jumping (propulsive) phases. Participants were instructed to keep hands on their hips the whole time and were told to jump as high as they could.

Table I. Average (SD) values for countermovement jump metrics for collegiate female soccer players

Metrics	Pre-Competition	Post-Competition	P-value
Eccentric			
Braking Phase Duration (s)	0.20 (0.06)	0.18 (0.05)	$p = 0.012^*$
Eccentric Braking Mean Velocity ($m \cdot s^{-1}$)	- 0.652 (0.14)	- 0.657 (0.11)	$p = 0.769$
Eccentric Braking Peak Velocity ($m \cdot s^{-1}$)	- 0.974 (0.22)	- 0.987 (0.19)	$p = 0.588$
Eccentric Braking Mean Force (N)	968.70 (170.63)	977.60 (154.45)	$p = 0.377$
Eccentric Braking Peak Force (N)	1311.07 (240.66)	1315.60 (207.64)	$p = 0.870$
Concentric			
Takeoff Velocity ($m \cdot s^{-1}$)	2.32 (0.18)	2.30 (0.17)	$p = 0.247$
Jump Momentum ($N \cdot s^{-1}$)	147.70 (15.53)	144.16 (14.17)	$p = 0.011^*$
Concentric Phase Duration (s)	0.27 (0.04)	0.26 (0.04)	$p = 0.036^*$
Concentric Propulsive Mean Velocity ($m \cdot s^{-1}$)	1.39 (0.12)	1.38 (0.12)	$p = 0.667$
Concentric Propulsive Peak Velocity ($m \cdot s^{-1}$)	2.45 (0.18)	2.42 (0.17)	$p = 0.232$
Concentric Propulsive Mean Force (N)	1186.74 (165.19)	1189.06 (148.32)	$p = 0.859$
Concentric Propulsive Peak Force (N)	1429.67 (197.06)	1446.73 (183.90)	$p = 0.472$
Concentric Propulsive Mean Power (W)	1520.18 (234.70)	1508.24 (204.39)	$p = 0.636$
Concentric Propulsive Peak Power (W)	2802.17 (311.67)	2773.75 (280.28)	$p = 0.388$
Other			
Vertical Jump Height (cm)	27.71 (4.43)	27.13 (4.00)	$p = 0.236$
RSI-Modified	0.35 (0.07)	0.36 (0.07)	$p = 0.108$

* Significant difference < 0.05



RESULTS

For the eccentric phase, only the breaking phase was significant ($p=0.012$), and all other phases were non-significant ($p=0.373-0.938$). For the concentric phase, significant differences were seen for jump momentum and propulsive phase ($p=0.012-0.036$), and no differences were seen for any other concentric variables ($p=0.232-0.859$). No significant differences were observed for other variables ($p=0.108-0.236$).

CONCLUSIONS

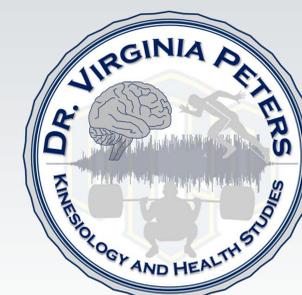
The present study observed a significant difference in for the breaking phase duration (Post < Pre) and jump momentum and propulsive phase duration (Post < Pre). All other observed variables were non-significant when comparing pre and post jump performance.

PRACTICAL APPLICATIONS

While measurements from a CMJ typically focus on power and velocity metrics, an overall encompassing assessment (duration, power, velocity, force) throughout the eccentric and concentric phases of the jump can allow for greater understanding of fatigue. Further studies may want to assess CMJ performance (using a force plate) with other sports before and after a game of their respective sports. Additionally, other sports may want to look at the impacts of dynamic repetition on jumping performance.

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