

Does plyometric training improve explosive muscle performance in experienced boulder climbers?

Submission date 22/06/2026	Recruitment status No longer recruiting	☐ Prospectively registered ☐ Protocol
Registration date 09/07/2026	Overall study status Completed	☐ Statistical analysis plan ☐ Results
Last Edited 23/06/2026	Condition category Other	☐ Individual participant data ☒ Record updated in last year

Plain English summary of protocol

Background and study aims

Boulder climbing requires the ability to produce force rapidly in pulling movements. This study investigated whether a 10-week plyometric training programme of exercises involving explosive jumps and reactive pulls, could improve this capacity in experienced male boulder climbers.

Who can participate?

Male boulder climbers aged 20–40 years with a minimum bouldering performance level of V5 (self-reported current maximum redpoint grade).

What does the study involve?

Participants were randomly assigned to either a training group or a control group. The training group performed two plyometric sessions per week for 10 weeks, while the control group continued their usual climbing training. Muscle function was assessed before and after the intervention using tests of pulling strength, explosive push-up power, finger flexor strength, and jump performance.

What are the possible benefits and risks of participating?

Possible benefits: participants may experience improvements in explosive muscle performance, pulling strength, push-up power, and jump ability as a result of the plyometric training program.

Possible risks: as with any exercise program involving high-intensity explosive movements, there was a small risk of musculoskeletal injury, particularly to the upper limbs, fingers, and lower limbs. Participants were screened for pre-existing injuries before inclusion, and all sessions were supervised by a qualified coach to minimize this risk.

Where is the study run from?

Viña del Mar University, Chile.

When is the study starting and how long is it expected to run for?

August 2025 to October 2025.

Who is funding the study?
Viña del Mar University, Chile.

Who is the main contact?
Dr Guillermo Cortés Roco, guillermo.cortes@uvm.cl

Contact information

Type(s)

Principal investigator, Public, Scientific

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Additional identifiers

Study information

Scientific Title

The effects of a 10-week plyometric training programme on selected neuromuscular outcomes in trained-to-highly-trained male boulder climbers: a preliminary exploratory trial

Study objectives

To determine the effect of a 10-week plyometric training programme on selected neuromuscular outcomes, including isometric pull-up rate of force development, upper-body explosive power, and finger flexor strength , in trained-to-highly-trained male boulder climbers.

Ethics approval required

Ethics approval required

Ethics approval(s)

Approved 08/07/2025, Scientific Ethics Committee, Viña del Mar University (Comité Ético Científico, Universidad Viña del Mar; CEC-UVM) (Avenida Agua Santa 7055, Sector Rodelillo, Viña del Mar, 2560000, Chile; +56 9 8292 6125; consultascec@uvm.cl), ref: 32-25

Primary study design

Interventional

Allocation

Randomized controlled trial

Masking

Blinded (masking used)

Control

Active

Assignment

Single

Purpose

Treatment

Study type(s)**Health condition(s) or problem(s) studied**

Neuromuscular performance in sport. This study examined the effects of plyometric training on explosive force production and rate of force development in trained boulder climbers. No clinical condition or disease was studied; participants were healthy, trained athletes.

Interventions

Participants were randomly assigned to groups using a computer-generated random number sequence produced in Microsoft Excel prior to the baseline assessment. The sequence was generated by a researcher not involved in the intervention delivery or outcome assessment.

The intervention group performed two plyometric training sessions per week for 10 weeks (45–60 minutes per session), including plyometric push-ups, reactive pull-ups, campus board exercises, and lower-body plyometric jumps, supervised by a qualified strength and conditioning coach. Session volume was progressed across four phases: adaptation (weeks 1–4), bouldering-specific plyometrics (weeks 5–6 and 8–10), and a deload week (week 7). The control group maintained their habitual climbing training (minimum three sessions per week) without additional plyometric stimuli.

Intervention Type

Behavioural

Primary outcome(s)

1. Isometric pull-up rate of force development (RFD) measured using a load cell (Tindeq Progressor®); RFD calculated from force-time curve at 0–200ms and 20–80% of maximal force intervals, at pre-intervention (August 2025) and post-intervention (October 2025)

Key secondary outcome(s)

1. Upper-body explosive power, finger flexor strength and RFD, lower-body explosive power, and pull-up performance measured using plyometric push-up power (W) and Power Slap distance (cm) assessed using Chronojump® and campus board; maximum isometric finger flexor strength (kg) and RFD at 0–200ms and 20–80% Fmax on 20mm hold using Tindeq Progressor®; countermovement jump height (cm) and power (W) using Chronojump®; maximum pull-up repetitions to failure at pre-intervention (August 2025) and post-intervention (October 2025)

2. Pull-up repetition performance measured using the maximum pull-up repetitions to failure; prone grip, dead-hang start, chin above bar criterion, no kipping at pre-intervention (August 2025) and post-intervention (October 2025)

Completion date

25/10/2025

Eligibility

Key inclusion criteria

1. Male boulder climbers aged 20–40 years
2. Minimum bouldering performance level of V5 (self-reported current maximum redpoint grade)
3. At least two years of continuous sport climbing experience
4. Training frequency of three or more sessions per week over the previous six months
5. Absence of active musculoskeletal injuries at the time of initial assessment

Healthy volunteers allowed

Yes

Age group

Adult

Lower age limit

20 Years

Upper age limit

40 Years

Sex

Male

Total final enrolment

18

Key exclusion criteria

1. Active musculoskeletal injury at the time of initial assessment
2. Medical conditions contraindicating reactive or ballistic training
3. Injury sustained during the intervention period preventing continuation of the protocol
4. Session adherence rate below 80% of scheduled sessions

Date of first enrolment

02/08/2025

Date of final enrolment

09/08/2025

Locations

Countries of recruitment

Chile

Sponsor information

Organisation

Viña del Mar University

ROR

<https://ror.org/00txsqk22>

Funder(s)

Funder type

Funder Name

Universidad Viña del Mar

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary

Not expected to be made available