Clinical Trial Protocol
Iranian Registry of Clinical Trials

22 Nov 2026

Investigating the Effect of Combined Training with Blood Flow Restriction and Hypoxia Compared to Each Alone on Selected Indicators of Physical Fitness and Recovery in Boxing Athletes

Protocol summary

Study aim

Comparing effects of 8 weeks of combined BFR+hypoxic training vs each alone on selected physical fitness (aerobic capacity, anaerobic power, speed, strength, endurance) and recovery (fatigue, muscle soreness, sleep quality, heart rate recovery, perceived recovery) in male boxers aged 18-30.

Design

RCT, single-blind (assessors), 4 parallel groups, pre-/post-test, N=44, software randomization, phase N/A.

Settings and conduct

boxing clubs in Tehran, Iran. After screening/consent, 8wk intervention under trainer/physician. Blinded assessments pre-/post-test.

Participants/Inclusion and exclusion criteria

Inclusion criteria: male pro boxers 18-30; ≥3yrs experience; full health; no performance-affecting medications; no seizure or chronic pulmonary disease; no thrombosis or severe varicose veins; consent. Exclusion criteria: chronic cardiac/pulmonary/neurological disease; severe injury in 6mo; head trauma with unconsciousness in 6mo; SpO_2 <88%; hypertension during exercise.

Intervention groups

Combined: 8wk, 3×45min/wk, boxing training with BFR (50-80% AOP) in hypoxia (15-15.5% O_2). BFR: same with BFR in normoxia. Hypoxic: same in hypoxia without BFR. Control: routine boxing.

Main outcome variables

Physical fitness (aerobic by Cooper test; anaerobic by RAST; speed by 20m sprint; strength by bench press; endurance by plank test); recovery (fatigue by MFI; sleep quality by PSQI; muscle soreness by VAS; heart rate recovery; perceived recovery by 0-10 scale).

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20260624069940N7**
Registration date: **2026-08-22, 1405/05/31**
Registration timing: **prospective**

Last update: **2026-08-22, 1405/05/31**
Update count: **0**

Registration date

2026-08-22, 1405/05/31

Registrant information

Name
Atiye Gholizadeh
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Tarbiat modares university
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Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2026-09-01, 1405/06/10

Expected recruitment end date

2026-10-27, 1405/08/05

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title

Investigating the Effect of Combined Training with Blood Flow Restriction and Hypoxia Compared to Each Alone on Selected Indicators of Physical Fitness and Recovery in Boxing Athletes

Public title
Comparison of Combined, Blood Flow Restriction, and Hypoxic Training on Physical Fitness and Recovery in Boxers

Purpose
Supportive

Inclusion/Exclusion criteria

Inclusion criteria:
Male professional boxers aged 18 to 30 years At least 3 years of boxing competition experience Complete general health and no medical restrictions or injuries No use of medications affecting muscle or respiratory function No use of anticoagulants, corticosteroids, or strong stimulant supplements at least 4 weeks prior to the study No history of seizures, migraine with aura, or chronic pulmonary disease (for hypoxia) No history of deep vein thrombosis, grade 3 or higher varicose veins, renal failure, or uncontrolled hypertension (for BFR) Ability to understand and cooperate in performing tests and exercises Signed written informed consent to participate in the study

Exclusion criteria:
Presence of any chronic cardiac, pulmonary, or neurological disease History of severe injury in the past six months preventing exercise History of head trauma resulting in unconsciousness in the past 6 months or any unresolved concussion symptoms Blood oxygen saturation drop below 88% for more than 1 minute despite rest Systolic blood pressure above 180 or diastolic above 110 during exercise

Age
From **18 years** old to **30 years** old

Gender
Male

Phase
N/A

Groups that have been masked

- Outcome assessor

Sample size
Target sample size: **44**

Randomization (investigator's opinion)
Randomized

Randomization description
After initial screening and confirmation of eligibility, eligible participants will be randomly assigned to four groups (Combined, BFR, Hypoxic, and Control) using randomization software. The randomization method is simple randomization with individual as the unit of randomization. No stratification is used. The random sequence is generated by software. Allocation concealment is ensured using sealed envelopes.

Blinding (investigator's opinion)
Single blinded

Blinding description
In this study, due to the nature of the exercise intervention, complete blinding is not possible. However, outcome assessors who are responsible for administering the physical fitness and recovery tests will be blinded to participants' group allocation. Participants, the principal investigator, and trainers are aware of the intervention type. Outcome assessors are blinded through participant coding and lack of access to group allocation information.

Placebo
Not used

Assignment
Parallel

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee
Research Ethics Committee of Tarbiat Modares University

Street address
Shahid Chamran Blvd.

City
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Postal code
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Approval date
2026-07-18, 1405/04/27

Ethics committee reference number
IR.MODARES.REC.1405.122

Health conditions studied

1

Description of health condition studied
Boxing

ICD-10 code
Y93.71

ICD-10 code description
Activity, boxing

Primary outcomes

1

Description
Aerobic Capacity

Timepoint
Before the intervention and after 8 weeks of intervention

Method of measurement
Cooper Test (12-minute run at maximum effort); calculating maximal oxygen consumption based on distance covered using formula: (22.351 × distance in km) - 11.288 (ml/kg/min)

2

Description
Anaerobic Power
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Running-based Anaerobic Sprint Test (six 35-meter sprints at maximum speed with 10 seconds rest between repetitions); calculating peak power, mean power, and fatigue index using standard formulas

3

Description
Speed
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
20-Meter Sprint Test with quick start; recording time using digital stopwatch (in seconds)

4

Description
Muscular Strength
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Bench Press Test; determining the maximum weight that can be lifted in one repetition maximum (in kilograms)

5

Description
Muscular Endurance
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Plank Test; recording the time maintaining the plank position (in seconds)

6

Description
Fatigue
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Multidimensional Fatigue Inventory (20 items in five dimensions: general fatigue, physical fatigue, reduced activity, reduced motivation, and mental fatigue; scored on a 5-point Likert scale; range 20-100, higher score indicates greater fatigue)

7

Description
Sleep Quality
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Pittsburgh Sleep Quality Index (seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction; scored 0-21, score >5 indicates poor sleep quality)

8

Description
Delayed Onset Muscle Soreness
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Visual Analog Scale for pain (10 cm line from 0 = no pain to 10 = worst possible pain)

9

Description
Post-Exercise Heart Rate Recovery
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
Calculating the difference between heart rate immediately after exercise and heart rate one minute after exercise (in beats per minute)

10

Description
Perceived Recovery Status
Timepoint
Before the intervention and after 8 weeks of intervention
Method of measurement
0-10 scale (0 = not recovered at all, 10 = fully recovered)

Secondary outcomes

empty

Intervention groups

1

Description
Intervention group 1 (Combined): Combined training (blood flow restriction and hypoxia) for 8 weeks, three sessions per week, each session lasting 45 minutes. Each session includes 10 minutes of warm-up (light running, dynamic stretching, and shadow boxing), 30 minutes of main exercise (controlled-intensity bag punching, mitt work for reaction speed and accuracy, and plyometric exercises such as depth jumps and medicine ball throws) with BFR cuffs applied to proximal limbs (pressure 50 to 80% of arterial occlusion pressure) in a hypoxic chamber (simulated altitude 2500 to 3000 meters with approximately 15 to 15.5% oxygen), and 5 minutes of cool-down (static stretching and breathing exercises). Exercise intensity will gradually increase over the 8 weeks.
Category
Behavior

2

Description
Intervention group 2 (Blood Flow Restriction): Blood flow restriction training for 8 weeks, three sessions per week, each session lasting 45 minutes. Each session includes 10 minutes of warm-up (light running, dynamic stretching, and shadow boxing), 30 minutes of main exercise (controlled-intensity bag punching, mitt work for reaction speed and accuracy, and plyometric exercises such as depth jumps and medicine ball throws) with BFR cuffs applied to proximal limbs (pressure 50 to 80% of arterial occlusion pressure) in normoxic conditions, and 5 minutes of cool-down (static stretching and breathing exercises). Exercise intensity will gradually increase over the 8 weeks.

Category
Behavior

3

Description
Intervention group 3 (Hypoxic): Hypoxic training for 8 weeks, three sessions per week, each session lasting 45 minutes. Each session includes 10 minutes of warm-up (light running, dynamic stretching, and shadow boxing), 30 minutes of main exercise (controlled-intensity bag punching, mitt work for reaction speed and accuracy, and plyometric exercises such as depth jumps and medicine ball throws) in a hypoxic chamber (simulated altitude 2500 to 3000 meters with approximately 15 to 15.5% oxygen) without BFR cuffs, and 5 minutes of cool-down (static stretching and breathing exercises). Exercise intensity will gradually increase over the 8 weeks.

Category
Behavior

4

Description
Control group: Participants in this group receive no structured training intervention outside their routine boxing training and are asked to continue their normal daily activities and boxing training throughout the 8-week study period. After the study completion, if the interventions prove effective, the beneficial training program will be offered to this group as well.

Category
Other

Recruitment centers

1

Recruitment center

Name of recruitment center
Tarbiat Modares University

Full name of responsible person
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Sponsors / Funding sources

1

Sponsor

Name of organization / entity
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Grant name

Grant code / Reference number

Is the source of funding the same sponsor organization/entity?
Yes

Title of funding source
Tarbiat Modares University

Proportion provided by this source
100

Public or private sector
Public

Domestic or foreign origin
Domestic

Category of foreign source of funding
empty

Country of origin

Type of organization providing the funding
Academic

Person responsible for general inquiries

Contact

Name of organization / entity
Tarbiat Modares University

Full name of responsible person
Moustafa Hadi

Position
PhD Candidate in Exercise Physiology

Latest degree
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Other areas of specialty/work

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Person responsible for updating data

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Sharing plan

Deidentified Individual Participant Data Set (IPD)
Yes - There is a plan to make this available
Study Protocol
Yes - There is a plan to make this available
Statistical Analysis Plan
Yes - There is a plan to make this available
Informed Consent Form
Yes - There is a plan to make this available
Clinical Study Report
Yes - There is a plan to make this available
Analytic Code
No - There is not a plan to make this available
Data Dictionary
Yes - There is a plan to make this available
Title and more details about the data/document
De-identified individual participant data, study protocol, statistical analysis plan, informed consent form, clinical study report, and data dictionary: All collected data related to outcome variables (physical fitness and recovery indices) will be shared completely without identifying information. Documentation regarding methodology, forms used, and analysis plan will also be provided.
When the data will become available and for how long
Six months after publication of study results
To whom data/document is available
Researchers affiliated with reputable academic and scientific institutions who have an approved research proposal by their institutional ethics committee.
Under which criteria data/document could be used
Data may be used solely for research purposes and secondary analyses related to exercise physiology and sports performance. Commercial use of the data is not permitted. All users must adhere to ethical requirements and maintain data confidentiality, and must report any findings from their analyses to the primary authors. Requests must include a detailed description of the project and its objectives.
From where data/document is obtainable
To request data, please contact the corresponding author, Mr. Moustafa Hamed Hadi, via email at Moustafa.hadi@modares.ac.ir. Requests may also be submitted through the Department of Exercise Sciences at Tarbiat Modares University.
What processes are involved for a request to access data/document
Upon submission of a request via email, the corresponding author will review the application. After approval by the university ethics committee, the request will be forwarded to the research team. If finally approved, de-identified data will be provided within two to four weeks via email or a secure data-sharing platform.
Comments

Data will be provided solely for non-commercial purposes, with full adherence to ethical principles and confidentiality of participant information.