The effect of handgrip exercise on the prevention of ischaemia-reperfusion injury: a pilot study

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To investigate the impact of different doses of handgrip exercises (moderate vs high intensity) and stimuli (exercise vs ischemia) on the ability to protect endothelial damage from ischemia-reperfusion injury in healthy humans. A secondary goal is...

Ethical review	Approved WMO
Status	Pending
Health condition type	Vascular injuries
Study type	Interventional

Summary

ID

NL-OMON56947

Source
ToetsingOnline

Brief title
IRI and handgrip exercise

Condition

- Vascular injuries

Synonym
Ischaemia reperfusion injury, vascular damage

Research involving
Human

Sponsors and support

Primary sponsor: Radboud Universitair Medisch Centrum
Source(s) of monetary or material Support: ZonMW

Intervention

Keyword: Ischemia-reperfusion, Physical activity, Preconditioning, Vascular

Outcome measures

Primary outcome

Change in endothelial function (measured with flow-mediated dilation) before and after IR injury (induced by 15-minute ischemia to the forearm, followed by 20 minutes of reperfusion)

Secondary outcome

The reduction of cardiac injury via the transfer of humoral cardioprotective agents in ex vivo models of ischemia-reperfusion.

Study description

Background summary

Exercise training has strong cardioprotective effects in asymptomatic subjects as well as those with established cardiovascular risk and/or disease. Ischaemia-reperfusion (IR) represents a significant and harmful stimulus for tissues, including the myocardium and the vascular endothelium. Studies have found evidence that exercise training is associated with reduced endothelial and cardiac IR injury, which may partly contribute to the protective effects of exercise training. Possibly, acute bouts of exercise possess the ability to prevent endothelial IR injury in humans and potentially myocardial rescue.

Recent studies have demonstrated that also handgrip exercise has a distinct impact on the ability to prevent endothelial and potentially cardiac IR injury. Such protection through exercise would be similar as observed with ischaemic preconditioning (IPC), i.e. a validated and successful method to prevent endothelial IR injury and is typically applied with short episodes of local arm ischaemia. This raises the question of whether local (forearm) exercise may be sufficient to induce systemic protective effects. This is highly relevant since whole-body training is a demanding type of exercise, which might be difficult to implement in the clinical setting. Local, handgrip exercise, however, would be more feasible to implement in clinical settings to reduce IR injury. Previous studies using handgrip exercise have presented conflicting results

which may relate to the intensity of exercise, highlighting that also the dose of handgrip exercise is crucial for establishing protection.

Study objective

To investigate the impact of different doses of handgrip exercises (moderate vs high intensity) and stimuli (exercise vs ischemia) on the ability to protect endothelial damage from ischemia-reperfusion injury in healthy humans. A secondary goal is to investigate the possible mechanisms by which preconditioning mediates its beneficial effects on IR damage.

Study design

An explorative randomized cross-over trial.

Intervention

Two sessions of local handgrip exercise (i.e., low and moderate intensities), one session of ischaemic conditioning, and a control session.

Study burden and risks

Non-invasive cuff occlusion is used to examine endothelial function (5-minute ischemia) and produce the stimulus that induces IR injury (15-minute ischemia). Cuff inflation is non-invasive and not associated with a health risk for the subject. Also, handgrip exercise is not associated with a significant health risk in our participants. Blood will be drawn three times per session for the analysis of cardioprotective factors using ex vivo models of IR. The volunteers will not benefit directly from participating in this study. Participants will not benefit from participating in this study.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)

Inclusion criteria

- Adults >18 years, <64 years.
- BMI < 30kg/m2
- Recreational athlete (i.e. minimal 1h/week exercise, maximal 5 days/week of exercise)
- Mentally able/allowed to give informed consent.

Exclusion criteria

A potential subject who meets any of the following criteria will be excluded from participation in this study:
- Presence of an absolute contra-indication for the performance of exercise (see also SOP Inspanningstest Department of Physiology):
- Acute myocardial infarction (3-5 days)
- Unstable angina
- Uncontrolled arrhythmias causing symptoms or hemodynamic compromise
- Active endocarditis
- Acute myocarditis or pericarditis
- Symptomatic severe aortic stenosis
- Uncontrolled heart failure
- Acute pulmonary embolus or pulmonary infarction
- Thrombosis of lower extremities
- Suspected dissecting aneurysm
- Uncontrolled asthma
- Pulmonary oedema
- Respiratory failure
- Acute noncardiopulmonary disorder that may affect exercise performance or be

aggravated by exercise (i.e. infection, renal failure, thyrotoxicosis)
- Mental impairment leading to inability to cooperate
- Use of medication that alters the effect of cardioprotection:
• β-blockers
• Calcium Channel blockers
• Nitrates
• Opioids
• Anti-platelet agents (e.g. paracetamol)
• Statins and anti-hyperlipidaemic drugs
• Anti-diabetic treatment

Study design

Design

Study type:	Interventional
Intervention model:	Crossover
Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Prevention

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	01-06-2024
Enrollment:	15
Type:	Anticipated

Ethics review

Approved WMO

Date:	13-08-2024
Application type:	First submission
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL86485.091.24