ISRCTN15880445 https://doi.org/10.1186/ISRCTN15880445

Effects of mild hyperbaric oxygen therapy on fatigue recovery following a simulated fencing round-robin pool in tier 3 fencers

Submission date 24/09/2026	**Recruitment status** No longer recruiting	[_] Prospectively registered [_] Protocol
Registration date 25/09/2026	**Overall study status** Completed	[_] Statistical analysis plan [_] Results
Last Edited 24/09/2026	**Condition category** Other	[_] Individual participant data [X] Record updated in last year

Plain English summary of protocol

Background and study aims

Fencing can cause both physical and mental fatigue. This may affect a fencer's reaction time, attention and performance. Mild hyperbaric oxygen therapy involves breathing oxygen-rich air in a chamber where the air pressure is slightly higher than normal. This study aimed to find out whether mild hyperbaric oxygen therapy can help trained fencers recover from fatigue after a simulated fencing competition. It also looked at whether the treatment affects reaction time, attention, heart rate patterns and fencing performance.

Who can participate?

Men and women aged 18 to 25 years who were highly trained, national-level épée fencers could take part. Participants needed to be able to train and compete normally and to be considered safe to receive mild hyperbaric oxygen therapy. People could not take part if they had an injury or health condition that made participation unsafe, or if they had a condition that meant they could not safely or comfortably use a hyperbaric chamber, such as claustrophobia, an acute middle-ear infection or sinusitis.

What does the study involve?

Each participant took part in two study sessions, separated by more than 48 hours. The order of the two sessions was decided at random by a computer.

At each session, participants completed a 35-minute standard warm-up followed by a series of assessments. They then took part in a simulated épée competition involving five fencing bouts. After the competition, participants spent about 30 minutes sitting in a hyperbaric chamber. In one session, the chamber was pressurised to 1.3 atmospheres and participants breathed air containing about 90% oxygen through a face mask. In the other session, the chamber remained at normal atmospheric pressure and no extra oxygen was given. Participants read neutral material while sitting in the chamber.

The researchers measured participants' mental and physical fatigue, reaction time, attention, heart rate patterns and fencing performance. These assessments were carried out before the simulated competition, immediately after it and after the recovery period.

What are the possible benefits and risks of participating?
Participants may not have received any direct benefit from taking part. The study may help researchers understand whether mild hyperbaric oxygen therapy could help trained fencers recover from fatigue after competition.
Taking part involved exercise and fencing, which can cause tiredness and physical discomfort. Mild hyperbaric oxygen therapy can also cause discomfort related to changes in air pressure, particularly in the ears and sinuses. Participants were screened before taking part to check that it was safe for them to use the hyperbaric chamber.

Where is the study run from?
The study was run in China by researchers at Tsinghua University in Beijing (China).

When is the study starting and how long is it expected to run for?
The first participants joined the study on 7 April 2026. The study was completed on 25 May 2026, so it ran for about 7 weeks.

Who is funding the study?
The study was funded by the Tsinghua University Initiative Scientific Research Program (China).

Who is the main contact?
Mr Jiakai Tang, tjk25@mails.tsinghua.edu.cn

Contact information

Type(s)
Public, Principal investigator, Scientific

Contact name
Mr Jiakai Tang

ORCID ID
https://orcid.org/0009-0004-6759-4832

Contact details
Division of Sports Science and Physical Education, Tsinghua University, 30 Shuangqing Road, Haidian District
Beijing
China
100084
+86 18981580010
tjk25@mails.tsinghua.edu.cn

Additional identifiers

Study information

Scientific Title

To investigate whether a simulated fencing épée round-robin pool induces subjective mental and physical fatigue and alters autonomic and psychomotor outcomes in tier 3 fencers, and to evaluate whether a 30-min mild hyperbaric oxygen (mHBO) intervention facilitates recovery compared with normobaric passive rest

Study objectives

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 20/03/2026, Tsinghua University Science and Technology Ethics Committee (Medicine) (30 Shuangqing Road, Haidian District, Beijing, 100084, China; +86 10 6279 6175; yandong2012@mail.tsinghua.edu.cn), ref: THU-01-2026-0021

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Placebo

Assignment
Crossover

Purpose
Supportive care

Study type(s)

Health condition(s) or problem(s) studied
Research on warm-up activation and post-exercise fatigue recovery

Interventions
Participants completed a randomized, single-blind, two-condition crossover trial. Each participant completed both the mild hyperbaric oxygen (mHBO) condition and the control condition on separate experimental days, with a washout period of more than 48 h. The order of conditions was determined using a computer-generated randomization sequence.

In each formal experimental session, participants first completed a 35-min standardized warm-up, followed by baseline assessments (T1). They then performed a simulated six-fencer épée round-robin pool consisting of five bouts per participant, with each bout ending when one fencer reached five touches. Post-competition assessments were conducted immediately afterward (T2).

In the mHBO condition, participants underwent approximately 30 min of mild hyperbaric oxygen exposure at 1.3 ATA with an oxygen concentration of approximately 90%, including 5-min compression and 5-min decompression phases. Participants remained seated, breathed oxygen through an individual face mask, and read emotionally neutral material. In the control condition, participants remained seated in the same chamber for an equivalent duration under normobaric conditions (1.0 ATA) without supplemental oxygen and read the same material. Post-intervention assessments were subsequently conducted (T3).

Randomisation process
This study used a randomised, single-blind, two-period crossover design.
The randomisation sequence was generated using the randomizeBE package in R (version 4.4.3).
Participants were randomly assigned to one of two intervention sequences:
• mild hyperbaric oxygen therapy (mHBO) followed by the control condition; or
• the control condition followed by mHBO.
The two experimental sessions were separated by a washout period of more than 48 hours.
No sealed envelopes or online randomisation service were used. The randomisation schedule was generated electronically prior to the experimental sessions.

Intervention Type
Other

Primary outcome(s)
1. Subjective mental fatigue (VAS-MF) measured using a 0–100 digital visual analogue scale (VAS), with 0 indicating "not fatigued at all" and 100 indicating "extremely fatigued" at T1: pre-competition; T2: immediately post-competition; T3: immediately post-intervention/control

2. Subjective physical fatigue (VAS-PF) measured using a 0–100 digital visual analogue scale (VAS), with 0 indicating "not fatigued at all" and 100 indicating "extremely fatigued" at T1: pre-competition; T2: immediately post-competition; T3: immediately post-intervention/control

3. Fencing-specific performance (FST) measured using a 3-min fencing-specific test consisting of 10 reaction-lunge trials. Outcomes included successful hits, missed targets, and mean, minimum, and maximum lunge reaction time. at T1, T2, and T3

Key secondary outcome(s)
1. Root mean square of successive differences (RMSSD) measured using a 3-min seated heart rate variability recording using a Firstbeat wearable device. at T1, T2, and T3

2. Standard deviation of normal-to-normal intervals (SDNN) measured using a 3-min seated heart rate variability recording using a Firstbeat wearable device. at T1, T2, and T3

3. Psychomotor vigilance performance (PVT-B) measured using a 3-min brief psychomotor vigilance test (PVT-B) was administered using the PVT Research Tool smartphone application. Outcomes included performance score and mean, minimum, and maximum reaction time. at T1, T2, and T3

Completion date
25/05/2026

Eligibility

Key inclusion criteria
1. Adult male or female épée fencers who were able to participate normally in fencing training and competition
2. Tier 3 (highly trained/national-level) fencers engaged in regular systematic fencing training
3. No musculoskeletal or sports-related injury that affected normal participation in fencing
4. No known disease or health condition that prevented safe participation in the experimental protocol
5. No use of medications, supplements, alcohol, caffeine, or other substances that could substantially interfere with the experimental outcomes during the required pre-test control period
6. Eligible to undergo mild hyperbaric oxygen exposure based on pre-participation safety screening
7. Voluntary participation with written informed consent

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
18 Years

Upper age limit
25 Years

Sex
All

Total final enrolment
18

Key exclusion criteria
1. Current sports injury or a recent injury that prevented normal participation in fencing training or competition
2. Presence of an acute or chronic health condition that made participation unsafe
3. Use of medications, supplements, alcohol, caffeine, or other substances that could interfere with the experimental outcomes and could not be appropriately controlled before testing
4. Contraindications or intolerance to mild hyperbaric oxygen exposure, including claustrophobia, acute otitis media, or sinusitis
5. Inability to complete the experimental protocol or withdrawal of informed consent

Date of first enrolment
07/04/2026

Date of final enrolment
07/04/2026

Locations

Countries of recruitment
China

Sponsor information

Organisation
Tsinghua University Initiative Scientific Research Program

Funder(s)

Funder type

Funder Name
Tsinghua University Initiative Scientific Research Program

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available