

Clinical Trial Protocol

Iranian Registry of Clinical Trials

11 Sep 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; ≥ 3 yrs 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, 3x45min/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

Name of organization / entity

Tarbiat modares university

Country

Iran (Islamic Republic of)

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Recruitment status

recruiting

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

۱۴۱۱۵۱۱۱

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: $(22.351 \times \text{distance in km}) - 11.288$ (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

Master

Other areas of specialty/work

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Person responsible for scientific inquiries

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Person responsible for updating data

Contact

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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.