

Grip Strength, Bilateral Asymmetry, and Strength Changes During Repeated Exhaustive Tasks Across Climbing Ability Levels in Male Lead Climbers

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ABSTRACT

Purpose: This study examined associations of handgrip strength (HG) and maximal finger strength (FS) with climbing ability in male lead climbers, and investigated bilateral asymmetry and strength changes during repeated exhaustive exercise.

Methods: Eighteen male lead climbers (40.11 ± 11.84 years) were classified by IRCRA redpoint grade (RP) into LOW (n=5, RP: 8.8), MID (n=6, RP: 13.1), and HIGH (n=7, RP: 21.2) groups. HG and FS during crimp grip were measured bilaterally, with the stronger hand as maximal strength, and asymmetry was calculated as between-hand difference relative to the stronger value (%). Exhaustive exercise comprised three sets of repeated contractions at 80% of FS matching metronome beat of 70 bpm with 1-minute rests. Repetitions, time, and post-set FS were recorded. Pearson correlation and one-way ANOVA or Welch's test were used.

Results: Grade correlated positively with HG ($r=.578$, $p=.012$) and FS ($r=.789$, $p<.001$), numerically higher for FS. Asymmetry was $6.07 \pm 5.51\%$ (HG) and $9.86 \pm 6.67\%$ (FS). FS asymmetry was 14.12% in LOW, 8.56% in MID, and 7.93% in HIGH, decreasing markedly from LOW to MID but not differing significantly between groups ($p=.468$). Repetitions, time, and post-set FS decreased across sets; groups differed in post-set FS in every set but not in repetitions or time (set 1, $p=.008$; set 2, $p=.001$; set 3, $p<.001$).

Conclusion: FS showed a numerically higher correlation with climbing ability than HG, suggesting a usefulness of FS as an evaluation parameter. Asymmetry tended to be lower in higher-level groups, though not significant, possibly reflecting a less hand-to-hand asymmetry in HIGH, or limited crimp grip proficiency in LOW. Despite similar repetitions and time under relative load, higher-level groups showed greater strength in all sets, suggesting climbing ability relates more to maximal strength than repeated performance. Assessment and training should prioritize maximal strength, alongside bilateral balance and repeated performance. The small sample warrants cautious.

Keywords: climbing, grip strength, finger strength, strength asymmetry, repeated exhaustion