Clinical Trial Protocol
Iranian Registry of Clinical Trials

10 Jun 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
City
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

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

City
Rasht

Province
Guilan

Postal code
4199613776

Phone
+98 13 3369 0274

Email
basti@guilan.ac.ir

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

City
Tehran

Province
Tehran

Postal code
1439634665

Phone
+98 21 8216 1000

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

Street address
5th Kilometer of Persian Gulf Highway, Rasht, Guilan Province, Iran

City
Rasht

Province
Guilan

Postal code
4199613776

Phone
+98 13 3369 0274

Email
pmovahedpour@webmail.ac.ir

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

Street address
5th Kilometer of Persian Gulf Highway, Rasht, Guilan Province, Iran

City
Rasht

Province
Guilan

Postal code
4199613776

Phone
+98 13 3369 0685

Fax
+98 13 3369 0675

Email
mehrabanij@guilan.ac.ir

Person responsible for updating data

Contact

Name of organization / entity
The University of Guilan

Full name of responsible person
Vida Alipour

Position
Masters Student

Latest degree
Bachelor

Other areas of specialty/work
Sport Physiology

Street address
5th Kilometer of Persian Gulf Highway, Rasht, Guilan Province, Iran

City
Rasht

Province
Guilan

Postal code
4199613776

Phone
+98 13 3333 0146

Email
vida.alipour79@webmail.guilan.ac.ir

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