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Effects of beetroot juice and brief leg blood flow restriction on cycling sprint performance in male college athletes

Submission date 05/11/2026	**Recruitment status** No longer recruiting	[_] Prospectively registered [_] Protocol [_] Statistical analysis plan [_] Results [_] Individual participant data [X] Record updated in last year
Registration date 06/11/2026	**Overall study status** Completed	
Last Edited 05/11/2026	**Condition category** Other	

Plain English summary of protocol

Background and study aims
The study examined whether nitrate-rich beetroot juice and ischemic preconditioning, used separately or together, affect power during brief maximal cycling exercise.

Who can participate?
Healthy male collegiate track-and-field athletes aged 18–24 years who undertook regular structured training

What does the study involve?
At four visits in a random order at least 7 days apart athletes were allocated to drink either 70 ml of nitrate-rich beetroot juice or nitrate-depleted placebo 150 minutes before testing, together with either three 5-minute thigh-cuff inflations at 220 mmHg (each followed by 5 minutes of reperfusion) or sham treatment at 20 mmHg. They then performed a standardised warm-up, a seated 6-second maximal cycling sprint, and a 30-second Wingate cycling test after 10 minutes of rest. Cycling power and perceived exertion were measured.

What are the possible benefits and risks of participating?
No individual benefit was guaranteed. Temporary cuff discomfort, exertion-related fatigue or soreness, or digestive discomfort were possible. Exercise was supervised.

Where is the study run from?
Beijing Sport University (China)

When is the study starting and how long is it expected to run for?
November 2025 to January 2026

Who is funding the study?
Fundamental Research Funds for the Central Universities and the Chinese Universities Scientific Fund, grant 2025KYPT09

Who is the main contact?
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Contact information

Type(s)
Public, Scientific, Principal investigator

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Study information

Scientific Title
Effects of dietary nitrate and ischemic preconditioning, alone and in combination, on early cycling power compared with placebo and sham in male collegiate track-and-field athletes: a randomized factorial crossover trial

Study objectives

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 10/11/2025, Sports Science Experiment Ethics Committee of Beijing Sport University (No. 48 Xinxi Road, Haidian District, Beijing, 100084, China; +86 (0)10 6298 9306; mt5345916@163.com), ref: 2025507H

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Placebo

Assignment
Crossover

Purpose
To evaluate the independent and combined effects of dietary nitrate supplementation and ischemic preconditioning on short-duration cycling performance in trained athletes.

Study type(s)

Health condition(s) or problem(s) studied
Short-duration high-intensity cycling performance and neuromuscular power

Interventions
An investigator independent of participant testing and statistical analysis generated a computer-based allocation to 24 fully counterbalanced orders of the four conditions in a randomised 2 × 2 factorial crossover study. The 24 randomised participants each completed one of the 24 orders, with each intervention occurring six times in each period. Visits were separated by 7 days. Supplement and conditioning allocations were coded, and participants were blinded to supplement identity and not informed which conditioning protocol was active.

Each participant completed four experimental conditions in a randomized order:
1. Nitrate-rich beetroot juice (BRJ) + ischemic preconditioning (IPC).
2. BRJ + sham IPC
3. Nitrate-depleted placebo (PL) + IPC
4. PL + sham IPC

The four experimental visits were separated by 7-day washout periods.

Dietary supplementation:
Participants consumed either 70 ml of nitrate-rich beetroot juice (Beet It Pro Elite Shot, James White Drinks Ltd., UK), providing approximately 400 mg nitrate (6.4 mmol NO_3), or 70 ml of nitrate-depleted placebo 150 minutes before the 6-second cycling sprint.

Ischemic preconditioning:
Pneumatic cuffs were placed bilaterally around the proximal thighs. IPC consisted of three 5-minute cuff inflations at 220 mmHg, each followed by 5 minutes of reperfusion. Sham IPC followed the same procedure at 20 mmHg. Both procedures were administered approximately 10–40 minutes before the 6-second sprint.

Exercise testing:
Each visit included a standardized 5-minute cycling warm-up, followed by 5 minutes of passive recovery and a seated 6-second maximal cycling sprint. After 10 minutes of passive recovery, participants completed a seated 30-second Wingate test using a Wattbike Trainer.

Participants were blinded to supplement identity and were not informed which cuff pressure represented active IPC or sham. Experimental condition assignments were coded during outcome processing.

Intervention Type
Mixed

Primary outcome(s)
1. Body-mass-normalised 6-second sprint peak power measured using a Wattbike Trainer at each of the four experimental visits, 150 minutes after supplement ingestion and following IPC or sham intervention

2. Body-mass-normalised 0–10-second Wingate mean power measured using Wattbike software at each of the four experimental visits, during the first 10 seconds of the 30-second Wingate test, performed after 10 minutes of passive recovery following the 6-second sprint

Key secondary outcome(s)
1. Mean power output during the seated 6-second maximal cycling sprint, measured using a Wattbike Trainer and recorded through Wattbike software. Values were normalised to body mass (W/kg). Measurements were performed approximately 150 minutes after supplement ingestion, following IPC or sham intervention.
2. Mean power output during the first 15 seconds of the seated 30-second Wingate cycling test, measured using a Wattbike Trainer and its associated software, and normalised to body mass (W/kg). The Wingate test was performed after 10 minutes of passive recovery following the 6-second sprint.
3. Peak power output recorded during the seated 30-second Wingate cycling test, measured using a Wattbike Trainer and its associated software, and normalised to body mass (W/kg). The test was performed after 10 minutes of passive recovery following the 6-second sprint.
4.Mean power output across the entire seated 30-second Wingate cycling test, measured using a Wattbike Trainer and its associated software, and normalised to body mass (W/kg). The test was performed after 10 minutes of passive recovery following the 6-second sprint.
5. Perceived exertion was assessed using the Borg 6–20 scale immediately after the 6-second maximal cycling sprint and separately immediately after the 30-second Wingate test at each of the four experimental visits.

Completion date
30/01/2026

Eligibility

Key inclusion criteria
1. Male collegiate track-and-field athletes aged 18–24 years
2. Classified as Tier 2 trained/developmental athletes
3. At least 3 years of structured sprint, jump, and resistance training
4. Completed at least five training sessions per week during the competitive season
5. Provided written informed consent before study participation

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
18 Years

Upper age limit
24 Years

Sex
Male

Total final enrolment
30

Key exclusion criteria
1. Cardiovascular, metabolic, neurological, or musculoskeletal disease
2. Lower-limb injury within the previous 6 months
3. Current use of nitrate-containing supplements or other ergogenic aids
4. Medication affecting cardiovascular or neuromuscular function
5. Current tobacco use
6. Regular or excessive alcohol consumption
7. Alcohol intake within 24 hours before testing

Date of first enrolment
10/11/2025

Date of final enrolment
13/11/2025

Locations

Countries of recruitment
China

Study participating centre
Beijing Sport University
Laboratory 103, First Floor, Sports Science Building
Beijing
China
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Sponsor information

Organisation

Beijing Sport University

ROR
https://ror.org/03w0k0x36

Funder(s)

Funder type

Funder Name
Fundamental Research Funds for the Central Universities and the Chinese Universities Scientific Fund

Results and Publications

Individual participant data (IPD) sharing plan
De-identified individual participant-level analysis data and the accompanying data dictionary will be available from the corresponding author upon reasonable request, subject to institutional ethics requirements, participant confidentiality, and an appropriate data-use agreement.

IPD sharing plan summary
Available on request