

Effect of muscle damage and delayed muscle onset soreness on muscular activation parameters during an isometric squat

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Summary

We have explored the effect of muscle damage and pain on surface electromyography during an isometric squat of 40 seconds. For this aim, we have measured these parameters in 31 participants during 4 days, being the fourth day 24 h after to induce muscle damage.

Introduction

The relationship between muscle activation, delayed onset muscle soreness (DOMS), and muscle damage remains a subject of ongoing debate. While some studies suggest that DOMS leads to higher Root Mean Square (RMS) during gait and lower values during maximum voluntary contraction [1], others did not observe an alteration of the surface electromyography (EMG) parameters [2]. Despite these insights, there is a lack of standardized tests to evaluate muscle activation under conditions of DOMS and muscle damage. To address this gap, we have chosen to employ a 40-second isometric squat to analyze EMG parameters.

Therefore, the objective of this study was to assess the effect of a muscle damage induction protocol on EMG parameters, and the correlation of these parameters with DOMS and creatine kinase (CK).

Methods

Thirty-one physically active volunteers participated in this study (10 females and 21 males; 25 ±5 years old). The study was approved by the Ethics Committee of the University of Valencia.

Data collections were undertaken over four days in two consecutive weeks: two consecutive days per week, with an interval of 24 hours between day one and two, and day three and four. No differences were between the first three days to have data that works as a control data. However, at the end of the third day (after measuring all the outcomes), an exercise-induced damage protocol was performed consisted of a validated protocol of drop jumps to induce muscle damage in the knee extensors. This protocol included 5 sets of 20 drop jumps from a 0.6 m box, with a rest of 10 minutes between jumps and 2 minutes between sets.

DOMS was measured with a visual analogue scale of 150 mm, CK by capillary blood samples (SimplexTAS 101, Germany), and muscular activation during the isometric squat of 40 seconds using the Trigno system (Delsys Inc., USA). The EMG parameters analyzed were the RMS and the mean frequency. Signal was divided in an initial section (second 5 to 15) and a final section (second 25 to 35). Then, final section

was normalized respect to the initial section. Isometric squats were performed with a knee flexion of 90°, keeping the heels of the feet off the ground, and the back touching a wall.

Results and Discussion

CK ($p < 0.01$; 210 ± 129 IU/L vs. 239 ± 161 IU/L vs. 196 ± 196 IU/L vs. 330 ± 197 IU/L) and DOMS ($p < 0.001$; 1.2 ± 1.9 cm vs. 1.6 ± 2.0 cm vs. 0.9 ± 1.2 cm vs. 3.5 ± 2.9 cm) were higher in the last day compared to the previous 3 sessions. Non-differences between days were observed in RMS ($p = 0.5$, $115 \pm 27\%$ vs. $117 \pm 24\%$ vs. $110 \pm 27\%$ vs. $108 \pm 26\%$) and mean frequency ($p = 0.7$, $100 \pm 9\%$ vs. $99 \pm 6\%$ vs. $101 \pm 19\%$ vs. $100 \pm 4\%$).

No significant correlations were observed between RMS and mean frequency with DOMS and CK (Figure 1).

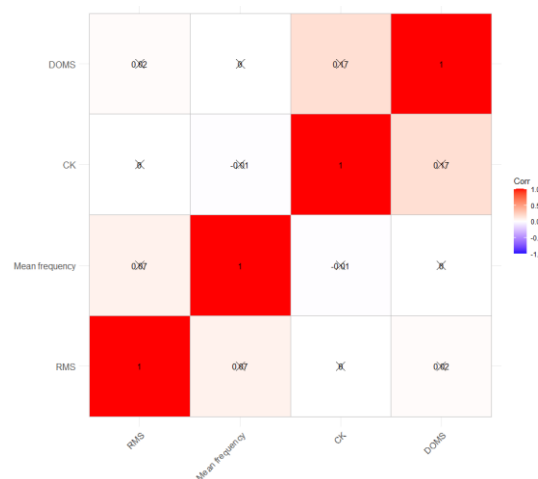


Figure 1: Bivariate correlation Pearson analysis.

Conclusions

No effect of DOMS and muscle damage on muscle activation parameters was evident during a 40-sec isometric squat.

Acknowledgments

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References

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- [2] Priego-Quesada et al. (2020) *Int J Environ Res Public Health*, **17**(18); 1-13