

# The acute effect of time-restricted feeding (12 & 16 hrs) and varying exercise intensities on fat-oxidation rate

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<b>Registration date</b> 06/10/2023	<b>Overall study status</b> Completed	<input type="checkbox"/> Protocol
<b>Last Edited</b> 14/08/2024	<b>Condition category</b> Nutritional, Metabolic, Endocrine	<input type="checkbox"/> Statistical analysis plan
		<input checked="" type="checkbox"/> Results
		<input type="checkbox"/> Individual participant data

## Plain English summary of protocol

### Background and study aims

Time-restricted feeding (TRF) is a dietary pattern that alternates between periods of fasting and feeding, which has gained significant attention in recent years. The 16/8 approach consists of fasting for 16 hours and feeding for an 8-hour window, while the 12/12 method consists of fasting for 12 hours and a 12-hour feeding window. Limited research exists comparing the effects of these methods coupled with physical activity (PA). The aim of this investigation is to examine the acute effects of varying TRF durations (12 and 16 hrs) and varying PA intensities on the fat oxidation rate. It is hypothesized that the TRF16 group would exhibit a higher maximum fat-oxidation rate and that PA will enhance these effects, and high-intensity interval training exercise will result in greater effects on maximum fat-oxidation rate compared to light-intensity exercise.

### Who can participate?

Adult people aged between 18-65 years old who either work or study at York University

### What does the study involve?

This study examines the acute effects of TRF/intermittent fasting + physical activity (PA).

The study is at a single centre and there will be one study arm with study participants serving as their own controls; the order of sessions will be randomized to control for order effects using a simple randomization via an Excel spreadsheet. The acute physical activity intervention consists of 8 visits per participant with no follow-up.

Study participants will not have any physical ailments contraindicating participation in the study (e.g., cardiomyopathies, neuropathy, or other diabetes-related complications). Study participants will be screened by certified exercise physiologists. Loren Yavelberg and Veronica Jamnik will be present during all screenings and data collections which will comprise individual face-to-face laboratory interventions at the York University Human Performance Laboratory.

In the study, participants provide written informed consent before undergoing study-related procedures. A copy of the consent form is given to each participant, and another copy is stored in the study master file. After obtaining informed consent and completing a physical activity questionnaire, participants undergo a laboratory assessment to check if they meet the inclusion criteria. The initial screening takes place on the first experimental day.

During the first visit, participants undergo anthropometric, physical, physiological, and VO<sub>2</sub>max assessments. This includes measuring height, body mass, BMI, body fat percentage (%BF), and recording pre-exercise blood pressure and heart rate. Body mass is measured using a scale, %BF is determined using bioelectrical impedance analysis, and height is measured with a stadiometer. Participants also wear a chest-mounted heart rate monitor and perform an incremental-to-maximal effort treadmill test to determine maximum aerobic fitness or power (VO<sub>2</sub>max) using a specific spirometry system.

On the second experimental day, participants undergo the maximum fat-oxidation rate (FORmax) protocol, either after a 12-hour or 16-hour overnight fast, and after consuming 500 mL of water.

Subsequent visits involve interventions, including different types of exercise (low-intensity steady state or LISS or high-intensity interval training or HIIT) following fasting conditions (TRF12 or TRF16). FORmax tests are repeated throughout the study to assess changes in fat oxidation.

The study aims to understand the impact of fasting and exercise on various health parameters and fat oxidation.

What are the possible benefits and risks of participating?

The benefits of participation include having a VO<sub>2</sub>max assessment, body anthropometric assessment, and a health assessment. The study researchers consider that this is a minimal-risk study. The risks of participation are similar to those of participating in physical activity and the interventions are relatively safe. However, there is a risk of a minor injury.

Where is the study run from?

York University, Ontario (Canada)

When is the study starting and how long is it expected to run for?

October 2020 to November 2023

Who is funding the study?

Investigator initiated and funded

Who is the main contact?

Veronica Jamnik, ronij@yorku.ca (Canada)

## Contact information

**Type(s)**

Public

**Contact name**

Dr Loren Yavelberg

**ORCID ID**

<https://orcid.org/0000-0001-5904-4452>

**Contact details**

7890 Bathurst St  
Thornhill  
Canada  
L4J0J8  
+1 647 244 0639  
lorenyav@gmail.com

**Type(s)**

Scientific, Principal investigator

**Contact name**

Prof Veronica Jamnik

**Contact details**

Department of Kinesiology and Health Science  
Faculty of Health, Physical Activity, and Chronic Disease Unit  
York University  
4700 Keele St.  
Toronto  
Canada  
ON M3J 1P3  
+1 416 736 2100 Ext. 22995  
ronij@yorku.ca

## Additional identifiers

**Clinical Trials Information System (CTIS)**

Nil known

**ClinicalTrials.gov (NCT)**

Nil known

**Protocol serial number**

Nil known

## Study information

**Scientific Title**

The acute effect of time-restricted feeding (12 & 16 hrs) and varying exercise intensities on fat-oxidation rate

**Study objectives**

It is hypothesized that:

1. the time-restricted feeding for 16 hours (TRF16) group will exhibit a higher maximum fat-oxidation rate and physical activity will enhance these effects

2. HIIT will result in greater effects on maximum fat-oxidation rate compared to light intensity steady state physical activity

### **Ethics approval required**

Ethics approval required

### **Ethics approval(s)**

approved 28/08/2019, York University (4700 Keele St, Toronto, M3J 1P3, Canada; +1 416 736 5914; acollins@yorku.ca), ref: e2019-301 (amended approval 01/10/2020: e2019-274)

### **Study design**

Single-centre randomized controlled acute physical activity intervention study

### **Primary study design**

Interventional

### **Study type(s)**

Efficacy

### **Health condition(s) or problem(s) studied**

Obesity

### **Interventions**

All study participants will provide written informed consent for voluntary participation in the study before undergoing any study-related procedures. A copy of the consent form is given to each participant, and another copy is added to the study master file. After the completion of the informed consent and the physical activity (PA) questionnaire, study participants will undergo a laboratory assessment to ensure they meet the inclusion criteria. The pre-exercise screening occurs on the first experimental day.

During the first visit, participants undergo anthropometric, physical, physiological, and VO<sub>2</sub>max assessments. This includes collecting anthropometric data such as height, body mass, BMI, and body fat percentage (%BF) using standardized laboratory protocols. Pre-exercise blood pressure and heart rate (HR) measurements are determined in a seated position in a private room using an automated device. Body mass is measured using a specific scale, %BF is measured using bioelectrical impedance analysis, and height is measured with a wall-mounted stadiometer.

Study participants are then equipped with a chest-mounted heart rate monitor and briefed on the VO<sub>2</sub>max test. The incremental-to-maximal effort treadmill test for the determination of VO<sub>2</sub>max follows a standardized protocol. The test includes a 2-minute warm-up, and then progressive exercise workloads increase every two minutes. Participants are instructed to remain on the treadmill until their work tolerance is compromised, at which point they receive a 2-minute low-intensity active recovery period. This sequence continues until the VO<sub>2</sub>max criteria are met. The VO<sub>2</sub>max test is terminated if the participant cannot complete the workload or if the criteria are met. VO<sub>2</sub> measurements are obtained through the analysis of mixed expired gases using a specific spirometry system.

The spirometry system includes a 120 L Tissot gasometer, rapid response oxygen and carbon dioxide gas analyzers, a flexible plastic hose, a two-way y-valve, a mouthpiece, and nose plugs. Participants breathe in and out of the mouthpiece throughout the VO<sub>2</sub> collection period with their noses plugged. The collected variables, minute ventilation, and fractions of expired carbon

dioxide and oxygen are used to calculate VO<sub>2</sub>max. The criterion HR is measured using a Polar HR chest monitor. Participants are instructed to maintain their regular lifestyle prior to each experimental day, including diet and physical activity.

Visit 2 involves the FORmax assessment. Once participants meet the preliminary inclusion criteria, they are randomized into groups based on fasting duration (TRF12 or TRF16) and exercise intensity (LISS or HIIT). Following randomization, participants return to the laboratory after a 12- or 16-hour overnight fast to complete the initial FORmax test, which serves as their own control for statistical analysis. Resting and exercise HR are measured using a Polar chest strap HR monitor. Resting VO<sub>2</sub> and FOR measurements are obtained with participants seated. Expired gases are collected and analyzed similarly to the VO<sub>2</sub>max test.

The FORmax protocol includes progressively increasing treadmill speed and elevation until the respiratory exchange ratio meets the criteria for FORmax attainment.

Subsequent visits (Visits 3 to 8) involve the start of intervention with TRF, PA, and additional FORmax tests. Participants arrive at the laboratory following their assigned fasting duration and engage in either LISS PA or HIIT. Kcal expenditure is calculated based on O<sub>2</sub> consumption, and the FORmax test is repeated at the end of each acute intervention phase. These interventions are repeated at different time points throughout the study.

### **Intervention Type**

Mixed

### **Primary outcome(s)**

Fat-oxidation rate measured using indirect calorimetry via the criterion discrete open circuit spirometry system following a 12/16 hour fast + post-physical activity intervention

### **Key secondary outcome(s)**

Weight loss measured using body weight scale + body fat scale (BIA device) following a 12/16 hour fast + post-physical activity intervention

### **Completion date**

28/11/2023

## **Eligibility**

### **Key inclusion criteria**

1. Aged 18-65 years old
2. Attending or an employee of York University
3. Classified as normal weight (BMI=18.5-24.9), overweight (BMI=25.0-29.9) or obese class I (30.0-34.9)
4. Absent of injuries that would diminish their ability to complete an exercise session
4. Having a VO<sub>2</sub>max  $\geq 30$  mL·kg<sup>-1</sup>·min<sup>-1</sup>, and resting blood pressure < 160/90 mmHg

### **Participant type(s)**

Employee, Learner/student

### **Healthy volunteers allowed**

No

### **Age group**

Adult

**Lower age limit**

18 years

**Upper age limit**

65 years

**Sex**

All

**Total final enrolment**

18

**Key exclusion criteria**

Regular exercisers (being active for the past 3 months, more than twice a week)

**Date of first enrolment**

01/12/2019

**Date of final enrolment**

31/10/2023

## **Locations**

**Countries of recruitment**

Canada

**Study participating centre**

**York University Human Performance Lab**

4700 Keele St

Bethune College Room 124

Toronto

Canada

M3J 1P3

## **Sponsor information**

**Organisation**

York University

## **Funder(s)**

## Funder type

Other

## Funder Name

Investigator initiated and funded

# Results and Publications

## Individual participant data (IPD) sharing plan

The data-sharing plans for the current study are unknown and will be made available at a later date. Until then, physical data will be stored in a locked cabinet in a locked room. Digital data is being stored on a password-protected computer, in a locked room.

## IPD sharing plan summary

Stored in non-publicly available repository, Data sharing statement to be made available at a later date

## Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Results article</a>		13/08/2024	14/08/2024	Yes	No