Clinical Trial Protocol
Iranian Registry of Clinical Trials

07 Nov 2026

The Effect of Combined Aerobic–Resistance Training with Leucine-Enriched Whey Protein Supplementation on Muscle-Derived Exosomal microRNAs and Muscle Functional Indices in Older Adults Aged 60–70 Years

Protocol summary

Study aim

To investigate the effect of combined aerobic-resistance training combined with leucine-rich whey protein supplementation on the expression of these microRNAs and muscle function in elderly men aged 60 to 70 years.

Design

The statistical population of the present study includes all elderly men aged 60 to 70 years living in Ahvaz city who have visited the city's sports and rehabilitation centers in the first six months of 1404.

Settings and conduct

In the present study, the effect of the independent variable (combined aerobic-resistance training with leucine-rich whey protein supplementation) on the dependent variables (levels of muscle-derived exosomal miR-1, miR-133a, and miR-206 and muscle function indices) was investigated.

Participants/Inclusion and exclusion criteria

Inclusion criteria: 1. Age range 60 to 70 years 2. Not participating in regular exercise programs (at least two sessions per week) in the past six months Exclusion criteria: 1. Missing more than two consecutive exercise sessions or more than 20% of the total exercise sessions during the study period 2. Having acute illnesses or exacerbation of chronic illnesses during the study period

Intervention groups

1. Exercise group: Combined aerobic-resistance training (no supplementation) 2. Supplementation group: Leucine-rich whey protein supplement (no exercise) 3. Exercise + Supplementation group: Combined aerobic-resistance training with Leucine-rich whey protein supplement 4. Control group: No exercise and no supplementation

Main outcome variables

Independent variable: • Combined aerobic-resistance training (8 weeks, three sessions per week) • Leucine-rich whey protein supplement (8 weeks, one serving per day) Dependent variables: • Muscle-derived exosomal miR-1 (relative expression) • Muscle-derived exosomal miR-133a (relative expression)

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20260821070744N1**
Registration date: **2026-09-05, 1405/06/14**
Registration timing: **retrospective**

Last update: **2026-09-05, 1405/06/14**
Update count: **0**

Registration date

2026-09-05, 1405/06/14

Registrant information

Name

Navid نوروزی

Name of organization / entity

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Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2026-04-09, 1405/01/20

Expected recruitment end date

2026-05-10, 1405/02/20

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title

The Effect of Combined Aerobic–Resistance Training with Leucine-Enriched Whey Protein Supplementation on Muscle-Derived Exosomal microRNAs and Muscle Functional Indices in Older Adults Aged 60–70 Years

Public title

Effects of Combined Training and Leucine-Enriched Whey Protein on MyomiRs and Muscle Function in Older Adults

Purpose

Supportive

Inclusion/Exclusion criteria

Inclusion criteria:

1. Age range 60-70 years2. Not participating in regular exercise programs (at least two sessions per week) in the past six months3. Score above 21 on the Mini-Mental State Examination4. Ability to walk independently without assistance or assistive devices5. Obtaining approval from a physician to participate in the exercise program6. Signing a written informed consent form

Exclusion criteria:

1. Absence of more than two consecutive training sessions or more than 20% of all training sessions during the study period2. Acute illness or exacerbation of chronic illness during the study period3. Starting to take drugs that affect muscle mass (such as corticosteroids, anabolic steroids, growth hormone) during the study4. Personal desire to withdraw from the study5. Hospitalization for any reason during the study period6. Occurrence of any musculoskeletal injury caused by training that prevents continuation of training7. Significant decline in cognitive status (decrease of more than 3 points in MMSE or score below 21)

Age

From **60 years** old to **70 years** old

Gender

Male

Phase

1

Groups that have been masked

- Participant

Sample size

Target sample size: **40**

Randomization (investigator's opinion)

Randomized

Randomization description

In this study, a quasi-randomized method based on alternating allocation based on the order of referral was used. Participants were randomly assigned to four groups (exercise, supplement, exercise + supplement, and control) in the order of study entry. The randomization unit was individual and stratification was not used due to the homogeneity of the participants. To conceal allocation, the allocation sequence was kept in opaque, numbered envelopes by someone independent of the researcher.

Blinding (investigator's opinion)

Single blinded

Blinding description

This study was designed as a single-blind study. Given the open-label nature of the exercise interventions and supplement use, blinding of participants and exercise trainers was not possible, and participants were aware of their intervention group. However, the outcome assessors and data analysts were kept completely blind to the group allocation of participants. All anthropometric measurements, muscle performance indices, and Real-Time PCR tests were performed by independent, trained assessors who were unaware of the grouping of participants. Blood samples and performance data were sent to the laboratory and statistical analyst with only specific codes (without mentioning the participant's name or group). The data analyst was also informed of the data grouping after the statistical analyses were completed and the final results were extracted. The principal investigator was unaware of the group allocation of participants until the intervention was completed and data were collected. This method minimised detection and analysis bias in accordance with the CONSORT 2010 statement and IRCT guidelines.

Placebo

Used

Assignment

Parallel

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee

کمیته اخلاق در پژوهش دانشگاه آزاد اسلامی واحد اهواز

Street address

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Postal code

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Approval date

2026-03-05, 1404/12/14

Ethics committee reference number

IR.IAU.AHVAZ.REC.1405.391

Health conditions studied

1

Description of health condition studied
Elderly
ICD-10 code
Z00.0
ICD-10 code description
Encounter for general adult medical examination

Primary outcomes

1

Description
Row Title Variable Type Measurement Time1 Relative expression of primary miR-1 before and 48 hours after intervention2 Relative expression of primary miR-133a before and 48 hours after intervention3 Relative expression of primary miR-206 before and 48 hours after intervention4 Secondary grip strength before and 48 hours after intervention5 Secondary sit-to-stand 30 seconds before and 48 hours after intervention6 Secondary TUG test before and 48 hours after intervention7 Secondary Myostatin/IGF-1 ratio before and 48 hours after intervention
Timepoint
Time Period Description Time IntervalPretest One week before the start of the intervention Week 0Posttest 48 hours after the last training session (end of week 8) Week 8
Method of measurement
Row Title Variable Measurement Instrument1 Relative expression of miR-1 Real-Time PCR with ABI Step One Plus, normalized with U6 snRNA2 Relative expression of miR-133a Real-Time PCR with ABI Step One Plus, normalized with U6 snRNA3 Relative expression of miR-206 Real-Time PCR with ABI Step One Plus, normalized with U6 snRNA4 Grip strength Takei digital handheld dynamometer, Japan5 30-second sit-to-stand test Standard chair (height 43 cm) and digital stopwatch6 TUG test Digital stopwatch, distance 3 m

Secondary outcomes

empty

Intervention groups

1

Description
Intervention group: Control Group:Participants in the control group will not receive any regular exercise program (aerobic, resistance, or combined) during the 8-week study period and will not take any whey protein supplements or other nutritional supplements. These individuals are asked to maintain their usual lifestyle and refrain from starting any new exercise programs or taking new supplements during the study period. After the study period and final measurements are completed, in order to comply with research ethics, the same exercise program as the intervention groups will be provided to the control group individuals.Intervention Group One (Combined Exercise Group):Participants in this group will participate in a combined aerobic-resistance exercise program, 3 sessions per week (Sunday, Tuesday, and Thursday) for 8 weeks. Each workout lasts 60 to 75 minutes and consists of three main parts:Warm-up (10 minutes): Includes 5 minutes of light-intensity aerobic activity (stationary bike or treadmill walking at a Borg intensity of 3 to 4) and 5 minutes of dynamic stretching.Main workout (50 minutes): Includes two separate parts:Resistance training (25 to 30 minutes): Includes 8 multi-joint movements for the major muscle groups (chest, shoulders, back, arms, thighs, and abs) including: dumbbell bench press, dumbbell shoulder press, lat pull-up (with resistance band), dumbbell biceps curl, dumbbell biceps curl, bodyweight squat, lunge, and plank. Workout intensity is determined based on percentage of one repetition maximum (1RM) and gradually increases from 50-60% of 1RM in the first and second weeks to 75-80% of 1RM in the seventh and eighth weeks. Each exercise is performed in 3 sets, each set consisting of 10 to 12 repetitions. Rest time between sets is 60 to 90 seconds and between exercises is 90 to 120 seconds.Aerobic exercise (20 to 25 minutes): Performed on a treadmill. Exercise intensity is determined based on the percentage of maximum heart rate reserve (HRR) using the Karonen formula and increases from 50-60% HRR in weeks 1 to 4 to 60-70% HRR in weeks 5 to 8. Aerobic exercise duration also increases from 20 minutes in week 1 to 25 minutes in week 8. Heart rate is monitored during sessions using a chest heart rate sensor (Polar).Cool down (10 minutes): Includes 5 minutes of very light walking and 5 minutes of static stretching for the main muscles involved.Intervention group 2 (leucine-enriched whey protein supplement group):Participants in this group received one serving of leucine-enriched whey protein supplement branded FortiFit® (ActiSyn™) (manufactured by Nutricia, Netherlands/France) daily for 8 weeks. Each serving of the supplement contained 20 g of whey protein powder, equivalent to 21 g of protein and containing 3 g of leucine and 800 IU of vitamin D. This supplement was dissolved in 200 to 300 ml of water and consumed on non-training days, on an empty stomach or between meals. Participants in this group did not receive any training program.Intervention group 3 (combined exercise + supplement group):Participants in this group received both of the above interventions simultaneously:1. Combined aerobic-resistance training program for 8 weeks, 3 sessions per week (according to the full description of the first intervention group).2. Leucine-rich whey protein supplement for 8 weeks, one serving daily (as per the full description of the second intervention group). On training days, the supplement is consumed up to 30 minutes after the end of the training session, and on non-training days, it is consumed on an empty stomach or between meals.
Category
Prevention

Recruitment centers

1

Recruitment center

Name of recruitment center
Selected sports and rehabilitation centers in Ahvaz city

Full name of responsible person
Navid Nowrozi

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Sponsors / Funding sources

1

Sponsor

Name of organization / entity
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Grant name
0

Grant code / Reference number
0

Is the source of funding the same sponsor organization/entity?
No

Title of funding source
Islamic azad university

Proportion provided by this source
100

Public or private sector
Private

Domestic or foreign origin
Foreign

Category of foreign source of funding
UN agencies and international organizations

Country of origin

Type of organization providing the funding
Academic

Person responsible for general inquiries

Contact

Name of organization / entity
Islamic Azad University

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Position
Master student

Latest degree
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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
No - There is not 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
General information and result are presentein the text of the thesis and article

When the data will become available and for how long
6 months after the student's defense

To whom data/document is available
The data will be published in the form of research findings and will be available for everyone to use

Under which criteria data/document could be used
The use of the results is permitted provided that the source is properly cited.

From where data/document is obtainable
The journal or journals in which the results will be published

What processes are involved for a request to access data/document
The process of publishing the article in journals

Comments
0