ISRCTN12195473 https://doi.org/10.1186/ISRCTN12195473

# Endothelial function during intermittent fasting

| Submission date | Recruitment status | [_] Prospectively registered |
|---|---|---|
| 23/07/2016 | No longer recruiting | [_] Protocol |
| **Registration date** | **Overall study status** | [_] Statistical analysis plan |
| 27/07/2016 | Completed | [X] Results |
| **Last Edited** | **Condition category** | [_] Individual participant data |
| 07/08/2019 | Circulatory System | |

## Plain English summary of protocol

Background and study aims
The inner lining of blood vessels (vascular endothelium) plays an important role in the circulation of blood around the body. A process called oxidative stress, in which unstable molecules called free radicals cause damage to cells, is thought to be particularly damaging to the vascular endothelium, leading to inflammation (swelling) and the development of heart and blood vessel disease. There is growing evidence that fasting reduces oxidative stress and inflammation, however it is not known why this happens. Previous studies have shown that oxidative stress goes down and nitrate (a natural chemical which helps blood vessels to expand) levels rise. Whether this leads to improvements in the function of the vascular endothelium however is unknown. The aim of this study is to investigate the effect of fasting on blood vessels.

Who can participate?
Healthy men who are fasting for Ramadan and healthy men of the same age who are not fasting.

What does the study involve?
Those in the fasting group fast for around 19 hours a day for around 26 days for Ramadan, eating no more than one large meal after sunset and one lighter meal before sunrise. These participants attend study visits to have measurements taken before they start fasting, half-way through fasting and then 34 days after the end of Ramadan. The non-fasting participants attend study visits to have measurements taken at the start of the study and then after 28 days. At the visits, all participants have a sample of blood taken to test their blood sugar, cholesterol, and markers of liver and kidney health. In addition, participants have the blood flow in their skin measured using laser Doppler imaging. This involves having a probe placed on the skin which projects an infrared laser beam over the skin. The light interacts with the moving blood cells and is converted into an electrical signal to show where blood is flowing on a screen. In addition, participants also have their blood pressure measured at the appointments.

What are the possible benefits and risks of participating?
Participants benefit from receiving information about the state of their blood vessels and general health. There is a small risk that some participants may experience pain or bruising from blood testing.

Where is the study run from?
Erasme Hospital (Belgium)

When is the study starting and how long is it expected to run for?
December 2013 to June 2018

Who is funding the study?
Université libre de Bruxelles (Belgium)

Who is the main contact?
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# Contact information

### Type(s)
Scientific

### Contact name
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# Additional identifiers

### Protocol serial number
B406201421283, Registered June 16, 2014

# Study information

### Scientific Title
Does intermittent fasting improve microvascular endothelial function in healthy middle-aged subjects?

### Study objectives
Recurrent intermittent fasting improves endothelial microvascular function in healthy subjects.

### Ethics approval required
Old ethics approval format

### Ethics approval(s)
Ethics committee of the Erasme University Hospital, 16/06/2014, ref: P2014/232

## Study design
Prospective case-control study

## Primary study design
Observational

## Study type(s)
Prevention

## Health condition(s) or problem(s) studied
Endothelial microvascular function

## Interventions
Two groups of participants take part in this study, those who are fasting during the Ramadan period and those who are not fasting. Fasting participants complete measurements at baseline (before-fasting session), fasting session (during Ramadan fasting period), post-fasting session (34 days after the end of Ramadan), and non-fasting participants complete measurements at baseline and 28 days.

Microvascular Endothelial Function Evaluation
All measurements are performed in a quiet room, in the supine position under carefully standardized conditions. The subjects are not allowed to sleep during the experiments. The ambient temperature in the room achieved by the air conditioner is 23±1°C.
Cutaneous microcirculatory blood flow is assessed by a LDI (Moor Instruments, version 5.3d software, Axminster, United Kingdom) to measure the skin blood flow (SkBF) in a region of interest corresponding to a surface of skin of 3.8 $cm^2$. For each measure, 12 scans are acquired, where the 2 first scans corresponded to the BSL cutaneous flow. Twenty minutes before the measurement, 5% EMLA cream® (2.5% lidocaine and 2.5% prilocaine; AstraZeneca, London, UK) is applied to the skin surface in order to limit any non-specific vasodilation induced by the electric current. Firstly, we performed Ach and SNP- induced hyperemia by administering these molecules percutaneously using dedicated iontophoresis chambers (ION6; Moor Instruments Ltd, Axminster, United Kingdom). Ach and SNP solutions are prepared to obtain a final concentration of 2g/dL in deionized water, and 2.5 ml of these solutions was introduced into the cathode (Ach electrode) and the anode (SNP electrode) chambers. Electric current is generated by an iontophoresis controller (MIC2, Moor Instruments Ltd, Axminster, United Kingdom), which was set to apply a current of 100 microamperes (µA) for 20 minutes. Ach and SNP iontophoresis are continued for 26 minutes in order to obtain a maximal skin vasodilation.
Skin hyperemia response to local heating is also assessed. This is done by heating the skin to 44° C using dedicated skin heater electrodes and a temperature monitor (SH02, Moor Instruments Ltd., Axminster, United Kingdom) after applying L-NAME (L-N-arginine-methyl-ester, 20 mmol/L) or NaCl (Normal saline 0.9 g/dL, Baxter®) iontophoresis to two adjacent skin areas. Heating is continued for 26 minutes in order to obtain a maximal skin vasodilation.

Blood sample collection
About 6ml of venous blood is obtained each time. Fasting blood glucose, triglycerides (TG), total cholesterol (Chol), high-density lipoprotein (HDL), low-density lipoprotein (LDL), blood urea nitrogen (BUN), creatinine (Cr), hepatic enzymes and total bilirubin (Tot. Bil) levels are determined in all subjects.

Blood pressure:
Blood pressure is measured in a sitting position, using a device (WelchAllyn, USA) with a cuff size

of 25-34 cm. After 5 minutes of rest, 2 measures on the non-dominant arm, separated by 1 minute, were averaged (in 3 sessions of fasting group, and 2 sessions of non-fasting group).

### Intervention Type
Other

### Primary outcome(s)
Evaluation of microvascular endothelial function is done at baseline (before-fasting session), fasting session (during Ramadan fasting period), post-fasting session (34 days after the end of Ramadan) for the fasting participants, and baseline and 28 days for non-fasting participants.
Evaluation of Microvascular endothelial function include:
1. Endothelial-dependent and independent vasodilations, evaluated by assessing skin hyperemia response to Ach and SNP
2. Nitric oxide bioavailability, measured by assessing skin hyperemia response to local heating

### Key secondary outcome(s))
All measures are taken at baseline (before-fasting session), fasting session (during Ramadan fasting period), post-fasting session (34 days after the end of Ramadan) for the fasting participants, and baseline and 28 days for non-fasting participants.

1. Blood pressure is measured using an automated sphygmomanometer (WelchAllyn, USA), in the sitting position
2. Weight is measured using a classic balance
3. Haematological parameters (fasting blood glucose, triglycerides, total cholesterol, high-density lipoprotein, low-density lipoprotein, blood urea nitrogen, creatinine, hepatic enzymes and total bilirubin) are measured using blood testing

### Completion date
01/09/2014

## Eligibility

### Key inclusion criteria
Fasting participants:
1. Male
2. Older than 18 years
3. Non-smoker
4. No concomitant disease
5. No medications
6. Fasting for Ramadan

Non-fasting participants:
1. Male
2. Older than 18 years
3. Non-smoker
4. No concomitant disease
5. No medications
6. Not fasting for Ramadan

### Participant type(s)
Healthy volunteer

**Healthy volunteers allowed**
No

**Age group**
Adult

**Lower age limit**
18 years

**Sex**
Male

**Total final enrolment**
14

**Key exclusion criteria**
1. Younger than 18 years
2. Smokers
3. Any disease
4. Taking any medication

**Date of first enrolment**
01/06/2014

**Date of final enrolment**
18/06/2014

# Locations

**Countries of recruitment**
Belgium

**Study participating centre**
**Erasme Hospital**
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# Sponsor information

**Organisation**
Université libre de Bruxelles (ULB) Erasmus Hospital

**ROR**
https://ror.org/01r9htc13

# Funder(s)

**Funder type**
University/education

**Funder Name**
Université libre de Bruxelles

# Results and Publications

## Individual participant data (IPD) sharing plan

**IPD sharing plan summary**
Stored in repository

**Study outputs**

| Output type | Details | Date created | Date added | Peer reviewed? | Patient-facing? |
|---|---|---|---|---|---|
| Results article | results | 14/09/2016 | 07/08/2019 | Yes | No |
| Participant information sheet | Participant information sheet | 11/11/2025 | 11/11/2025 | No | Yes |