Clinical Trial Protocol
Iranian Registry of Clinical Trials

07 Nov 2026

Effect of 12 Weeks of Progressive Resistance Training on Sex- and Fiber Type-Dependent Hypertrophy and Molecular Regulators in Young Adults

Protocol summary

Study aim
To determine whether 12 weeks of progressive resistance training elicits sex- and fiber type-dependent changes in muscle fiber cross-sectional area and selected molecular regulators in young adults.

Design
A prospective, randomized, controlled, 2x2 factorial trial stratified by sex with parallel groups. Participants will randomized using a computer-generated random number sequence with a 1:1 allocation ratio. Allocation will concealed using sequentially numbered, opaque, sealed envelopes. Outcome assessors will be blinded to group allocation. Sample size: 120 participants (n=30 per group).

Settings and conduct
The study will be conducted at the Exercise Physiology Laboratory of Ragheb Isfahani Higher Education Institute, Isfahan, Iran. Participants will undergo vastus lateralis biopsies pre-intervention and 72 hours post-intervention. Muscle fibers will manually isolated and typed by SDS-PAGE. Cross-sectional area will assessed histologically using immunohistochemistry. Fiber type-specific pooled samples will analyzed for protein abundance and phosphorylation by Western blotting, and gene expression by RT-qPCR.

Participants/Inclusion and exclusion criteria
Recreationally active adults aged 20-30 years; BMI 18.5-29.9 kg/m2; no structured resistance training in the prior 12 months; exclusion criteria: smoking; pregnancy; musculoskeletal disorders; supplement use.

Intervention groups
Group 1 (Resistance Training): 60 participants (30 men, 30 women) will complete supervised progressive resistance training three times per week for 12 weeks with periodized loading. Group 2 (Control): 60 participants (30 men, 30 women) received no training intervention.

Main outcome variables
Muscle fiber cross-sectional area of type I and II fibers; protein abundance and phosphorylation

General information

Reason for update

Acronym

IRCT registration information
IRCT registration number: **IRCT20211103052956N3**
Registration date: **2026-10-18, 1405/07/26**
Registration timing: **registered_while_recruiting**

Last update: **2026-10-18, 1405/07/26**
Update count: **0**

Registration date
2026-10-18, 1405/07/26

Registrant information

Name
Saeid Rostami
Name of organization / entity
Ragheb Isfahani higher education institute
Country
Iran (Islamic Republic of)
Phone
+98 31 3368 9040
Email address
srostami.20@gmail.com

Recruitment status
recruiting

Funding source

Expected recruitment start date
2026-10-12, 1405/07/20

Expected recruitment end date
2026-11-11, 1405/08/20

Actual recruitment start date
empty

Actual recruitment end date
empty

Trial completion date
empty

Scientific title
Effect of 12 Weeks of Progressive Resistance Training on Sex- and Fiber Type-Dependent Hypertrophy and Molecular Regulators in Young Adults

Public title
Resistance Training and Muscle Fiber Adaptation
Purpose
Basic scienece
Inclusion/Exclusion criteria
Inclusion criteria:
Recreationally active adults aged 20-30 years BMI between 18.5 and 29.9 kg/m2 No structured resistance training in the prior 12 months
Exclusion criteria:
Smoking Pregnancy Musculoskeletal disorders Supplement use
Age
From **20 years** old to **30 years** old
Gender
Both

Phase
N/A
Groups that have been masked

- Investigator

Sample size
Target sample size: **120**
Randomization (investigator's opinion)
Randomized
Randomization description
Single blind
Blinding (investigator's opinion)
Single blinded
Blinding description
single blind
Placebo
Not used
Assignment
Parallel
Other design features
This is a prospective, randomized, controlled, 2x2 factorial trial stratified by sex.Group (training vs control) and sex (men vs women) will between-subject factors. Time (pre vs post) and fiber type (Type I vs II) will be within-subject factors.

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Ethics Committee of Islamic Azad University, Isfahan Branch
Street address
Bassij
City
Isfahan
Province
Isfehan
Postal code
8316717492
Approval date
2026-08-01, 1405/05/10
Ethics committee reference number
IR.KHUISF.REC.1405.149

Health conditions studied

1

Description of health condition studied
Healthy skeletal muscle adaptation to resistance training
ICD-10 code
ICD-10 code description

Primary outcomes

1

Description
Cross-sectional area of Type I muscle fibers
Timepoint
Before the intervention (baseline) and 72 hours after the final training session
Method of measurement
Immunohistochemistry on transverse cryosections using myosin heavy chain isoform-specific antibodies, quantified with CellSens software

Secondary outcomes

empty

Intervention groups

1

Description
Intervention group: Participants in the resistance training group will complete a supervised progressive resistance training program three times per week for 12 weeks with periodized loading. Weeks 1-4: 3 sets of 12 repetitions at 60% of one-repetition maximum. Weeks 5-8: 4 sets of 10 repetitions at 70% of one-repetition maximum. Weeks 9-12: 5 sets of 8 repetitions at 80% of one-repetition maximum. Exercise selection will include leg press, knee extension, leg curl, chest press, seated row, shoulder press, lat pulldown, biceps curl, triceps extension, and abdominal exercises. All training sessions will be supervised by certified exercise physiologists. Adherence exceede 95%.
Category
Other

2

Description
Control group: Participants in the control group will receive no intervention during the 12-week study period and will instructed to maintain their usual physical activity and daily lifestyle habits. They will asked not to change their physical activity level during the study.
Category
Other

Recruitment centers

1

Recruitment center
Name of recruitment center
Ragheb Isfahani higher education institute
Full name of responsible person
Saeid Rostami
Street address
Bassij
City
Isfahan
Province
Isfehan
Postal code
813659784
Phone
+98 31 3368 7040
Email
srostami.20@gmail.com

Sponsors / Funding sources

1

Sponsor
Name of organization / entity
Ragheb Isfahani higher education institute
Full name of responsible person
Saeid Rostami
Street address
Isfahan
City
Isfahan
Province
Isfehan
Postal code
1111111111
Phone
+98 31 4522 9250
Email
srostami.20@gmail.com
Grant name
Grant code / Reference number
Is the source of funding the same sponsor organization/entity?
Yes
Title of funding source
Ragheb Isfahani higher education institute
Proportion provided by this source
100
Public or private sector
Private
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
Ragheb Isfahani higher education institute
Full name of responsible person
Saeid Rostami
Position
faculty member
Latest degree
Ph.D.
Other areas of specialty/work
Sport Medicine
Street address
Isfahan
City
Isfahan
Province
Isfehan
Postal code
1111111111
Phone
+98 31 4522 9250
Email
srostami.20@gmail.com

Person responsible for scientific inquiries

Contact
Name of organization / entity
Ragheb Isfahani higher education institute
Full name of responsible person
Saeid Rostami
Position
Faculty member
Latest degree
Ph.D.
Other areas of specialty/work
Sport Medicine
Street address
Isfahan
City
Isfahan
Province
Isfehan
Postal code
1111111111
Phone
+98 31 4522 9250
Email

srostami.20@gmail.com

Person responsible for updating data

Contact

Name of organization / entity
Ragheb Isfahani higher education institute

Full name of responsible person
Saeid Rostami

Position
Faculty member

Latest degree
Ph.D.

Other areas of specialty/work
Sport Medicine

Street address
Isfahan

City
Isfahan

Province
Isfehan

Postal code
1111111111

Phone
+98 31 4522 9250

Email
srostami.20@gmail.com

Sharing plan

Deidentified Individual Participant Data Set (IPD)
Yes - There is a plan to make this available

Study Protocol
No - There is not a plan to make this available

Statistical Analysis Plan
No - There is not a plan to make this available

Informed Consent Form
No - There is not a plan to make this available

Clinical Study Report
No - There is not a plan to make this available

Analytic Code
No - There is not a plan to make this available

Data Dictionary
No - There is not a plan to make this available

Title and more details about the data/document
De-identified individual participant data that underlie the results reported in this article

When the data will become available and for how long
Beginning 12 months after publication of the article and ending 36 months after publication

To whom data/document is available
Researchers affiliated with academic or scientific institutions who provide a methodologically sound research proposal

Under which criteria data/document could be used
Data will be shared for the purpose of reproducing the reported results or conducting secondary analyses. Requests must include a detailed research proposal, and a data sharing agreement must be signed. Data will be transferred via a secure electronic platform. The original research team must be acknowledged in any resulting publication.

From where data/document is obtainable
Saeid Rostami, Raghob Isfahani Higher Education Institute, Isfahan, Iran. Email: srostami.20@gmail.com. Tel: 00989131088601.

What processes are involved for a request to access data/document
Interested researchers should submit a written request to the corresponding author via email, including a brief research proposal and the intended use of the data. The request will be reviewed by the principal investigator and the ethics committee within 4 weeks. If approved, a data sharing agreement will be signed, and de-identified data will be transferred via a secure platform within 2 weeks after signing the agreement.

Comments
The data are not publicly available due to participant privacy. However, de-identified data may be available from the corresponding author upon reasonable request, subject to institutional and ethical approvals.