ISRCTN88544091 https://doi.org/10.1186/ISRCTN88544091

Comparing heart rate variability changes following exercise in young men who are athletes, obese non-athletes and non-obese non-athletes

Submission date
06/05/2022

Recruitment status
No longer recruiting

Registration date
10/05/2022

Overall study status
Completed

Last Edited
08/07/2025

Condition category
Not Specified

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims

Who can participate?
Men aged 20-30 years including normal-weight non-athletes, obese non-athletes and athletes.

What does the study involve?
All participants will carry out sprinting, resistance or quiet sitting and their heart rate and blood pressure will be measured before the activity and at various times up to 12-14 hours after the activity. They will do all three activities in random order.

What are the possible benefits and risks of participating?
Each participant will receive their own fitness test results, which may help them develop training programs. They may experience breathlessness, muscle tiredness and soreness during or after exercise tests. The sensation of breathlessness will resolve immediately after termination of the exercise, while the muscle soreness may remain for a few hours after the exercise. The researchers will try to reduce discomfort by including a standard warm-up /cool-down and will closely monitor physical and emotional states during exercise and recovery.

Where is the study run from?
Macao Polytechnic University (Macau)

When is the study starting and how long is it expected to run for?
January 2020 to November 2023

Who is funding the study?
Macao Polytechnic University (Macao S.A.R)

Who is the main contact?
Dr Qingde Shi, qdshi@ipm.edu.mo

Contact information

Type(s)
Principal investigator

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
RP/ESCSD-02/2020

Study information

Scientific Title
Autonomic recovery after exercise in trained endurance athletes: Implications for training prescription

Study objectives
Background:
During exercise, heart rate increases from the resting level are mainly accomplished by increasing sympathetic modulation and withdrawing parasympathetic activity to the heart. Such exercise-induced imbalance in the cardiac autonomic nervous activity attenuates the heart rate variability (HRV), which is an indicator of the autonomic function of the cardiovascular system and its adaptability to internal and external stimuli. Accordingly, HRV recovery of individuals after a workout, which reflects the reactivation of the cardiac parasympathetic neural activity, is

often used as a cardiovascular system recovery marker in guiding the subsequent training load prescription to avoid unnecessary overloading. In addition, sympathovagal imbalance in the cardiovascular system, with lowered parasympathetic and heightened sympathetic activation, is commonly found in obese individuals. However, the HRV responses to exercise in obese people were inconclusive in previous studies. Whether obesity influences the post-exercise HRV recovery in untrained individuals and athletes is unknown. The current study aims to examine the interaction of the post-exercise HRV recovery across normal-weight non-athletes, obese non-athletes and athletes. The study's findings should help to optimize training prescriptions for different populations.

Hypothesis:
Post-exercise heart rate variability (HRV) would be reduced from the corresponding non-exercising control values in non-athlete and athlete groups. The attenuated post-exercise HRV would regain faster in athletes than non-athletes, while the rate of HRV resumption would be comparatively lower in obese individuals. This study examined the alterations of heart rate variability following iso-duration resistance and sprint-interval exercises as well as non-exercise control in non-athlete (non-obese and obese) and athlete participants.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 03/08/2020, Pedagogic and Research Affairs Office (Macao Polytechnic University, Rua de Luís Gonzaga Gomes, Macao S.A.R; +853-85996333; dei@ipm.edu.mo). ref: CI144/DEI /2020

Study design
Randomised cross-over trial

Primary study design
Interventional

Study type(s)
Other

Health condition(s) or problem(s) studied
To compare the differences in autonomic function recovery after acute exercise in non-athletes and athletes to provide a basis for training prescription.

Interventions
All participants (normal weight non-athletes, obese non-athletes and athletes) will perform a sprint-interval exercise (SIE, 4 x 30-s all-out sprints with 4-min recovery), resistance exercise (RES, 1 set x 9 exercises at 10 RM) and control trials. The order in which the three trials are assigned to the participants in a random fashion. In the control trial, the experimental procedures are the same as that of the exercise trials, except that the exercise is replaced by quiet sitting.

Intervention Type
Other

Primary outcome(s)

Heart rate variability will be measured using a Holter electrocardiogram device at 0-120 min post-exercise, for one night's sleep, and 12-14 h post-exercise.

Key secondary outcome(s))
Blood pressure will be measured using an ambulatory blood pressure monitor (ABPM) at 0-120 min post-exercise, for one night's sleep, and 12-14 h post-exercise.

Completion date
31/10/2023

Eligibility

Key inclusion criteria
Non-athletes:
1. Male non-athletes who occasionally participate in recreational sports activities
2. Aged 20-30 years
3. Divided into two groups according to their obesity status, with cut-off for obesity set at the percentage of body fat of ≥25%: normal weight non-athlete and obese non-athlete groups.

Athletes:
1. Macao-trained endurance runners who participate in competitive endurance races with regular endurance training of an average of at least 5 days/week and 60 min/day for the previous 3 years or more
2. Aged 20-30 years (20-30 years old) will be recruited to participate in this study

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Sex
Male

Key exclusion criteria
1. Hormonal, orthopaedic, cardiovascular diseases, diabetes, hyperlipidemia, and hypertension identified by a medical screen
2. Smokers
3. On medication or dietary supplements of various types

Date of first enrolment
01/11/2020

Date of final enrolment
01/05/2023

Locations

Countries of recruitment
Macao

Study participating centre
Exercise Physiology Lab
P116, MPI Multisport Pavilion
Macao Polytechnic University
Rua de Luís Gonzaga Gomes
Macao
Macao
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Sponsor information

Organisation
Macau Polytechnic Institute

ROR
https://ror.org/02sf5td35

Funder(s)

Funder type
University/education

Funder Name
Instituto Politécnico de Macau

Alternative Name(s)
IPM

Funding Body Type
Government organisation

Funding Body Subtype
Local government

Location
Macao

Results and Publications

Individual participant data (IPD) sharing plan

The datasets, including raw data, generated during the current study will be available upon request from Dr Qingde Shi (qdshi@ipm.edu.mo) after publication of the data-related paper in a peer-reviewed academic journal.

IPD sharing plan summary

Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		01/09/2022	08/07/2025	Yes	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes