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Comparing sprint-interval training and moderate intensity continuous exercise training for fitness improvements in healthy females

Submission date 11/09/2025	**Recruitment status** Recruiting	[X] Prospectively registered [_] Protocol [_] Statistical analysis plan [_] Results [_] Individual participant data [X] Record updated in last year
Registration date 12/09/2025	**Overall study status** Ongoing	
Last Edited 12/09/2025	**Condition category** Other	

Plain English summary of protocol

Background and study aims
This study compares two types of exercise: traditional moderate-intensity continuous training and sprint interval training. Sprint interval training involves short, hard bursts of effort and requires a lower time commitment and total amount of exercise. Both types of exercise can improve cardiorespiratory fitness, which is linked to living longer and reducing the risk of many chronic diseases. This study is testing whether the sprint method works just as well as the longer, traditional approach. We are specifically looking to see whether the sprint method is "not worse than" the traditional approach for improving fitness.

Who can participate?
Healthy, but sufficiently inactive, female volunteers (aged 18-35 years).

What does the study involve?
Participants will be randomly placed into one of two exercise groups.
-One group will do sprint interval training on a special exercise bike. Each session includes a short warm-up, three 20-second all-out sprints, and a cooldown.
-The other group will do traditional moderate exercise on a different bike. Each session includes a warm-up, 50 minutes of steady cycling, and a cooldown.
Both groups will train three times a week for 12 weeks.

What are the possible benefits and risks of participating?
There are no proposed benefits to participants. However, the findings of this study could help determine whether people get similar health benefits with less time spent exercising.
As with any research, there are risks associated with participating, such as maximal exercise testing or blood samples. The research team has done everything possible to mitigate these risks and will gladly provide further information if requested.

Where is the study run from?
McMaster University in Hamilton, Ontario (Canada)

When is the study expected to run for?
May 2025 to January 2028

Who is funding the study?
Natural Sciences and Engineering Research Council of Canada (NSERC) (Canada)

Who is the main contact?
Dr Martin Gibala, gibalam@mcmaster.ca

Contact information

Type(s)
Public, Scientific, Principal Investigator

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Additional identifiers

EudraCT/CTIS number
Nil known

IRAS number

ClinicalTrials.gov number
Nil known

Secondary identifying numbers
HiREB #19090

Study information

Scientific Title
Peak oxygen uptake response to twelve weeks of sprint-interval or moderate-intensity continuous training in healthy females: A randomized non-inferiority trial

Acronym
NIF

Study objectives
The primary objective of the current study is to rigorously test whether 12 weeks of low-volume sprint-interval training elicits peak oxygen uptake improvements that are non-inferior to a moderate-intensity continuous training regimen modelled on common physical activity guidelines. We hypothesize that the low-volume sprint interval training-induced improvement in peak oxygen uptake will be non-inferior to moderate intensity continuous training.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 09/09/2025, Hamilton Integrated Research Ethics Board (237 Barton Street East, Hamilton, L8L 2X2, Canada; +1 905 521-2100 ext. 42013; belle@hhsc.ca), ref: 19090

Study design
Single-centre interventional single-blind randomized non-inferiority trial

Primary study design
Interventional

Secondary study design
Randomized non-inferiority

Study setting(s)
Laboratory

Study type(s)
Treatment

Participant information sheet
Not available in web format, please use contact details to request a participant information sheet.

Health condition(s) or problem(s) studied
Using different exercise treatments to improve cardiorespiratory fitness in young, insufficiently active but otherwise healthy females.

Interventions
Briefly, participants will be assigned via block randomization following a 1:1 allocation ratio to either low-volume sprint-interval training (LVSIT) or moderate intensity continuous training (MICT). A randomization sequence will be created using a computerized random number generator (Microsoft Excel). Participants randomized to the LVSIT arm will perform exercise on an electronically braked cycle ergometer (CAROL Bike, Integrated Health Partners, London, UK). Each LVSIT session will involve a 2-min warm-up, 3 × 20-s ‘all-out’ sprints, and a 3-min cooldown. The workload for the sprints will be an individualized resistance determined by a self-learning algorithm that adjusts based on the participant's mass, power output, and fatigue index. Participants randomized to the MICT arm will perform exercise on an electronically braked cycle ergometer (Kettler, Ergo Race I, Germany). Each MICT session will involve a 2-min warm-up, 50 min of continuous cycling at a fixed workload that elicits a mean intensity equivalent to ~70% HRmax, and a 3-min cooldown. Training will be performed three times per week for a total of 12 weeks.

Intervention Type
Other

Primary outcome measure
Peak oxygen uptake (VO2peak) will be determined by a progressive exercise test to maximal voluntary exertion using an electromagnetically braked cycle ergometer (Lode Excalibur Sport V2.0, Groningen, The Netherlands). Gas exchange and ventilatory variables will be continuously determined using a metabolic cart (Quark CPET metabolic cart, COSMED, Italy). Data will be averaged over 10-s intervals and VO2peak will be defined as the highest 30-s average over three consecutive intervals. VO2peak will be measured in duplicate before and after the 12-week intervention.

Secondary outcome measures
1. Heart rate measured (Polar A3, Finland) during exercise across all testing and training sessions.
2. Body mass measured using scale before and after the 12-week intervention .
3. Hippocampal-dependent learning and memory measured using the optimized Mnemonic Similarities Task (oMST), before and after the 12-week intervention.
4. Respiratory gases (VCO2, VO2, RER, VE) measured during exercise using metabolic cart (Quark CPET metabolic cart, COSMED, Italy) before and after the 12-week intervention and during select training sessions. Note that post-testing includes two separate trials i.e., at the same absolute and relative intensity as compared to baseline .
5. Serum: BDNF, Plasma: BDNF, cortisol, epinephrine, norepinephrine and insulin measured using commercially available assays, before and after the 12-week intervention . Note that post-testing includes two separate trials i.e., absolute and relative trials to baseline. Blood will be sampled at rest and prior to the cessation of exercise during each submaximal test.
6. [glucose], [pH], [lactate], pCO2, pO2 measured using blood analyzer cards (EPOC; Siemens Healthcare, Ontario, Canada) before and after the 12-week intervention. Note that post-testing includes two separate trials i.e., absolute and relative trials to baseline. Blood will be sampled at rest and prior to the cessation of exercise during each submaximal test.
7. Complete blood count analysis measured by Hamilton Regional Laboratory Medicine Program, Core Laboratory located at McMaster University Medical Centre before and after the 12-week intervention. Note that post-testing includes two separate trials i.e., absolute and relative trials to baseline. Blood will be sampled at rest and prior to the cessation of exercise during each submaximal test.
8. Rating of perceived exertion measured using the Borg Scale, before and after the 12-week intervention, including during training visits.

Overall study start date
01/05/2025

Completion date
01/01/2028

Eligibility

Key inclusion criteria
1. Biologically female
2. Aged 18–35 years
3. Insufficiently active based on self-report of not achieving 150 min of moderate to vigorous aerobic physical activity per the Canadian 24-h Movement Guidelines for Adults and deemed

generally safe engage in physical activity per completion of the Canadian Society for Exercise Physiology Get Active Questionnaire (GAQ)

Participant type(s)
Healthy volunteer

Age group
Adult

Lower age limit
18 Years

Upper age limit
35 Years

Sex
Female

Target number of participants
46

Key exclusion criteria
Not meeting inclusion criteria

Date of first enrolment
12/09/2025

Date of final enrolment
01/09/2027

Locations

Countries of recruitment
Canada

Study participating centre
Human Performance Laboratory
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Sponsor information

Organisation

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Sponsor type
University/education

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ROR
https://ror.org/02fa3aq29

Funder(s)

Funder type
Government

Funder Name
Natural Sciences and Engineering Research Council of Canada

Alternative Name(s)
Conseil de Recherches en Sciences Naturelles et en Génie du Canada, NSERC, CRSNG

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
Canada

Results and Publications

Publication and dissemination plan
Planned publication in a peer-reviewed journal and related presentations at physiological conferences.

Intention to publish date
01/01/2028

Individual participant data (IPD) sharing plan
The data-sharing plans for the current study are that all data will be made publicly available upon reasonable request from the PI, Dr. Martin Gibala (gibalam@mcmaster.ca).

IPD sharing plan summary
Available on request