# Clinical Trial Protocol
# Iranian Registry of Clinical Trials

16 Sep 2026

## Effect of diet restricted in advanced glycation end products (low-AGEs) on vascular adhesion, inflammatory markers, vascular vasodilation (FMD), energy expenditure and brown adipose tissue activity in patients treated with angioplasty

## Protocol summary


**Study aim**

The aim of this study is to determine the effect of diet restricted in advanced glycation end products (low-AGEs) on vascular adhesion, inflammatory markers, vascular vasodilation (Flow Mediated Dilation), energy expenditure and brown adipose tissue activity in patients treated with angioplasty.

**Design**

The present study is a parallel randomized clinical trial with a control group.

**Settings and conduct**

Patients are randomly divided into two groups of 21: intervention and control. Food record questionnaire to measure and control macronutrients and AGEs intake in the diet and physical activity registration to measure energy expenditure and adjustment of physical activity effect on AGEs production in body will be evaluated in beginning and every two weeks during the study. Ten milliliter fasting blood will be taken from all patients at the beginning and end of the intervention.

**Participants/Inclusion and exclusion criteria**

Patients aged 50 to 70 years whose BMI is between 18.5 to 35 kg/m2 and are required to undergo angioplasty due to obstruction in one or two vessels, will be enrolled. Patients with a history of diabetes, chronic kidney diseases, autoimmune diseases and cancer, consumed multivitamin-mineral supplements over the past 3 months, followed any weight loss or other special diets during last year, or smoke won't be entered in study.

**Intervention groups**

To the intervention group, the low-AGEs diet, and to the control group, the cardiovascular diet based on general recommendations provided by AHA with focusing on the reduction of saturated fats and salt will be given. Both groups will be required to follow their diet for 12 weeks.

**Main outcome variables**

The amount of energy expenditure and vascular vasodilatation (FMD) and serum levels of IL-6, TNF-α, VCAM, hs-CRP, MDA, NRG4, FGF21 and carboxy methyl lysine will be measured in both groups before and After the intervention.


## General information

**Reason for update**

Due to the outbreak of COVID-19, the work process of the hospital was disrupted and sampling was stopped for several months, and now that the work process of the hospital has returned to the previous state, the admission rate of patients is much lower than before. On the other hand, a large number of patients are reluctant to participate in the study due to the need to go to the hospital after the intervention and the high risk of developing COVID-19 if they go to the hospital. In general, these problems have disrupted the sampling of the study. At the beginning of the patients' recruitment, during ultrasound examinations, we found out that a large percentage of the patients had non-alcoholic fatty live disease (NAFLD), but were unaware of it. Given that NAFLD is one of the cardiovascular risk factors and increases the risk of atherosclerotic events in these patients, and recent studies have shown the causative role of AGEs in the pathogenesis of NAFLD, thus our intervention (restricting AGEs in the diet) may probably also be effective on reducing hepatic fat accumulation and the risk factors associated with NAFLD. Therefore, a number of extra outcomes related to NAFLD were added to the study, and in patients who also had NAFLD, these outcomes were measured before and after the study.

**Acronym**

**IRCT registration information**


IRCT registration number: **IRCT20131125015536N10**
Registration date: **2019-11-24, 1398/09/03**
Registration timing: **registered_while_recruiting**

Last update: **2023-05-13, 1402/02/23**
Update count: **2**

**Registration date**
2019-11-24, 1398/09/03

**Registrant information**

**Name**
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**Recruitment status**
**Recruitment complete**

**Funding source**

**Expected recruitment start date**
2019-11-06, 1398/08/15

**Expected recruitment end date**
2020-11-05, 1399/08/15

**Actual recruitment start date**
empty

**Actual recruitment end date**
empty

**Trial completion date**
empty

**Scientific title**
Effect of diet restricted in advanced glycation end products (low-AGEs) on vascular adhesion, inflammatory markers, vascular vasodilation (FMD), energy expenditure and brown adipose tissue activity in patients treated with angioplasty

**Public title**
Effect of diet restricted in advanced glycation end products (low-AGEs) in patients treated with angioplasty

**Purpose**
Prevention

**Inclusion/Exclusion criteria**

**Inclusion criteria:**
Age of 50 to 70 years BMI of 18.5 to 35 Kg/m2 Diagnosis of need for angioplasty treatment due to obstruction in one or two vessels

**Exclusion criteria:**
History of diabetes, thyroid disorders, chronic kidney diseases, autoimmune diseases, cancer History of myocardial infarction and stroke in the past 3 months Use of multi-vitamin, mineral, and antioxidant supplements over the past 3 months Follow of any weight loss diet or other special diets over the past year Familial hypercholesterolemia and hypertriglyceridemia History of well-known food allergy History of previous angioplasty Smoking, use of hubble-bubble and other drugs Ladies before menopause

**Age**
From **50 years** old to **70 years** old

**Gender**
Both

**Phase**
N/A

**Groups that have been masked**
*No information*

**Sample size**
Target sample size: **42**

**Randomization (investigator's opinion)**
Randomized

**Randomization description**
Since the variable of gender affect the outcomes of the study, and the two groups must be similar in terms of this variable, randomization is done using stratified randomization based on this variable. Therefore, we will have two categories: men and women. Then for each of these categories, random binary blocks are determined using table of random numbers. Eligible individuals entered the study, are placed in their own category according to their gender and based on the randomized sequences defined for that category, are assigned to either of the two groups receiving low-AGEs diet or cardiovascular diet (on basis of AHA recommendations). Given that the intervention of this study is diet and the person who enters the patients in the study and describes the type of diet for each patient, cannot be blind to the type of diet that each patient receives, allocation concealment does not apply in this study.

**Blinding (investigator's opinion)**
Not blinded

**Blinding description**

**Placebo**
Not used

**Assignment**
Parallel

**Other design features**

## Secondary Ids

empty

## Ethics committees

### 1

**Ethics committee**

**Name of ethics committee**
Ethics Committee on Research, Research and Technology department of Tehran University of Medical Sci

**Street address**
Floor 6, Central Organization of University, corner of Qods St., Keshavarz Blvd.

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Tehran

**Province**
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-

**Approval date**
2019-06-23, 1398/04/02

**Ethics committee reference number**
IR.TUMS.VCR.REC.1398.334

## Health conditions studied

**1**

**Description of health condition studied**
Atherosclerotic heart disease
**ICD-10 code**
I25.1
**ICD-10 code description**
Atherosclerotic heart disease of native coronary artery

**2**

**Description of health condition studied**
Non-alcoholic fatty liver disease
**ICD-10 code**
K76.0
**ICD-10 code description**
Fatty (change of) liver, not elsewhere classified

## Primary outcomes

**1**

**Description**
Carboxy methyl lysine
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**2**

**Description**
high sensitive C-Reactive Protein (hs-CRP)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**3**

**Description**
Tumor necrosis factor alpha (TNF-α)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**4**

**Description**
Interleukin 6 (IL-6)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**5**

**Description**
Vascular cell adhesion molecule 1 (VCAM-1)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**6**

**Description**
Flow Mediated Dilation (FMD)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Sonography

**7**

**Description**
Basal metabolism rate
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Bioelectrical Impedance Analysis (BIA)

**8**

**Description**
Neuregulin 4 (NRG4)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**9**

**Description**
Fibroblast growth factor 21 (FGF-21)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

## Secondary outcomes

**1**

**Description**
Appetite
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Visual analog scale

**2**

**Description**
Nesfatin
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELSA method

**3**

**Description**

Weight
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Weigher

**4**

**Description**
Waist circumference
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Meter

**5**

**Description**
Body composition
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Bioelectrical Impedance Analysis (BIA)

**6**

**Description**
Serum lipid profile (total cholesterol, triglyceride, LDL and HDL)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Enzymatic method

**7**

**Description**
Fasting Blood Sugar
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Enzymatic method

**8**

**Description**
Hemoglobin A1C
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Ion exchange chromatography

**9**

**Description**
Serum fasting insulin
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**10**

**Description**
Omentin
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
ELISA method

**11**

**Description**
Insulin resistance
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Calculation based on HOMA-IR formula

**12**

**Description**
Fatty liver grade
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Sonography

**13**

**Description**
Hepatic enzymes (ALT and AST)
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Enzymatic method

**14**

**Description**
The amount of visceral adipose tissue in anterior to the aorta, posterior to the aorta and anterior to the liver
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Sonography

**15**

**Description**
Carotid intima-media thickness
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Sonography

**16**

**Description**
The amount of subcutaneous fat
**Timepoint**
Before and after 12 weeks of intervention
**Method of measurement**
Sonography

## Intervention groups

### 1

**Description**
Intervention group: Individuals in the intervention group will receive isocaloric low AGEs diet (based on dietary recommendations by Uribarrie et al.) for 12 weeks. The general recommendations of American Heart Association for cardiovascular diseases focused on reduction of saturated fats to less than 6 percent of calories, reduction of salt intake to less than 2400 mg per day, and reduction of calorie intake from simple sugars to less than 150 kilocalories per day in men and less than 100 kilocalories per day in women will be considered in the design of this diet, so that the only difference in the diet of the intervention and control group would be the amount of AGEs intake. The list of foods that should be omitted from diet (foods with high amount of AGEs), alternative food sources, the proper type and time of food preparation method in order to reduce the amount of AGEs intake will be explained both verbally and in writing.

**Category**
Prevention

### 2

**Description**
Control group: To the individuals in the control group, isocaloric cardiovascular diet (based on general recommendations by American Heart Association) will be given for 12 weeks. This diet focused on the reduction of saturated fats to less than 6 percent of calories, reduction of salt intake to less than 2400 mg per day, and reduction of calorie intake from simple sugars to less than 150 kilocalories per day in men and less than 100 kilocalories per day in women.

**Category**
Other

## Recruitment centers

### 1

**Recruitment center**

**Name of recruitment center**
Tehran Heart Center

**Full name of responsible person**
Ali Vasheghani Farahani

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North Kargar Ave.

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### 2

**Recruitment center**

**Name of recruitment center**
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## Sponsors / Funding sources

### 1

**Sponsor**

**Name of organization / entity**
Tehran University of Medical Sciences

**Full name of responsible person**
Research and Technology Department of University

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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**
Tehran 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**

Tehran University of Medical Sciences

**Full name of responsible person**

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**Position**

Professor

**Latest degree**

Ph.D.

**Other areas of specialty/work**

Nutrition

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## Person responsible for scientific inquiries

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## Person responsible for updating data

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## Sharing plan

**Deidentified Individual Participant Data Set (IPD)**

Undecided - It is not yet known if there will be a plan to make this available

**Study Protocol**

Undecided - It is not yet known if there will be a plan to make this available

**Statistical Analysis Plan**

Undecided - It is not yet known if there will be a plan to make this available

**Informed Consent Form**

Undecided - It is not yet known if there will be a plan to make this available

**Clinical Study Report**

Undecided - It is not yet known if there will be a plan to make this available

**Analytic Code**

Undecided - It is not yet known if there will be a plan to make this available

**Data Dictionary**

Undecided - It is not yet known if there will be a plan to make this available