

Clinical Trial Protocol

Iranian Registry of Clinical Trials

27 Jul 2026

The effect of two resistance training models, rest-pause and superset, on hormones related to hypertrophy and muscle metabolism, delayed onset muscle soreness, and collagen breakdown in untrained men

Protocol summary

Study aim

Determining the effects of two resistance training models—rest-pause and superset—on growth hormone, insulin-like growth factor, the cortisol-to-testosterone ratio, and indices of delayed-onset muscle soreness, anaerobic enzymes, and markers of collagen degradation at 24, 48, and 72 hours post-exercise in non-athletic men.

Design

The clinical trial has two groups: superset and rest pause, with parallel groups, no blinding, randomized, and phase two on 24 participants. The rand function of Excel software will be used for randomization.

Settings and conduct

Body composition, anthropometric indices, and muscular strength will be assessed using the Brzycki 1-RM protocol. Participants will then be assigned to training groups, and SuperSet and Rest-Pause exercises will be performed at intensities of 70–85% of 1-RM. Exercise intensity and perceived pain will be measured using the Borg scale and VAS. Physiological responses, range of motion, and athletic performance will be evaluated up to 72 hours post-exercise.

Participants/Inclusion and exclusion criteria

Inclusion Criteria: Men who have not participated in regular exercise training during the past 4 to 6 months. Men aged 20 to 27 years. Exclusion Criteria: Women and Individuals with a history of regular exercise training. Individuals with musculoskeletal, cardiovascular, or hormonal disorders or injuries. Individuals who use tobacco products.

Intervention groups

Superset Group Rest Pause Group

Main outcome variables

Growth Hormone, IGF-1, Cortisol, Testosterone, Cortisol to Testosterone Ratio, Hydroxylysine and Hydroxyproline, Creatine Kinase, Lactate

Dehydrogenase, Muscle Soreness, Range of Motion, Exercise Performance, Rating of Perceived Exertion(RPE)

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20171009036662N1**

Registration date: **2026-01-07, 1404/10/17**

Registration timing: **prospective**

Last update: **2026-01-07, 1404/10/17**

Update count: **0**

Registration date

2026-01-07, 1404/10/17

Registrant information

Name

Name of organization / entity

Country

Iran (Islamic Republic of)

Phone

+98 13 3369 0685

Email address

mehrabanij@guilan.ac.ir

Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2026-01-21, 1404/11/01

Expected recruitment end date

2026-03-21, 1405/01/01

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title

The effect of two resistance training models, rest-pause and superset, on hormones related to hypertrophy and muscle metabolism, delayed onset muscle soreness, and collagen breakdown in untrained men

Public title

The effect of two resistance training models on hormones, muscle performance, and delayed onset muscle soreness in untrained men

Purpose

Education/Guidance

Inclusion/Exclusion criteria**Inclusion criteria:**

man not trained in 4-6 months men aged 20 to 27 years, inclusive

Exclusion criteria:

skeletal, muscular, cardiovascular, or hormonal disorders women and trained individuals smokers

Age

From **20 years** old to **27 years** old

Gender

Male

Phase

N/A

Groups that have been masked

No information

Sample size

Target sample size: **24**

Randomization (investigator's opinion)

Randomized

Randomization description

Participants will be randomly assigned to either the first intervention group or the second intervention group using a random number table. To ensure allocation concealment, sealed, opaque, and sequentially numbered envelopes will be used so that neither the researcher nor the participants are aware of the assigned group until each individual is enrolled in the study. Group allocation will be performed with a 1:1 ratio.

Blinding (investigator's opinion)

Not blinded

Blinding description**Placebo**

Not used

Assignment

Parallel

Other design features**Secondary Ids**

empty

Ethics committees**1****Ethics committee**

Name of ethics committee

Ethics committee in biomedical research of Guilan University

Street address

Guilan University, 5th kilometer of Persian Gulf Highway, Rasht, Guilan Province, Iran

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Rasht

Province

Guilan

Postal code

4199613776

Approval date

2025-11-03, 1404/08/12

Ethics committee reference number

IR.GUILAN.REC.1404.131

Health conditions studied**1****Description of health condition studied**

The effect of two resistance training models, rest-pause and superset, on hormones related to hypertrophy and muscle metabolism, delayed onset muscle soreness, and collagen breakdown in untrained men

ICD-10 code**ICD-10 code description****Primary outcomes****1****Description**

Growth Hormone (GH)

Timepoint

Before the exercise and immediately after the exercise

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

2**Description**

Insulin-like Growth Factor (IGF-1)

Timepoint

Before the exercise and immediately after the exercise

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

3**Description**

Cortisol

Timepoint

Before the exercise and immediately after the exercise

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

4

Description

Testosterone

Timepoint

Before the exercise and immediately after the exercise

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

5

Description

Lactate

Timepoint

Before the exercise and immediately after the exercise

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

6

Description

Creatine Kinase (CK)

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

7

Description

Lactate Dehydrogenase (LDH)

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

8

Description

Hydroxy lysine

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

9

Description

Hydroxy proline

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Blood samples from the brachial vein in a seated position, following standard hygienic procedures.

10

Description

Rating of Perceived Exertion(RPE)

Timepoint

During the activity, immediately after the activity, and 24, 48, and 72 hours after completing the activity

Method of measurement

Using the Borg scale

11

Description

Muscle soreness

Timepoint

During the activity, immediately after the activity, and 24, 48, and 72 hours after completing the activity

Method of measurement

Using the Visual Analogue Scale(VAS)

12

Description

Range of Motion(ROM)

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Using a protractor

13

Description

Exercise Performance

Timepoint

Before the activity and 24, 48, and 72 hours after completing the activity

Method of measurement

Using the leg press and chest press machines

Secondary outcomes

empty

Intervention groups

1

Description

Intervention group: The resistance training program will be performed using a superset method at an intensity of 75% of 1-RM. Participants will perform the training session with 10 minutes of warm-up prior to the exercise and 10 minutes of cool-down following the exercise. A total of eight exercises will be included: bench press, reverse-grip lat pulldown, leg extension, leg curl, good morning, Bulgarian squat, biceps curl, and cable triceps extension. The execution tempo will be controlled so that the concentric phase lasts 2 seconds and the eccentric phase lasts 3 seconds. In this training system, two exercises will be performed consecutively as a superset, with each exercise consisting of four sets, and 16, 16, 20, and 24 repetitions per set for both exercises. A 90-

second rest interval within each set between the paired exercises and a 2-minute rest period after completion of each superset pair will be provided.

Category

Other

2

Description

Intervention group: The rest-pause resistance training protocol will be performed using free weights, targeting large muscle groups at an intensity of 85% of one-repetition maximum (1-RM). Participants will complete 10 minutes of warm-up before and 10 minutes of cool-down after the training session. A total of eight exercises will be performed, including bench press, reverse-grip lat pulldown, leg extension, leg curl, good morning, Bulgarian squat, biceps curl, and triceps pushdown using a cable machine. The execution tempo will be controlled so that the concentric contraction lasts 2 seconds and the eccentric phase lasts 3 seconds. In this resistance training protocol, each exercise will be performed once (18 total repetitions), divided into three rest-pause sets (4-6-8 repetitions). A 10-second intra-set rest will be provided between segments, and a 2-minute rest period will be allocated between exercises.

Category

Other

Recruitment centers

1

Recruitment center

Name of recruitment center

University of Guilan

Full name of responsible person

Ali Basti

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Guilan University, 5th kilometer of Persian Gulf Highway, Rasht, Guilan Province, Iran

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Sponsors / Funding sources

1

Sponsor

Name of organization / entity

Iran National Science Foundation

Full name of responsible person

Ali Mohammad Soltani

Street address

No. 33, 5th St., North Karegar Ave., Tehran

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Tehran

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Phone

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Email

azimi.o@insf.org

Web page address

<https://insf.org/fa>

Grant name

Grant code / Reference number

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

Yes

Title of funding source

Iran National Science Foundation

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

The University of Guilan

Full name of responsible person

Pegah Movahedpour

Position

Masters Student

Latest degree

Bachelor

Other areas of specialty/work

Sport Physiology

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Person responsible for scientific

inquiries

Contact

Name of organization / entity

The University of Guilan

Full name of responsible person

Javad Mehrabani

Position

Associate Professor

Latest degree

Ph.D.

Other areas of specialty/work

Sport Physiology

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Person responsible for updating data

Contact

Name of organization / entity

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Full name of responsible person

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Latest degree

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Other areas of specialty/work

Sport Physiology

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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

Yes - There is 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

All data on measured variables can be shared after de-identifying the participants.

When the data will become available and for how long

Data Access begins from 2026

To whom data/document is available

Only for researchers affiliated with academic and scientific institutions

Under which criteria data/document could be used

Scientific use in improvement and comparison with other studies is permitted.

From where data/document is obtainable

Email address for correspondence with the researcher to obtain necessary information: Mehrabanij@guilan.ac.ir

What processes are involved for a request to access data/document

The applicant must send the reason for using the documents via email, and after being reviewed by the researcher, a response will be provided as soon as possible Mehrabanij@guilan.ac.ir

Comments