Clinical Trial Protocol
Iranian Registry of Clinical Trials

16 Sep 2026

Evaluating the effect of beetroot extract supplementation coinciding with resistance training on maximum concentric peak torque and power of the quadriceps and hamstring muscles in semi-professional male athletes after anterior cruciate ligament surgery

Protocol summary

Study aim
Determining the effect of 4 weeks of beetroot extract supplement along with resistance training on body composition, maximum concentric torque, and power in quadriceps and hamstring muscles at 60, 90 and 120 degrees per second after ACL surgery

Design
Non-randomized, parallel, unblinded, phase 2 clinical trial on 46 male athletes

Settings and conduct
This study will be conducted in the filed of post ACL reconstruction surgery rehabilitation on 46 male athletes (18 to 35 years old) who underwent ACL reconstruction surgery (after 90 days) in a sports medicine center in Mashhad. All subjects (intervention and control groups) will follow a similar exercise protocol of 90-minute strength training 3 sessions per week for 4 weeks (overall 12 sessions). The intervention group will also consume 250 ml beetroot extract (40% ADI for nitrate), two hours before exercise in 2 non-consecutive sessions. A list of nitrate rich foods will be given to subjects to reduce dietary nitrate intake. Maximum concentric torque and quadriceps and hamstring power by isokinetic device and body composition by body composition analyzer will be assessed at baseline and 48 hours after the last exercise session.

Participants/Inclusion and exclusion criteria
Inclusion criteria: Male athletes who have undergone ACL reconstruction (allograft technique) 90 days prior to inclusion in the study. No entry conditions: Allergy to beetroot, bilateral injuries to the knee and other tissues and ligaments of the knee, including intra-articular fractures, consuming beetroot extract less than 2 times a week during the study, failure to follow the diet and exercise program based on research protocol

Intervention groups
Intervention group: 250 cc beetroot extract (40% ADI of nitrate) with resistance exercise Control group: Resistance exercise

Main outcome variables
Strength and power of quadriceps and hamstrings, body composition

General information

Reason for update
Failure to update previous revision

Acronym

IRCT registration information
IRCT registration number: **IRCT20210217050393N2**
Registration date: **2021-07-26, 1400/05/04**
Registration timing: **registered_while_recruiting**

Last update: **2022-10-21, 1401/07/29**
Update count: **2**

Registration date
2021-07-26, 1400/05/04

Registrant information

Name
REZA REZVANI

Name of organization / entity

Country
Iran (Islamic Republic of)

Phone
+98 51 3800 2418

Email address
rezvanir@mums.ac.ir

Recruitment status
Recruitment complete

Funding source

Expected recruitment start date
2021-06-22, 1400/04/01
Expected recruitment end date
2021-12-22, 1400/10/01
Actual recruitment start date
empty
Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Evaluating the effect of beetroot extract supplementation coinciding with resistance training on maximum concentric peak torque and power of the quadriceps and hamstring muscles in semi-professional male athletes after anterior cruciate ligament surgery

Public title
Evaluating the effect of beetroot extract supplementation coinciding with resistance training in rehabilitation of athletes with anterior cruciate ligament rupture
Purpose
Supportive
Inclusion/Exclusion criteria
Inclusion criteria:
Male semi-professional athletes who play in provincial teams in the fields of football, futsal, volleyball and basketball Undergoing ACL reconstructing surgery using allograft technique 90 days have passed since the ACL reconstruction surgery Adhere to the same protocol, which includes 40 sessions of physiotherapy with 60 sessions of exercise therapy, from the day of surgery to the end of 90 days for all subjects Willingness to participate in research Age between 18 and 35 years old
Exclusion criteria:
Disease including: diabetes, kidney stones, gallstones, cancer and other serious diseases Taking any medication or performing extra exercise compared to the research protocol Using oral and injectable nutritional supplements before and after the research period Consumption of any herbal medicine Allergy to beetroot Smoking Alcohol consumption History of performing any surgery on the operated limb Bilateral knee injuries Damage to other tissues and ligaments of the knee, including intra-articular fractures
Age
From **18 years** old to **35 years** old
Gender
Male

Phase
2
Groups that have been masked
No information
Sample size
Target sample size: **46**
Randomization (investigator's opinion)
N/A
Randomization description
Blinding (investigator's opinion)
Not blinded
Blinding description
Placebo
Not used
Assignment
Single
Other design features
This study is a non-randomized parallel clinical trial with control group

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Ethics committee of Mashhad university of medical sciences
Street address
Mashhad university of medical sciences, Azadi squre
City
Mashhad
Province
Razavi Khorasan
Postal code
9138813944
Approval date
2021-04-20, 1400/01/31
Ethics committee reference number
IR.MUMS.MEDICAL.REC.1400.109

Health conditions studied

1

Description of health condition studied
Anterior cruciate ligament rehabilitation
ICD-10 code
M62.50
ICD-10 code description
Muscle wasting and atrophy, not elsewhere classified, unspecified site

Primary outcomes

1

Description
Maximum concentric torque of quadriceps and hamstring at 60 degree per second
Timepoint
Baseline and 48 hours after the last exercise session (4 weeks)
Method of measurement
Isokinetic device at 60 degree per second

2

Description

Maximum concentric torque of quadriceps and hamstring at 90 degree per second

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Isokinetic device at 90 degree per second

3

Description

Maximum concentric torque of quadriceps and hamstring at120 degree per second

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Isokinetic device at 120 degree per second

4

Description

Power of quadriceps and hamstring muscles at 60 degree per second

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Isokinetic device at 60 degree per second

5

Description

Power of quadriceps and hamstring muscles at 90 degree per second

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Isokinetic device at 90 degree per second

6

Description

Power of quadriceps and hamstring muscles at 120 degree per second

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Isokinetic device at 120 degree per second

Secondary outcomes

1

Description

body composition

Timepoint

Baseline and 48 hours after the last exercise session (4 weeks)

Method of measurement

Body analyzer device

Intervention groups

1

Description

Intervention group: 250 cc beetroot extract containing 40% ADI nitrate based on body weight will be given to the athlete two hours before exercise in two non-consecutive sessions. The duration of the intervention will be 4 weeks, which includes 12 sessions of resistance training and 8 servings of beetroot supplement. Sachets containing extract powder will be prepared by the Mashhad School of Pharmacy

Category

Rehabilitation

2

Description

Control group: Resistance training for 4 weeks including 12 resistance training sessions.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

Mehregan Pars Physiotherapy Center

Full name of responsible person

Mohammad Hossein Khabaz Kababi

Street address

Mehregan Pars building, Next to the Shahid Aghdaei 1St, Vakilabad 35 Ave, Vakilabad Blvd

City

Mashhad

Province

Razavi Khorasan

Postal code

9188957202

Phone

+98 51 3869 3007

Email

ahoseleh@yahoo.com

Sponsors / Funding sources

1

Sponsor

Name of organization / entity

Mashhad University of Medical Sciences

Full name of responsible person

Mohsen Tafaghodi

Street address

Mashhad university of medical sciences, Azadi squre

City

Mashhad

Province

Razavi Khorasan

Postal code
9138813944
Phone
+98 51 3841 1538
Email
tafaghodim@mums.ac.ir
Grant name
Grant code / Reference number
Is the source of funding the same sponsor organization/entity?
Yes
Title of funding source
Mashhad University of Medical Sciences
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
Mashhad University of Medical Sciences
Full name of responsible person
Reza Rezvani
Position
Assistant Professor
Latest degree
Ph.D.
Other areas of specialty/work
Nutrition
Street address
School of Medicine, Mashhad University of Medical Sciences. Azadi Square, Campus of University, Mashhad, Iran Postal Code: 9177948564
City
Mashhad
Province
Razavi Khorasan
Postal code
99191-91778
Phone
+98 51 3800 2418
Fax
Email
rezvanir@mums.ac.ir

Person responsible for scientific inquiries

Contact
Name of organization / entity
Mashhad University of Medical Sciences
Full name of responsible person
Reza Rezvani
Position
Assistant Professor
Latest degree
Ph.D.
Other areas of specialty/work
Nutrition
Street address
School of Medicine, Mashhad University of Medical Sciences. Azadi Square, Campus of University, Mashhad, Iran Postal Code: 9177948564
City
Mashhad
Province
Razavi Khorasan
Postal code
99191-91778
Phone
+98 51 3800 2418
Fax
Email
rezvanir@mums.ac.ir

Person responsible for updating data

Contact
Name of organization / entity
Mashhad University of Medical Sciences
Full name of responsible person
Reza Rezvani
Position
Assistant Professor
Latest degree
Ph.D.
Other areas of specialty/work
Nutrition
Street address
School of Medicine, Mashhad University of Medical Sciences. Azadi Square, Campus of University, Mashhad, Iran Postal Code: 9177948564
City
Mashhad
Province
Razavi Khorasan
Postal code
99191-91778
Phone
+98 51 3800 2418
Fax
Email
rezvanir@mums.ac.ir

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
There is no more information
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