

## Specific strength in sport climbing disciplines

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Strength of the upper limbs has been suggested to be a determinant in climbing performance (1). However, different kinds of assessments have provided contradictory results. Strength has been measured with general (handgrip) and specific (SCD, specific climbing dynamometer) tools. Isometric maximal voluntary contraction (MVC) and rate of force development (RFD) can be considered as outcomes. The SCD showed validity (correlated with lead performance  $n=38$ ,  $r=-0.61$ ,  $p<0.001$ ) (2), reliability (Typical Error as CV was 8, 16% for SCD MVC and peak-RFD and ICC of 0.91, 0.82, respectively) (3) and internal responsiveness (effect size 1.44 in SCD peak-RFD) (4). Lead and Boulder are widespread disciplines in sport climbing. Boulder climbers showed higher values of MVC and pRFD compared to Lead climbers (5). Muscle fatigue (i.e. decrease in MVC and RFD parameters) can give further details in the importance of neuromuscular properties in sport climbing disciplines. The aim of this study was to examine muscle fatigue after Boulder and Lead activity.

### Methods

Fourteen climbers (age  $29 \pm 10$  yrs, height  $176 \pm 8$  cm, weight  $70 \pm 7$  kg, climbing level IRCRA scale moderate to advanced) participated in a simulated competition in Lead and Boulder. Before the measurement climbers were involved in a survey investigation. Participants were randomly assigned to a sequence Lead-Boulder or Boulder-Lead in a counterbalanced design with two conditions (i.e. Lead and Boulder) and washout (i.e. recovery) period of 4 hours. Specific strength (MVC and RFD) was measured with a SCD at baseline and after Boulder and Lead.

### Results

Climbers perceived strength of the forearms to be important in boulder and lead (12 and 13% of the answers) performances and physical strength of higher importance in boulder compared to lead (34 and 42% of answers). MVC and pRFD at baseline were  $7.2 \pm 1.1$  N/kg and  $38.2 \pm 8.6$  N/kg/s. After boulder, MVC and pRFD were  $6.8 \pm 1.5$  N/kg and  $32.7 \pm 10.3$  N/kg/s, percentage differences  $-7.4$  (90% CI  $\pm 7.3$ ) and  $-16.3$  (90% CI  $\pm 15$ ). After lead MVC and pRFD were  $6.4 \pm 1.7$  N/kg and  $30 \pm 11.3$  N/kg/s, percentage differences  $-12.8$  (90% CI  $\pm 10.8$ ) and  $-25.4$  (90% CI  $\pm 13$ ).

### Discussion

The decline in strength after Lead and Boulder simulation of competition confirms the occurrence of muscle fatigue. This study confirmed previous results attained after a Lead official competition and simulation for pRFD (-19%) and MVC (-6%) (2). The great decline in pRFD underlined the importance of rapidly exerting the strength (i.e. contact strength) during both disciplines.

### Conclusion

Specific strength should be assessed with SCD. Rate of force development seems to be more appropriate compared to maximal voluntary contraction for investigating fatigue after climbing disciplines.

## References

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