Clinical Trial Protocol
Iranian Registry of Clinical Trials

08 Nov 2026

Comparison of Plyometric Training by Differential Learning or Nonlinear Pedagogy Approach on Functional and Biomechanical Factors in Athletes at High Risk of ACL Injury: A Field Trial Study

Protocol summary

Study aim

The comparison of plyometric training with differential learning or nonlinear pedagogy methods on biomechanical and functional factors in athletes with high risk of anterior cruciate ligament injury.

Design

The clinical trial has two intervention groups and one control group, with parallel groups, and a single-blind method, randomized by the web method on 48 participants and includes the concealment of random allocation.

Settings and conduct

The study will be conducted at the Faculty of Physical Education, Kharazmi University, Karaj Branch. A single-blind method was used where only participants were tried to be blinded from the study. For this purpose, all the participants in the study will continue their daily life after the pre-test and according to the purpose of the research, the intervention groups will receive the exercises, but they will not know the type of exercise interventions. For this purpose, each group's interventions will be done on different days.

Participants/Inclusion and exclusion criteria

Inclusion criteria: All male university athletes at a competitive level. Normal body mass index in the range of 18.5 to 25. Age range from 18 to 26 years. Exclusion criteria: Participation in injury risk reduction programs during the past year. Non-participation of subjects in two consecutive training sessions and three. non-consecutive training sessions.

Intervention groups

The first intervention group: plyometric exercises with nonlinear learning pedagogy. The second intervention group: plyometric exercises with differential learning pedagogy. Control group: will continue with daily sports activities.

Main outcome variables

Trunk flexion; trunk lateral flexion; knee flexion; knee abduction; hip adduction and internal rotation and ankle dorsiflexion angles. Vertical ground reaction force and knee flexion; knee abduction and hip abduction and external rotation moments.

General information

Reason for update

Due to significant structural differences in the training protocols, there is a possibility of bias in blinding participants. Also, due to ethical considerations in research that participants should be aware of the entire research protocol, and outcome assessors will be blinded instead of participants. Due to limitations and personal problems, the date of patient recruitment (participant recruitment) will change.

Acronym

ACL

IRCT registration information

IRCT registration number: **IRCT20210602051477N3**
Registration date: **2025-03-15, 1403/12/25**
Registration timing: **prospective**

Last update: **2025-07-08, 1404/04/17**
Update count: **1**

Registration date

2025-03-15, 1403/12/25

Registrant information

Name

Majid Hamoongard

Name of organization / entity

The University of Kharazmi

Country

Iran (Islamic Republic of)

Phone

+98 25 3775 6424

Email address

std_majid.hamoongard@khu.ac.ir

Recruitment status
Recruitment complete
Funding source

Expected recruitment start date
2025-09-23, 1404/07/01
Expected recruitment end date
2025-10-21, 1404/07/29
Actual recruitment start date
empty
Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Comparison of Plyometric Training by Differential Learning or Nonlinear Pedagogy Approach on Functional and Biomechanical Factors in Athletes at High Risk of ACL Injury: A Field Trial Study

Public title
Comparing the effects of differential learning and nonlinear pedagogy in anterior cruciate ligament injury
Purpose
Prevention
Inclusion/Exclusion criteria
Inclusion criteria:
All male university athletes at a competitive level (futsal, basketball and handball) Normal body mass index in the range of 18.5 to 25 Having a score equal to or greater than 6 in the tuck jump test Absence of any visible abnormalities in the trunk (hyper-kyphosis, hyper-lordosis, and severe scoliosis) and lower limbs (genu varum, genu valgum, and severe flat feet) and no acute and chronic musculoskeletal injury during the past year (any injury that causes the athlete to be away for a long time) There is no history of injury or rupture of the anterior cruciate ligament and no medical history of neurocognitive, metabolic, hearing, and vision defects. Absence of concussion or concussion-related symptoms (frequent headaches or migraines, eye movement deficits, and balance disorders) within the past five years
Exclusion criteria:
Participation in injury risk reduction programs during the past year Non-participation of subjects in two consecutive training sessions and three non-consecutive training sessions
Age
From **18 years** old to **26 years** old
Gender
Male

Phase
N/A
Groups that have been masked

- Outcome assessor

Sample size
Target sample size: **48**
Randomization (investigator's opinion)
Randomized
Randomization description
To randomize, the online randomization method (http://randomizer.org/Social Psychology Network Middletown, CT, USA, accessed on June 22, 2013) will be used, which is provided to researchers for free. In this way, participants are randomly assigned in a 1:1:1 allocation ratio to one of the groups: 1=non-linear pedagogy, 2=differential learning, and 3=control. To allocate concealment, the table of block random numbers will be used. For this purpose, random numbers will be placed in sealed and opaque envelopes inside the box. The other researcher, who is not aware of the initial assignment of the subjects, opens the envelopes and will continue the exercises after determining the assignment of the groups.
Blinding (investigator's opinion)
Single blinded
Blinding description
In the present study, a single-blinded method will be used for blinding, in which only the outcome assessors are blinded. For this purpose, outcome assessors who are unaware of the participant allocation, research method, and hypotheses collect data related to the outcome variables.
Placebo
Not used
Assignment
Parallel
Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Research Ethics Committees of Kharazmi University
Street address
No. 43, Shahid Moftah Ave., Enghelab Blvd., Tehran Town
City
Tehran
Province
Tehran
Postal code
15719-14911
Approval date
2025-02-23, 1403/12/05
Ethics committee reference number
IR.KHU.REC.1403.169

Health conditions studied

1

Description of health condition studied
Prevention of anterior cruciate ligament injury

ICD-10 code
ICD-10 code description

Primary outcomes

1

Description
Knee and hip kinematics
Timepoint
Knee and hip kinematics will be measured at pre-test (before the start of the intervention) and post-test (after 8 weeks).
Method of measurement
A motion capture system with 8 high-speed cameras (Kestrel 8.0 motion analysis, US) with a sampling frequency of 120 Hz will be used to measure 3D kinematics.

2

Description
Knee and hip Kinetics
Timepoint
Knee and hip kinetics will be measured at pre-test (before the start of the intervention) and post-test (after 8 weeks).
Method of measurement
A Bertec force plate device, made in the United States, with dimensions of 60 x 40 cm (Bertec Corporation, Columbus, OH) with a sampling frequency of 1200 Hz will be used to collect kinetic data.

Secondary outcomes

1

Description
Triple crossover hop for distance test
Timepoint
It will be measured in the pre-test (before the intervention) and post-test (after 8 weeks).
Method of measurement
The jump distance (meters) from the starting line to the foot heel will be considered the participant's record.

2

Description
Tuck jump test
Timepoint
It will be measured in the pre-test (before the intervention) and post-test (after 8 weeks).
Method of measurement
10-question scoring form for the tuck jump test

3

Description
90 medial rotation hop for distance
Timepoint
It will be measured in the pre-test (before the intervention) and post-test (after 8 weeks).
Method of measurement
The jump distance will be measured from the medial of the foot when jumping to the toes when landing.

4

Description
Medial side triple hop for distance test
Timepoint
It will be measured in the pre-test (before the intervention) and post-test (after 8 weeks).
Method of measurement
The total jump distance after three consecutive steps is measured from the medial side of the foot when jumping to the medial side of the foot when landing.

5

Description
Coordination variability of lower extremity
Timepoint
It will be measured in the pre-test (before the intervention) and post-test (after 8 weeks).
Method of measurement
A motion capture system (Kestrel 8.0 motion analysis, US) 8 cameras with a sampling frequency of 120 Hz

Intervention groups

1

Description
The first intervention group: Plyometric training combined with nonlinear learning pedagogy will be conducted for 8 weeks, 3 sessions per week, each session lasting 60 minutes, for a total of 24 training sessions.
Category
Prevention

2

Description
Second intervention group: Plyometric exercises combined with differential learning pedagogy for 8 weeks, 3 sessions per week, each session lasting 60 minutes, for a total of 24 training sessions.
Category
Prevention

3

Description
Control group: Participants will continue with their daily lives and will not receive any intervention.
Category
N/A

Recruitment centers

1

Recruitment center

Name of recruitment center
Kharazmi University

Full name of responsible person
Majid Hamoongard

Street address
No. 43, Shahid Moftah St., Enghelab Blvd., Tehran Town

City
Tehran

Province
Tehran

Postal code
15719-14911

Phone
+98 26 3457 9600

Email
majidhamoongard@gmail.com

Sponsors / Funding sources

1

Sponsor

Name of organization / entity
Kharazmi University

Full name of responsible person
Malihe hadadnezhad

Street address
No. 43, Shahid Moftah Ave., Enghelab Blvd., Tehran Town

City
Tehran

Province
Tehran

Postal code
15719-14911

Phone
+98 26 3457 9600

Email
m.hadadnezhad@yahoo.com

Grant name
Vice President for Research, Kharazmi University, Tehran

Grant code / Reference number

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

Title of funding source
Kharazmi 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
The University of Kharazmi

Full name of responsible person
Majid Hamoongard

Position
Ph.D Student

Latest degree
Master

Other areas of specialty/work
Corrective Exercises & Sports Injuries

Street address
No. 43, Shahid Moftah Ave., Enghelab Blvd., Tehran Town

City
Tehran

Province
Tehran

Postal code
15719-14911

Phone
+98 26 3457 9600

Fax

Email
std-majid.hamoongard@khu.ac.ir

Person responsible for scientific inquiries

Contact

Name of organization / entity
The University of Kharazmi

Full name of responsible person
Majid Hamoongard

Position
Ph.D Student

Latest degree
Master

Other areas of specialty/work
Corrective Exercises & Sports Injuries

Street address
No. 43, Shahid Moftah Ave., Enghelab Blvd., Tehran Town

City
Tehran

Province
Tehran

Postal code
15719-14911

Phone
+98 26 3457 9600

Fax

Email
std-majid.hamoongard@khu.ac.ir

Person responsible for updating data

Contact

Name of organization / entity
The University of Kharazmi

Full name of responsible person
Majid Hamoongard
Position
Ph.D Student
Latest degree
Master
Other areas of specialty/work
Corrective Exercises & Sports Injuries
Street address
No. 43, Shahid Moftah Ave., Enghelab Blvd., Tehran Town
City
Tehran
Province
Tehran
Postal code
1571914911
Phone
+98 26 3457 9600
Fax
Email
std-majid.hamoongard@khu.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
Not applicable
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
Not applicable
Data Dictionary
Not applicable
Title and more details about the data/document
The participant data form, study protocol, informed consent form, and study report will be published anonymously after the research is completed as an attachment to the article, as well as the results as an average of all participants.
When the data will become available and for how long
The access period to protocols and results will begin approximately 6 months after the results are published.
To whom data/document is available
Researchers working in scientific centers and universities, strength and conditioning coach, physiotherapists, and sports medicine specialists can access the results.
Under which criteria data/document could be used
The research results will be published in the form of articles in scientific databases and will be accessible through this means.
From where data/document is obtainable
To receive the study results, they can email the corresponding author. Email address: majidhamoongard@gmail.com
What processes are involved for a request to access data/document
After contact, the corresponding author for the article will be responded to as soon as possible.
Comments