Repeat Sprint Fatigue and Altered Neuromuscular Performance in Recreationally Trained Basketball Players

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Introduction

Multiple research reports have shown that during gameplay, basketball athletes frequently perform high intensity accelerations, decelerations, jumps, as well as changes in direction. It seems apparent that in order to avoid non-favorable training adaptions, workload and fatigue-monitoring strategies may be of interest to sport-science practitioners working with athletes that perform in such environments that are dense in games and practices. Given the commonality of movements in basketball that involve the use of the stretch-shortening-cycle (SCC), monitoring strategies have been implemented to gain insights into athletes' neuromuscular performance, which may be influenced by the workloads they are exposed to.

Purpose

The primary aim was to investigate how the fatigue induced by repeated sprints acutely affects neuromuscular performance as quantified via the CMJ and DJ, within a sample of recreationally trained basketball athletes. Further, the second aim was to account for the level of participant fatigue and fitness through performance within the RSA protocol, to quantify how this may affect changes in neuromuscular performance.

Methods

Participants completed pre-RSA testing, which consisted of three CMJ's and DJ's performed on a force plate. Following pre-RSA testing, participants performed a commonly implemented repeat sprint ability assessment. This assessment was implemented to (1) induce a level of acute fatigue, and (2), measure participants repeat sprint ability. Following the RSA protocol, participants were provided with 2 minutes of passive rest, and were then re-tested within the CMJ and DJ tasks performed prior. Then, participants were given an additional 15 minutes of rest, after which pre-RSA testing tasks were re-done one last time.

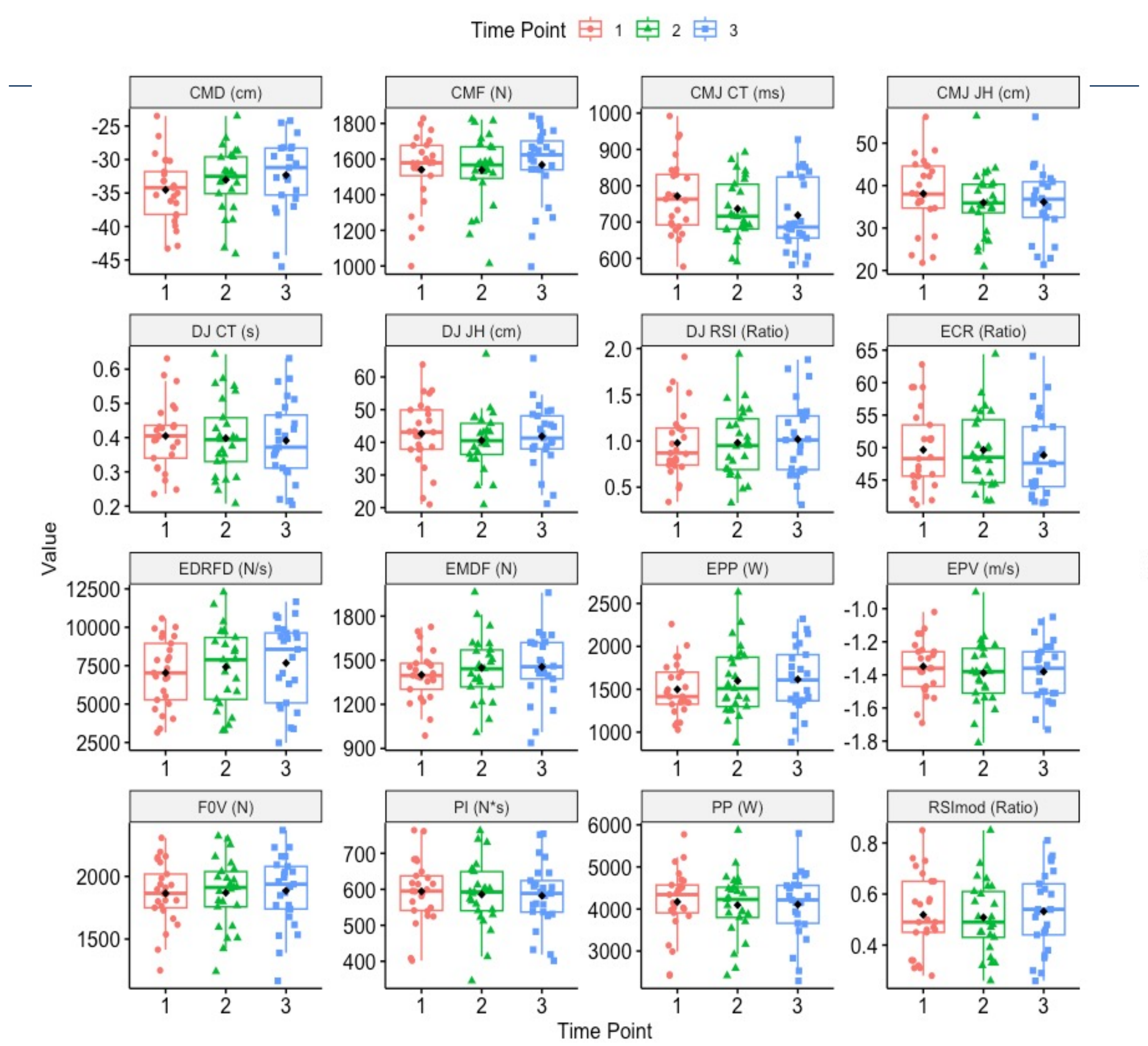
Table 1. Descriptive statistics for CMJ and DJ force-time metrics across the three time-points

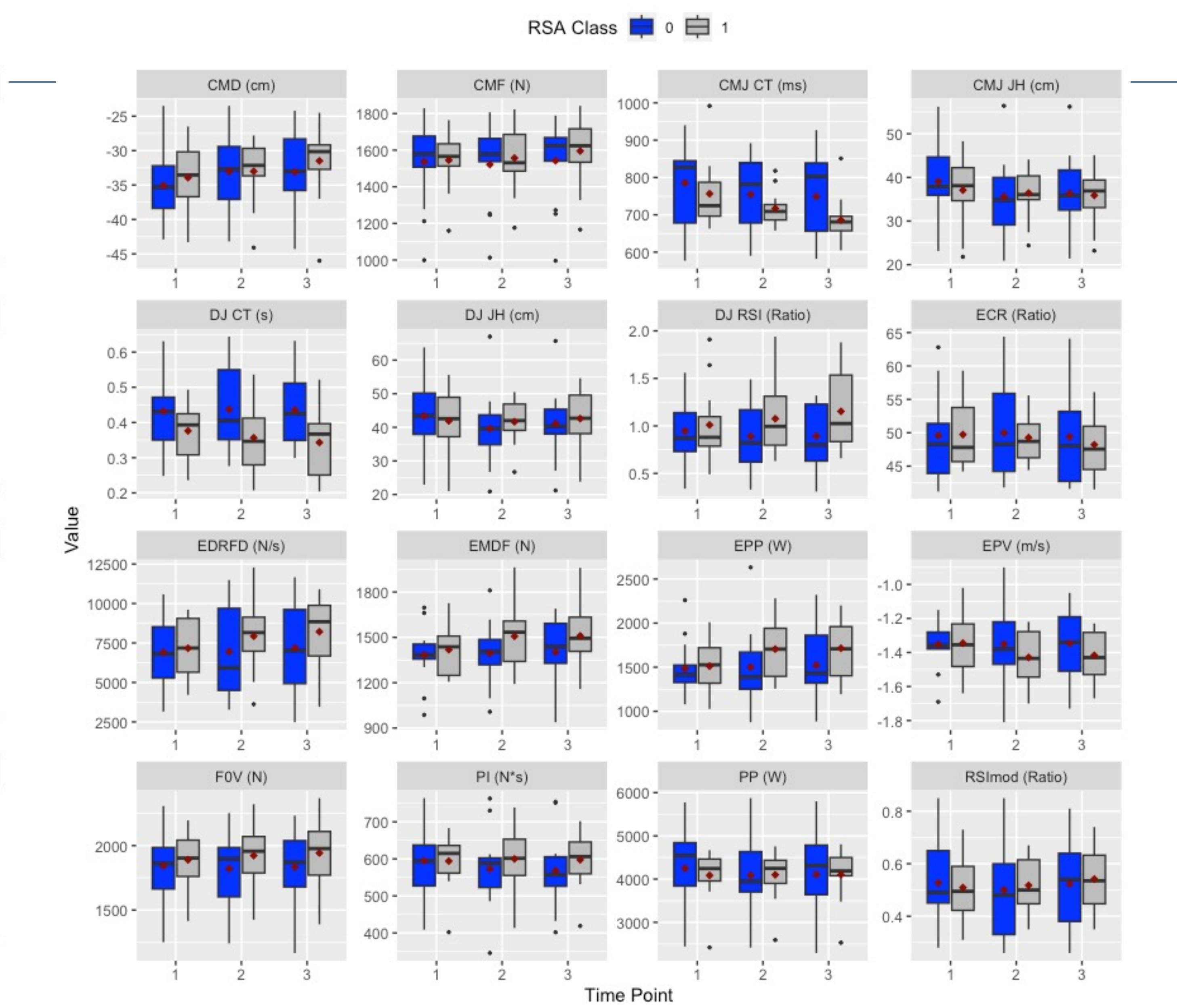
Countermovement Jump Metrics	Pre-RSA	Post-RSA$_1$	Post-RSA$_2$
ECC Mean Deceleration Force (N)	1401 ± 176	1448 ± 219	**1454 ± 225***
ECC Peak Velocity (m/s)	-1.35 ± 0.16	-1.39 ± 0.19	-1.38 ± 0.18
ECC Peak Power (W)	1499 ± 310	1598 ± 407	**1615 ± 391***
ECC:CON Mean Force Ratio (Ratio)	49.7 ± 6.15	49.6 ± 5.80	**47.6 ± 6.30***
ECC Deceleration RFD ($N \cdot s^{-1}$)	7034 ± 2216	7419 ± 2586	7674 ± 2696
Contraction Time (ms)	772 ± 102	**737 ± 82.9‡**	**719 ± 99.8†**
Countermovement Depth (cm)	-34.5 ± 4.84	**-33.0 ± 4.90†**	**-31.2 ± 5.39‡**
CON Mean Force (N)	1541 ± 202	1539 ± 203	1568 ± 213
Force at Zero Velocity (N)	1865 ± 251	1870 ± 276	1886 ± 287
Jump Height (cm)	38.1 ± 8.50	**35.9 ± 7.62†**	**36.8 ± 8.15‡**
Peak Power (W)	4170 ± 798	4094 ± 772	4106 ± 791
Positive Impulse (N•s)	594 ± 87.8	586 ± 94.2	582 ± 91.3
RSI-modified (Ratio)	0.518 ± 0.16	0.508 ± 0.14	0.532 ± 0.16
Drop Jump Metrics			
Contact Time (s)	0.41 ± 0.10	0.40 ± 0.11	0.39 ± 0.12
Jump Height (cm)	42.7 ± 10.3	**40.6 ± 9.16***	41.8 ± 9.58
RSI (Ratio)	0.98 ± 0.38	0.98 ± 0.38	1.02 ± 0.41

**Note: Bold = significantly different from baseline, * = small effect size, † = moderate effect size, ‡ = large effect size*

Results

Results revealed multiple significant between-phase differences for the whole sample, which may be observed in table 1. Further, results from the two-factor analysis revealed that the participants level of fitness might have influenced the fatigue response. For instance, significant time*RSA classification effects were observed for ECC peak velocity, with those participants with superior RSA experiencing significant increases in ECC peak velocity, and those with inferior RSA experienced slight non-significant decreases. While speculative, this may suggest that the fatigue of the RSA protocol hindered the participants of the low RSA group in employing a faster eccentric contraction, as seen within the high RSA group. Moreover, with regards to peak power, participants with lower RSA experienced significant decreases in from pre-RSA to post-RSA$_1$, while those with higher RSA experienced slight, non-significant increases in peak power following the fatiguing task.





Conclusions & Practical Applications

Practitioners may find findings from this study insightful when choosing neuromuscular performance tests and metrics to gain insights into athlete's readiness and fatigue levels. It is not uncommon for practitioners to implement assessments of neuromuscular function prior to and following a game or competition. Performing a neuromuscular performance assessment such as the ones used in this study, following the commencement of a training session or competition, may provide insights into how well athletes responded to the workload they were exposed to, and whether or not additional recovery options may be considered prior to the next training session or competition, in order to enhance readiness and performance. Metrics such as jump height or peak power may be sensitive to acute fatigue in populations with little experience with neuromuscular assessments such as the CMJ or DJ, while strategy metrics should also be considered in populations that present with sufficient test familiarity.

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