Neuromuscular Fatigue From Repeated Sprint Exercise and the Impact It Has on Jump Performance: A Pilot Study

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Abstract

In this work we present the preliminary results of the effects that a repeated sprint exercise has on neuromuscular fatigue. We focused on repeated sprint ability of athletes with different training backgrounds and considered how it may influence muscle fatigue. Jump mats were used to measure change in force output, peak power and impulse. Change in sprint times were used to calculate a fatigue percentage decrement.

Background

Repeated Sprint Analysis (RSA)

- The ability to recover and reproduce performance in subsequent sprints (Girad, 2011)
- Superior RSA may be a deciding factor for success in many sports
- Deteriorates substantially with fatigue development

Repeated Sprint Exercise (RSE)

- Maximal-effort sprints lasting <10 seconds and rest periods lasting <60 seconds (Bishop,2011)

Neuromuscular Fatigue

- The decrease in ability to perform physical actions, in both maximal force and power exerted, following a sustained physical activity (Enoka, 2008)

Jump Performance

- Vertical jump can be implemented as a way to measure lower-body power (Watkins, 2017)
- CMJ testing is the most suitable for monitoring neuromuscular fatigue due to the high repeatability and immediate and prolonged fatigue-induced changes (Gathercole, 2015)
- Impulse: Net upward momentum (force applied/time)
- PPO: Peak power output of jump (greatest output/time)

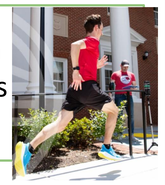
Goals

- Determining if muscle fatigue can accurately be measured through the use of a jump mat
- Determining if different training backgrounds has an impact on muscle fatigue during RSE

Methods

Subjects

College students who have been physically active within 6 months of testing



Familiarization Day

Subjects taken through full procedure and familiarized with equipment

- Baseline testing for jumping & sprints

Instrumental Setup

Smartspeed gates and Fusion Sport Smart Jump® mat are set up

Experimental Session

Subjects warm up and complete RSE session

- Performed 12, 30 meter uphill sprints at 100% effort with 30 seconds of rest in between
- Jumps taken pre, post and post 10 minutes of RSE session

Statistical Analysis

Used a one way ANOVA (pre vs post vs post 10)

- There was not a statistically significant difference between pre, post, and post 10 for average PPO ($p>.05$)
- There was not a statistically significant difference between pre, post and post 10 for average impulse ($p>.05$)

Results

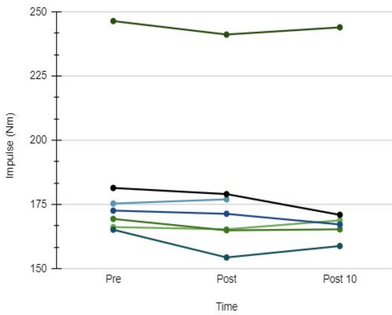


Figure 1. The change in impulse throughout the testing session, characterized by a decline in the post jumps.

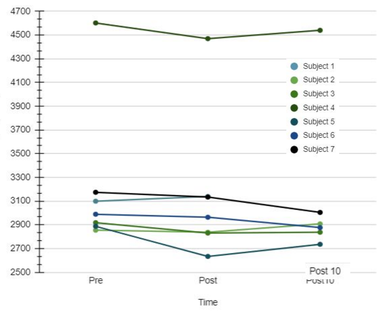


Figure 2. The change in PPO throughout the testing session, characterized by decline in the post jumps.

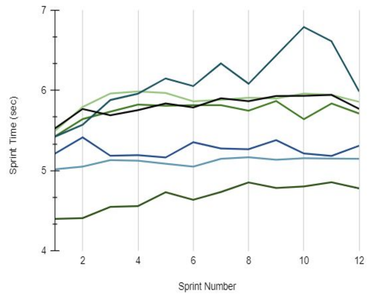


Figure 3. Change in sprint time over the RSE test. Subject 1 was a detrained female, subjects 2-4 female soccer athlete, subjects 5-7 endurance and strength trained males. Average fatigue decrement was 6.71%

Conclusion

- Decreased impulse and PPO during immediate post jump suggests that athletes are needing more time and effort to give maximal jump following RSE
- We were unable to achieve an average of 12% fatigue decrement as other studies had, we focused on D1 athletes which limited muscle fatigue

Acknowledgements & References

We thank Longwood University PRISM program for funding our research. We also thank Dr. Blaisdell and Dr. Porter for making this research possible.

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