Nitrate Supplementation Improves Peak Force & Motor Unit Activation of the Vastus Medialis Oblique During a Squat Exercise

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BACKGROUND

Nitrate supplementation has gained attention because of the physiological and potential performance effects (De Oliveira 2017). Nitrate is found in many fruits and leafy greens, especially beet root juice (Mark, Katie 2016). Nitrate is converted to nitric oxide, which the human body needs (Gilchrist et al., 2009). Physiological factors that are affected by nitrate supplementation include regulated blood pressure, increased blood flow, muscle O_2 saturation, muscle contractility, and increased blood volume.

When inorganic nitrate is orally administered to the subject, anaerobic bacteria forms in the mouth that can use nitrate instead of oxygen (Gilchrist, 2009). Nitrate that is not digested is stored and converted to nitric oxide in times of low oxygen availability. Beetroot juice and supplements are one of the most popular nitrate abundant substances found to increase athletic performance in high intensity and endurance exercise (Mark K., 2016). However, few studies have tested anaerobic exercise, moderate exercise, and muscle contractility with healthy individuals as the sample.

The objective of this study was to test the effects of nitrate supplementation on muscle electrical activity, and peak force during maximum contraction in a one rep max squat relative to subject's maximum.

METHODS

Thirteen female Division II athletes (19.8 ±1.14 yr) participated in this study. Subjects were all members of the Palm Beach Atlantic University softball team and considered healthy with no injuries or disabilities. Peak force and motor unit activation (EMG) were assessed before (PRE) and 3 hours after (POST) nitrate supplementation.

1RM and 70% 1RM measurement: A series of progressively maximal squat exercises were performed to determine a 1RM value. Peak Power and EMG were then assessed while performing the squat exercise at 100% and 70% of 1RM. Subjects were instructed to hold a maximal contraction for three seconds at the top of the squat exercise.

Motor Unit activation (EMG) measurement: The wireless FREEEMG (BTS Bioengineering, Milan, ITA) recorded surface EMG signals via two EMG electrodes placed on the subject's dominant vastus medialis oblique. Electrodes were placed 4 cm apart at a 50° angle between the lateral side of the patella and the anterior superior iliac spine.

Peak Force measurement: A Tendo© Sports Machine unit was used to track average peak power and velocity during squat exercises.

Nitrate Supplementation: Subjects ingested 10g (12.6 mmol of nitrate) of Human BeetElite supplement three hours prior to testing.

Statistical Analysis: A paired t test was used to assess differences in PRE V. POST measurements of all variables, with an alpha level set a 0.05.

CONCLUSION

Nitrate supplementation significantly improved peak power and EMG activity during a 70% 1RM squat exercise in the vastus medialis muscle. Other studies, such as Coggan's (2015) study on the effect of nitrate intake on maximal knee extensor speed and power, exhibit similar findings post supplementation. This study, however, was limited to a small sample size (n=10) and one gender. Suggestions for future research include a more inclusive sample and ingesting supplementation over multiple times prior to post testing.

BIBLIOGRAPHY

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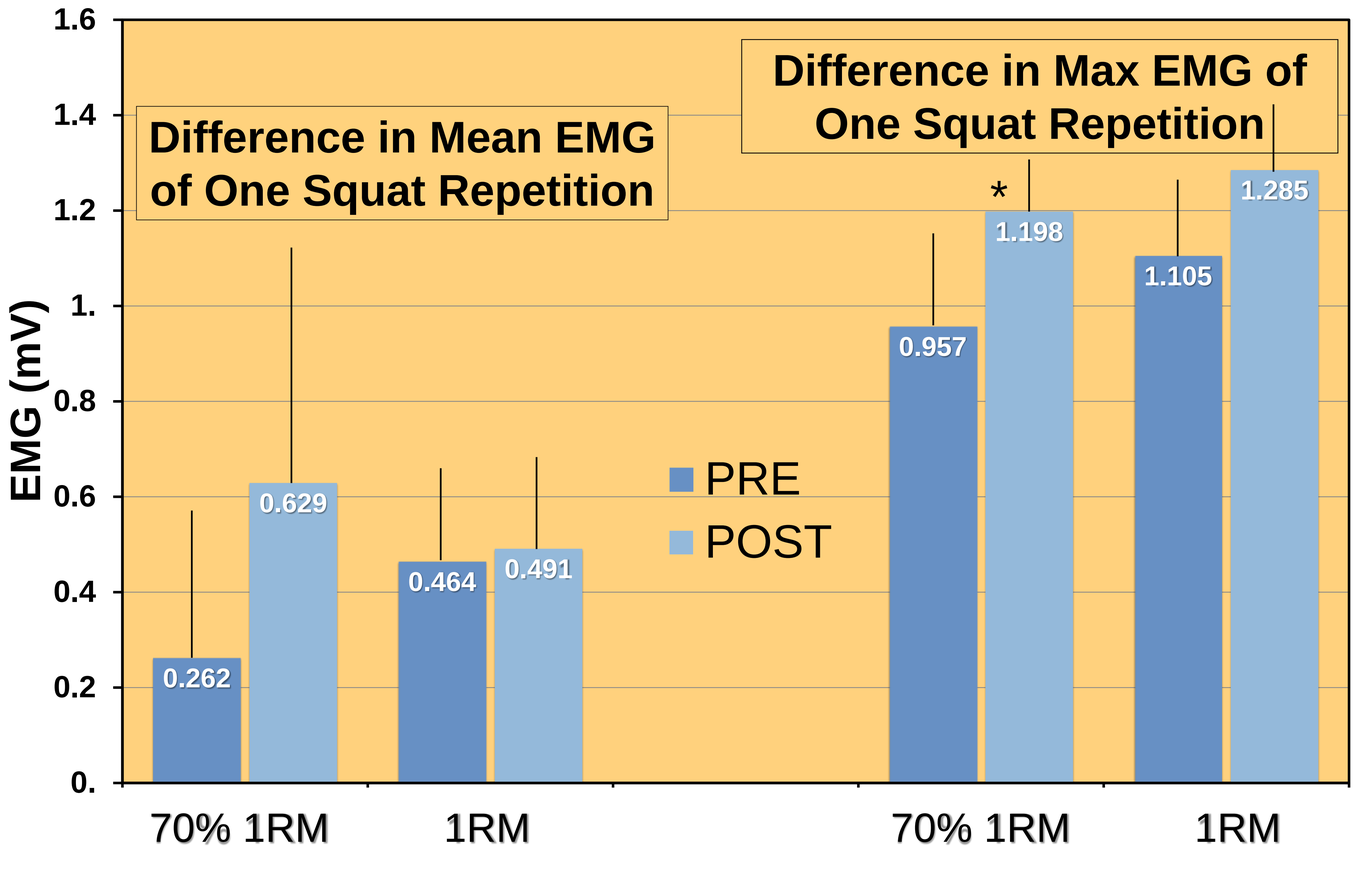
RESULTS

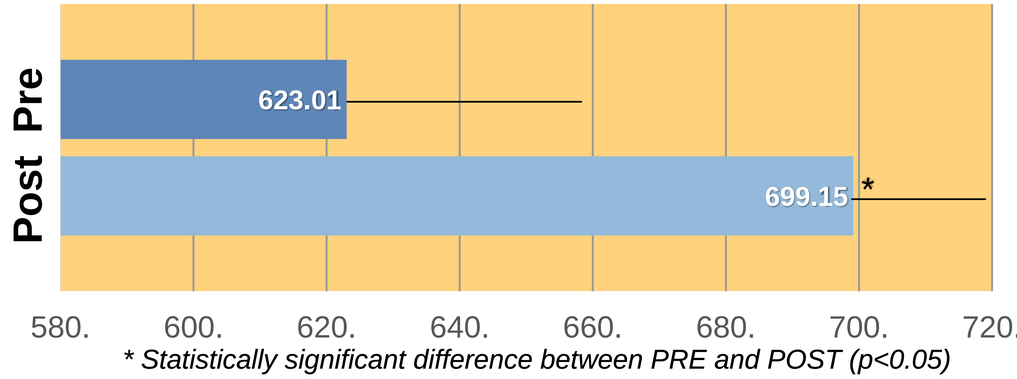


EMG and Peak Force Results – PRE v POST

n=13	Mean at 70% 1RM (mV)	Mean at 1RM (mV)	Max at 70% 1RM (mV)	Max at 1RM (mV)	Peak Power (W)
PRE	0.262 (±0.67)	0.463 (±0.49)	0.95 (±0.44)	1.105 (±0.38)	623.01 (±60.76)
POST	0.629 (±1.09)	0.491 (±0.47)	1.198* (±0.28)	1.285 (±0.33)	699.15* (±34.54)

** Statistically significant difference between PRE and POST (p<0.05)*

Peak Power (W) in Vastus Medialis During 1RM



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