Clinical Trial Protocol
Iranian Registry of Clinical Trials

10 Jun 2026

Plyometric-jump training with versus without unstable load to improve physical fitness in trained young volleyball players: a randomized controlled trial

Protocol summary

Study aim
Examination and comparison of the effects of plyometric jump training with unstable load versus plyometric jump training without unstable load on physical fitness indices in trained young volleyball players

Design
A controlled clinical trial with parallel groups, single-blind, randomized, phase 2, conducted on 37 subjects. Randomization was performed using the RAND function in Excel software.

Settings and conduct
A single-blind, parallel randomized controlled trial was conducted at Shahid Beheshti University's Sports Science Laboratory and a volleyball gym. Participants were randomly assigned to three groups for a 4-week intervention (three sessions/week). Participants were unaware of their group allocation, and data analysis was performed by an independent, blinded analyst.

Participants/Inclusion and exclusion criteria
Trained male adolescent volleyball players (average age 17 years) with ≥2 years of experience in school or Tehran league competitions and ≥6 hours of weekly volleyball training were included. Inclusion criteria: good health, no training restrictions, and written consent from players and parents. Exclusion criteria: history of acute or chronic musculoskeletal injuries.

Intervention groups
Intervention Group 1 (UL-PJT) Participants underwent 4 weeks (3 sessions/week) of plyometric jump training with an unstable load (10% body weight, using barbell + water-filled gym balls). Training included consecutive jumps over 35–50 cm obstacles, progressing from 48 to 104 jumps per session. Work-to-rest ratio was 1:7, with 2-minute rest intervals. Sessions lasted 15–25 minutes. Intervention Group 2 (S-PJT) Same protocol as UL-PJT but without unstable load. Control Group (CON) Participants continued regular volleyball training for 4 weeks without additional plyometric exercises.

Main outcome variables
Jump performance، Muscle strength، Balance performance

General information

Reason for update

Acronym
UL-PJT = unstable loaded plyometric-jump training

IRCT registration information
IRCT registration number: **IRCT20250905067129N1**
Registration date: **2025-09-15, 1404/06/24**
Registration timing: **retrospective**

Last update: **2025-09-15, 1404/06/24**
Update count: **0**

Registration date
2025-09-15, 1404/06/24

Registrant information

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Shahid Beheshti University

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Recruitment status
Recruitment complete

Funding source

Expected recruitment start date
2025-04-21, 1404/02/01

Expected recruitment end date

2025-05-24, 1404/03/03

Actual recruitment start date

2025-04-21, 1404/02/01

Actual recruitment end date

2025-05-24, 1404/03/03

Trial completion date

2025-05-24, 1404/03/03

Scientific title

Plyometric-jump training with versus without unstable load to improve physical fitness in trained young volleyball players: a randomized controlled trial

Public title

Plyometric-jump training with unstable load

Purpose

Supportive

Inclusion/Exclusion criteria

Inclusion criteria:

At least 2 years of experience competing in Tehran volleyball school competitions or Tehran league competitions. Their specific sports training volume is ≥6 hours per week. Boys age range 14 to 18 years. No cardiovascular problems. Avoiding the use of stimulants and certain medications (steroids) No smoking or drinking alcohol.

Exclusion criteria:

A history of acute or chronic musculoskeletal injury/disorders of the ankle, knees, or lower back. Training volume less than 6 hours per week. Age above 18 and below 14. History of cardiovascular disease and problems in the participant. Taking steroid medications. Tobacco and alcohol consumption. Experience of participating in competitions for more or less than 2 years.

Age

From **14 years** old to **18 years** old

Gender

Male

Phase

N/A

Groups that have been masked

- Participant
- Data analyser

Sample size

Target sample size: **30**

Actual sample size reached: **37**

Randomization (investigator's opinion)

Randomized

Randomization description

In this study, the allocation of participants to groups was performed using a combined approach of pair-matching and simple randomization in order to both reduce baseline heterogeneity between groups and ensure true randomization. First, all participants were matched in pairs based on their baseline performance in the Jump-and-Reach test, so that individuals with similar jump ability were grouped together. This pair-matching procedure was applied to achieve a more balanced distribution of baseline jumping ability across groups. Within each pair, participants were then assigned to the study groups using simple randomization. The random sequence was generated with Microsoft Excel using the RAND() function. Each participant received a random number, and after sorting these numbers in ascending order, participants were allocated to one of the three study groups: 1.Unstable Load Plyometric Jump Training (UL-PJT), 2.Stable Plyometric Jump Training without additional load (S-PJT), and 3. Active Control (CON). The unit of randomization was individual-based. The randomization sequence was generated and kept by a researcher who was not involved in data collection or analysis. To maintain allocation concealment and prevent any potential selection bias, the randomization codes were placed in opaque, sealed, and sequentially numbered envelopes, which were opened only at the time of participant assignment. Thus, the randomization procedure in this trial ensured both a reduction in baseline heterogeneity across groups and the preservation of a truly random allocation process.

Blinding (investigator's opinion)

Single blinded

Blinding description

This trial was conducted with a single-blind design. Participants were not informed about their group allocation or the specific differences between interventions. In addition, data analysis was performed by an independent statistical consultant who was blinded to group assignments. However, due to the nature of the intervention and the need for close supervision during exercise sessions and testing, the investigator responsible for conducting the interventions and outcome assessments was aware of group allocation. Therefore, blinding was ensured at the level of participants and data analysis, while assessor blinding was not feasible.

Placebo

Not used

Assignment

Parallel

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee

Research Ethics Committee of Shahid Beheshti University

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Ethics Committee in Biomedical Research, Shahid Beheshti University, Shahid Shahriari Square, Daneshjoo Boulevard, Evin.

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Approval date

2025-04-19, 1404/01/30

Ethics committee reference number

IR.SBU.REC.1404.006

Health conditions studied

1

Description of health condition studied

ICD-10 code

ICD-10 code description

Primary outcomes

1

Description

Jump-and-reach height

Timepoint

1. Initial measurement (pre-test) of jump and reach height in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

For J&R, standing reach height was initially assessed during upright erect standing with both feet in lateral position close to a wall, the dominant arm fully extended in upright direction and the fingers touch-ing a wall-mounted touch-sensitive sensor connected to a digital display (Sargent jump device, Danesh Salar Iranian, Iran). Subsequently, participants performed a countermovement (i.e., knee and hip flexion) with arm swing immediately followed by a rapid and powerful vertical jump. The participants' task was to touch the wall-mounted scale during flight time at the highest position with their middle finger.

2

Description

Drop jump

Timepoint

1. Initial measurement (pre-test) of drop jump in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

Drop jumps were performed with the participants stepping off a 40 cm box, landing on firm floor, and immediately jumping as high as possible. Participants were instructed to touch the wall-mounted scale during the flight at the highest position. Jump height was defined as the difference between standing reach height and jumping reach height.

3

Description

Knee flexion/extension peak isokinetic torque

Timepoint

1. Initial measurement (pre-test) of Knee flexion/extension peak isokinetic torque in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

The Knee flexion/extension peak isokinetic torque in the dominant leg was measured using the Biodex Multi-Joint System 4 Pro (Biodex Medical System Inc., USA). Leg dominance was determined based on the lateral preference questionnaire. The device was calibrated before each test. Participants were seated with a hip joint angle of 80 degrees and secured with straps around the upper body and pelvis. The shank of the dominant leg was attached to the dynamometer lever to record the torque generated by the muscles. The knee joint range of motion was set between 10 and 100 degrees (0 degrees = full extension). The test consisted of three sets of five maximal knee flexion–extension movements at an angular velocity of 60 degrees/second. The rest interval between sets was 180 seconds. For the final analysis, the average of the three sets was calculated.

4

Description

Knee flexion/extension time to peak isokinetic torque

Timepoint

1. Initial measurement (pre-test) of Knee flexion/extension time to peak isokinetic torque in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

The Knee flexion/extension time to peak isokinetic torque in the dominant leg was measured using the Biodex Multi-Joint System 4 Pro (Biodex Medical System Inc., USA). Leg dominance was determined based on the lateral preference questionnaire. The device was calibrated before each test. Participants were seated with a hip joint angle of 80 degrees and secured with straps around the upper body and pelvis. The shank of the dominant leg was attached to the dynamometer lever to record the torque generated by the muscles. The knee joint range of motion was set between 10 and 100 degrees (0 degrees = full extension). The test consisted of three sets of five maximal knee flexion–extension movements at an angular velocity of 60 degrees/second. The rest interval between sets was 180 seconds. For the final analysis, the average of the three sets was calculated.

5

Description

Knee flexion/extension power

Timepoint

1. Initial measurement (pre-test) of Knee flexion/extension power in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

The Knee flexion/extension power in the dominant leg

was measured using the Biodex Multi-Joint System 4 Pro (Biodex Medical System Inc., USA). Leg dominance was determined based on the lateral preference questionnaire. The device was calibrated before each test. Participants were seated with a hip joint angle of 80 degrees and secured with straps around the upper body and pelvis. The shank of the dominant leg was attached to the dynamometer lever to record the torque generated by the muscles. The knee joint range of motion was set between 10 and 100 degrees (0 degrees = full extension). The test consisted of three sets of five maximal knee flexion–extension movements at an angular velocity of 60 degrees/second. The rest interval between sets was 180 seconds. For the final analysis, the average of the three sets was calculated.

6

Description

Overall Stability Index

Timepoint

1. Initial measurement (pre-test) of Overall Stability Index in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

Static bilateral balance was measured using the Biodex Balance System SD (Biodex Medical System Inc., USA). After necessary training by the tester, participants were asked to stand as still and stable as possible during the test. Each player performed three 20-second trials with a 10-second rest interval between trials. The test difficulty was set at a tilt level ranging from 8 to 5 (based on initial pilot results), with level 1 creating the highest degree of instability. Continuous visual feedback regarding the body's center of gravity was provided on the screen during the test. Ultimately, the Overall Stability Index was calculated, and the average of the three trials was used for the final analysis.

7

Description

Medial–Lateral Stability Index

Timepoint

1. Initial measurement (pre-test) of Medial–Lateral Stability Index in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

Static bilateral balance was measured using the Biodex Balance System SD (Biodex Medical System Inc., USA). After necessary training by the tester, participants were asked to stand as still and stable as possible during the test. Each player performed three 20-second trials with a 10-second rest interval between trials. The test difficulty was set at a tilt level ranging from 8 to 5 (based on initial pilot results), with level 1 creating the highest degree of instability. Continuous visual feedback regarding the body's center of gravity was provided on the screen during the test. Ultimately, the Medial–Lateral Stability Index was calculated, and the average of the three trials was used for the final analysis.

8

Description

Anterior–Posterior Stability Index

Timepoint

1. Initial measurement (pre-test) of Anterior–Posterior Stability Index in week zero, before the start of training.2. Final measurement (post-test) at the end of week four, 48 hours after the last training session.

Method of measurement

Static bilateral balance was measured using the Biodex Balance System SD (Biodex Medical System Inc., USA). After necessary training by the tester, participants were asked to stand as still and stable as possible during the test. Each player performed three 20-second trials with a 10-second rest interval between trials. The test difficulty was set at a tilt level ranging from 8 to 5 (based on initial pilot results), with level 1 creating the highest degree of instability. Continuous visual feedback regarding the body's center of gravity was provided on the screen during the test. Ultimately, the Anterior–Posterior Stability Index was calculated, and the average of the three trials was used for the final analysis.

Secondary outcomes

empty

Intervention groups

1

Description

Intervention group1: Participants in this group performed plyometric jump training with an unstable load equivalent to 10% of their body weight over a 4-week period (three sessions per week, totaling 12 sessions). The unstable load was provided using a barbell and two water-filled gym balls. The exercises were conducted on the gym floor and consisted of consecutive jumps over obstacles with heights ranging from 35 to 50 cm. The intensity and volume of the training progressively increased, with the number of jumps rising from 48 repetitions in the first session to 104 repetitions in the final sessions. Each session lasted 15 to 25 minutes, with a work-to-rest ratio of 1:7 and a 2-minute rest interval between exercises. All sessions began with a RAMP warm-up protocol (light running, dynamic stretching, and submaximal jumps).

Category

Other

2

Description

Intervention group2: This group followed the same training protocol as the UL-PJT group, with the exception that no unstable load was added to the exercises. Participants performed jump training on a stable surface without using water-filled gym balls. The number of sessions, duration of training, type of exercises, volume, intensity, and warm-up protocol were identical to those of the first group, ensuring that the only interventional

variable was the presence or absence of an unstable load.

Category
Other

3

Description
Control group: Participants in the control group continued their regular volleyball training over the 4-week period (three sessions per week, each approximately 90 minutes). Their training consisted of standard team technical and tactical activities, with no additional plyometric exercises or specific interventions. This group served as a comparison to determine the net effect of the plyometric interventions in the other two groups.

Category
Other

Recruitment centers

1

Recruitment center

Name of recruitment center
Shahid Beheshti University

Full name of responsible person
Mohammad Fashi

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Sponsors / Funding sources

1

Sponsor

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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
Shahid Beheshti 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
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Full name of responsible person
Mohammad Fashi

Position
Assistant professor

Latest degree
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Other areas of specialty/work
Exercise physiology

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Latest degree

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Other areas of specialty/work

Exercise physiology

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Person responsible for updating data

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Sharing plan

Deidentified Individual Participant Data Set (IPD)

No - There is not a plan to make this available

Justification/reason for indecision/not sharing IPD

To adhere to ethical principles and protect participants' personal and confidential information, the raw data (individual participant data) from this study will not be shared for public use or secondary research. However, if required, and solely to assure journal reviewers or editors of the accuracy of statistical analyses, the data will be provided confidentially.

Study Protocol

Yes - There is a plan to make this available

Statistical Analysis Plan

No - There is not a plan to make this available

Informed Consent Form

Yes - There is 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

The Study Protocol, designed based on previous studies, along with the consent form, will be shared as a proprietary document. This protocol includes a comprehensive description of the study design, intervention methods, measured variables, and assessment timelines. The document will be provided as a PDF file upon formal request from reviewers or qualified researchers, subject to approval by the research committee. No individual participant raw data or identifiable information will be shared. Additionally, no analytical files or data dictionaries will be provided for public use or secondary research. Other documents will not be shared for public use or secondary research to comply with ethical principles and protect participants' personal and confidential information. However, if required, and solely to assure journal reviewers or editors of the accuracy of statistical analyses, the data will be provided confidentially.

When the data will become available and for how long

Access to the study protocol will begin six months after the publication of the final research results and will remain available for five years. The document will be provided only upon formal request from journal reviewers or qualified researchers, subject to approval by the research committee.

To whom data/document is available

The study data and documentation will be provided only to individuals requesting them for scientific and research purposes, with a commitment to maintaining confidentiality and ethical use of the information. Eligible individuals may include: - Researchers employed at universities or research institutions - Graduate students working on topics related to the study - Independent researchers with credible and relevant projects - Individuals in related industries requiring data for scientific and practical development Access to the data is subject to a written request and approval by the ethics committee or study authorities. Recipients are also required to comply with data protection and participant confidentiality regulations.

Under which criteria data/document could be used

**Conditions for the Use of Anonymized Data and

Documentation:** Anonymized data and documentation will be provided to ensure the privacy and confidentiality of participants. Use of these data is permitted solely for scientific and research purposes, including statistical analyses, meta-analyses, trend evaluations, and scientific comparisons. Commercial use, unauthorized copying, or dissemination of data without written permission is strictly prohibited. **Governing Mechanisms for Use:** - Recipients must adhere to research ethics principles and maintain confidentiality. - Data may only be used for the purposes specified in the request. - Any publication of results must acknowledge the source and obtain approval from the principal investigator. - Any use beyond the stated purposes requires renewed approval from the ethics committee. **Conditions and Criteria for Submitting a Request:** To obtain data and documentation, applicants must: - Submit a written request specifying the exact research or application purpose of the data. - Provide a research CV or relevant credentials to verify scientific qualification. - Sign a confidentiality and research ethics commitment. - Agree to use the data solely for the stated purposes and not transfer it to unauthorized individuals or entities. - Obtain approval from the ethics committee or study authorities if required.

From where data/document is obtainable

Guidelines for Requesting Study Data and Documentation: To request anonymized study data and documentation, please follow these steps in order of priority: 1. **Contact the Principal Investigator:** Initiate contact with the principal investigator of the study. Their contact information is typically provided in the introduction or abstract of the study. 2. **Submit a Formal Written Request:** Send a written request (via email or official letter) to the principal investigator, including the precise research purpose, a research CV, and an ethical commitment letter. 3. **Contact the Institutional Ethics Committee:** If ethical approval is required, reach out to the ethics committee of the relevant university or institution. 4. **Receive Data After Approval:** Upon approval of the request and signing of the confidentiality agreement, the requested data and documentation will be provided. **Contact Information:** - **Principal Investigator:** Dr. Mohammad Fashi - **Email:** fashi84.u@gmail.com - **Phone:** +98 912 863 4907 - **Office Address:** Shahid Beheshti University, Faculty of Sport Sciences, Second Floor, Head of Exercise Physiology Department

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

Process for Obtaining Documentation and Data and Related Details: 1. **Request Submission and Review:** Upon submission of a written request including the research purpose, supporting documents, and an ethical commitment letter, the request will be reviewed by the responsible researcher and, if necessary, the ethics committee. This stage typically takes 7 to 14 business days. 2. **Request Approval and Ethical Agreement:** After verification of qualifications and ethical considerations, the applicant must sign a confidentiality and research ethics commitment letter. This may be done electronically or in person and usually takes 1 to 3 business days. 3. **Data Preparation and Analysis:** Anonymized data and documentation will be prepared based on the request. If specific data processing or extraction is required, this stage may take 3 to 7 business days. 4. **Data Delivery:** Once prepared, the data will be delivered as electronic files (e.g., Excel, SPSS, PDF) via secure email or a secure data-sharing platform. 5. **Support and Clarifications:** After data delivery, the responsible researcher will be available to provide guidance or address any questions. **Estimated Total Time:** The entire process, from request submission to data delivery, typically takes 2 to 4 weeks, depending on the data volume and processing complexity.

Comments