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

Submission date
28/09/2023

Recruitment status
No longer recruiting

Registration date
06/10/2023

Overall study status
Completed

Last Edited
14/08/2024

Condition category
Nutritional, Metabolic, Endocrine

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] 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 VO2max 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 (VO2max) 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 VO2max 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

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Additional identifiers

Clinical Trials Information System (CTIS)
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)

Primary study design
Interventional

Study design
Single-centre randomized controlled acute physical activity intervention study

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 VO2max 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 VO2max test. The incremental-to-maximal effort treadmill test for the determination of VO2max 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 VO2max criteria are met. The VO2max test is terminated if the participant cannot complete the workload or if the criteria are met. VO2 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 VO2 collection period with their noses plugged. The collected variables, minute ventilation, and fractions of expired carbon dioxide and oxygen are used to calculate VO2max. 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 VO2 and FOR measurements are obtained with participants seated. Expired gases are collected and analyzed similarly to the VO2max 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 O2 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 VO2max ≥30 mL·kg-1·min-1, 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
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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?
Results article		13/08/2024	14/08/2024	Yes	No