

**THE EFFECTS OF A WEIGHTED DEAD-HANG
TRAINING PROGRAM ON GRIP STRENGTH
AND ENDURANCE IN EXPERT CLIMBERS WITH
DIFFERENT LEVELS OF STRENGTH.**

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Abstract

Grip strength and endurance are determinant factors of climbing performance. The training response to strength training depends on initial strength levels. This study aims to investigate the effects on grip strength and endurance of a 4-week weighted dead-hang training program in experienced rock climbers with a higher (HS; n = 10) and lower strength level (LS; n = 12) according to the median value in the initial strength test. Grip strength and endurance changes were significant for the LS group, but not for HS (35.8%, $p < 0.01$; 35,6%, $p < 0.01$; against 3.7% and -4% respectively). These results suggest that finger strength levels must be taken into consideration when designing finger training programs.

Keywords: Hangboard, fingerboarding, finger strength, rock climbing, performance

Résumé

La force de préhension et l'endurance sont des facteurs déterminants pour la performance en escalade. La réponse à l'entraînement de la force dépend du niveau de force initiale. L'objectif de cette étude est d'investiguer les effets, sur la force de préhension et l'endurance, d'un programme d'entraînement de suspensions avec poids durant 4 semaines sur des grimpeurs expérimentés qui ont un niveau de force supérieur à (HS; n = 10) et inférieur à (LS; n = 12) selon la valeur moyenne du test de force initiale. Les changements sur la force d'agrippement et l'endurance sont significatifs pour le groupe LS, par contre ce n'est pas le cas pour le groupe HS (35.8%, $p < 0.01$; 35,6%, $p < 0.01$; contre 3.7% et -4% respectivement). Ces résultats suggèrent que le niveau de force des doigts doit être pris en compte pour la création de programmes d'entraînement des doigts.

Mots clés: Poutre de traction, entraînement sur fingerboard, force des doigts, escalade, performance

Introduction

Grip strength and endurance are determinant factors of climbing performance. The effects of strength training differ according to the initial strength level and years of training experience of each athlete (Peterson et al. 2005), individualization being among the basic principles of training. In climbing, there are scarce studies that have assessed the suitability of several grip strength training methods for rock climbers (López-Rivera & González-Badillo, 2012, 2016) and boulderers (Medernach et al. 2015). There is, however, a lack of research on the implications of dissimilar initial strength levels. This study evaluated the effects on grip strength and endurance of a weighted hang training program, as proposed by the previously cited study, in experienced climbers with different starting strength levels.

Methods

The fingerboard apparatus and tests used in this study were those validated by López-Rivera and González-Badillo (2012). The endurance test (ET) consisted in hanging to failure off an 11 mm-deep edge and the strength test (ST) measured the maximum added weight that the athlete could hold for 5 seconds off a 15 mm-deep edge. Twenty-two climbers (average of French 8a redpoint grade level, 31.5 years old and 12.2 years of climbing experience) trained for 4 weeks using the dead-hang training method proposed by the previously reported study, involving 3-5 10-second maximal dead-hangs with 3-minute pauses between them. The participants were divided according to their median value at ST1: HS ($ST1 \leq 30$ kg)

and LS (ST1 > 30 kg). In week 4 ST2 and ET2 were performed. The ANOVA repeated measures test and Pearson correlation were used to analyze the data.

Results

The LS group showed greater grip strength and endurance gains than HS ($p < 0.005$). When controlling for body weight, LS yielded a significant higher correlation between ST1 and ET1, as well as between ST2 and ET2 than that of HS ($r = 0.82$, $r = 0.82$, against $r = 0.67$; $r = 0.70$; respectively).

Table 1. Results in ST1 (kg; mean \pm s) and ET1 (s; mean \pm s)

	ST1(kg)	ST2 (kg)	ET1 (s)	ET2 (s)
LS (n = 7)	22.71 \pm 7.72	30.83 \pm 9.96 ^a	24.95 \pm 11.99	33.82 \pm 15.83 ^b
%		35.78%		35.59%
ES		1.05		0.7
HT (n = 10)	41.95 \pm 7.71	43.50 \pm 9.80	50.35 \pm 18.04	48.22 \pm 13.30
%		3.69%		-4.22%
ES		0.20		-0.12

^a Intra-group significant differences compared to ST1 ($p \leq 0.001$). ^b Intra-group significant differences compared to ST1 ($p \leq 0.01$)

Discussion

The main result from this study is that in climbing, similarly to other sports, a maximal finger strength training yields greater gains for athletes that start from a lower level of strength, probably due to neural development (Häkkinen et al. 1987). It is worth noting the different relationship between grip strength and endurance that LS and HS display, both before and after training. Interestingly, while training for strength had a positive influence on LS in terms of grip endurance on small edges in line with López-Rivera and González-

Badillo (2012), the smaller strength gains obtained by HS were paired with a reduction in endurance. A possible explanation could lie in different muscle fiber composition among groups (Wüst et al., 2008) which could favor developing one quality in detriment of the other, a greater fatigability, or that they may need a stronger stimulus or an extended training period. These results can provide coaches with tools for a better individualization and periodization of grip training in climbing.

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