Participant Information Sheet For Adults

UCL Research Ethics Committee Approval ID Number: _LMS REC - 2025-1324_____

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study:
How exercise benefits executive function

Department:
UCL's Institute of Sport, Exercise and Health

Name and Contact Details of the Researcher(s):
Dr Benjamin Tari (btari@ucl.ac.uk)
Name and Contact Details of the Principal Researcher:
Dr Flaminia Ronca (f.ronca@ucl.ac.uk)

1. **Invitation Paragraph**
   You are being invited to take part in a research project at University College London's (UCL) Institute of Sport, Exercise and Health (ISEH, 170 Tottenham Court Road, W1T 7HA). This is a research study, and NOT for any diagnostic purpose. Before you decide it is important for you to understand why the research is being done and what participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.
   Thank you for reading this.

2. **What is the project's purpose?**
   Single bouts of exercise have been known to support executive functioning (i.e., higher-order cognitive processes necessary for daily living) for up to one hour after exercise completion. The mechanisms underlying this benefit, however, are still unclear. This project aims to understand how different modalities of exercise (i.e., passive exercise, cycling, leg raises), and muscle stimulation improve executive function in healthy adults. The data collected will be used as part of research being undertaken by staff and students at UCL. This research is NOT for any diagnostic purpose.

   This study explores how passive exercise — like being moved by an external source rather than moving yourself — might help improve cognitive function during and after the activity. Passive exercise has been shown to be an effective rehabilitation technique; however, its use in the context of brain health is still poorly understood. Therefore, we will compare its effects to three additional sessions on separate days which will include aerobic cycling, resistance exercise, and electrical muscle stimulation, respectively. To understand the relationship between these exercises and cognition, we'll measure:
   - Brain activity using a light-based scanner placed on the head
   - Blood glucose and lactate levels with 4 small finger-prick samples per session
   - Muscle activity using sensors that track muscle signals
   - Heart rate and blood pressure with a standard finger-pulse monitor
   - Breathing and oxygen use with a machine that analyses air flow during exercise
   - Cognition using a tablet-based pointing task

   These outcomes will be useful to provide a comprehensive mechanistic understanding of how the exercises will differ and how this may translate to differences in cognitive outcomes. All sessions will last about 1.5 hours from set-up to completion.

3. Why have I been chosen?

33 participants will be recruited for this study. You are invited to take part in this research study if you meet the following criteria:

- 18-35 years of age
- Normal or corrected-to-normal vision
- Right-hand dominant
- Non-smoking
- Do not regularly partake in recreational drugs
- No history of neurological impairment (including concussion)
- No history of neuropsychiatric disorder
- No history of cardiovascular or metabolic disease that would hinder exercise participation
- No history of neuromuscular impairment
- Are free from illness on the days of testing (i.e., no flu-like symptoms).
- Answer "No" to relevant questions on the physical activity readiness questionnaire (PAR-Q)
- Score higher than 14 on the Godin leisure time exercise questionnaire (GLTEQ)

4. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw at any time without giving a reason and without it affecting any benefits that you are entitled to. If you decide to withdraw you will be asked what you wish to happen to the data, you have provided up that point. If you have participated in at least one session but have not yet completed the study in its entirety, you are still able to withdraw. We will ask you to indicate what you wish to happen to the data we have collected up to that point.

5. What will happen to me if I take part?

If you are interested in taking part, you are encouraged to first consult the inclusion criteria above. If you are satisfied with the information included in this letter, and if you feel you satisfy all the inclusion criteria, please email us to schedule a video call with a member of the research team. At this time, we can complete a pair of screening questionnaires (i.e., physical activity readiness questionnaire (PAR-Q); the Godin leisure time exercise questionnaire (GLTEQ)) which will be attached to your recruitment email or the QR code on the recruitment poster. These are straightforward to review and complete. We can also go through any questions you may have. If you are eligible to participate, we will be able to schedule your in-person sessions.

At your first session, you will be asked to sign the PAR-Q and GLTEQ forms and fill out and sign a study consent form. You will be asked to provide your name, date of birth/age, and email address, and be assigned a study ID.

The study will include 4 study days wherein you will be asked to complete a session of passive exercise, a session of stationary aerobic cycling, a session of lower-limb resistance exercises, and a session of mild electro-stimulation. Executive function will be assessed before, during, and after each intervention via a purpose-built pointing task (anti-pointing). Moreover, each session will involve an exploration of heart rate, breath-by-breath gas exchange, ventilation, blood pressure, muscle activity, and neural activity. We will also carry out finger prick blood testing before, during, and after testing. Each session will take about an hour to complete, but we ask you allow up to 1.5 hours for set-up and deconstruction (i.e., 6 hours over 4 days).

Information regarding all relevant measures/tests is included below.

PAR-Q
The PAR-Q asks a series of questions such as "Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?" and other similar questions to determine your "readiness" to participate in an exercise task. The PAR-Q is a reliable and valid metric for determining an individual's "readiness" to participate in physical activity.

GLTEQ
The GLTEQ asks for you to report how frequently you engage in strenuous, moderate and mild exercise in a 7-day period.

Pro- Antipointing task
For all study visits you will complete an executive function assessment before, during, and after each session. You will be seated in a chair with an iPad® placed flat and lengthwise (i.e., landscape mode) on a tabletop. You complete a series of trials requiring you to point directly at (i.e., propoint) a target circle, or to point in the opposite direction of a target circle (i.e., antipoint; measure of inhibition) that appears on the tablet screen.

Upon completion of the executive assessments, de-identified .txt files will be created and automatically sent to the tablet's Files application. The .txt file does not include any personal information. This task is completely anonymous and no personal or location data will be collected.

Borg Scales and Psychological Assessments
These scales will allow us to quantify how strenuous you perceive each session, and ensure you are not in distress during each session. Note that psychological assessments relate to your mental fatigue, concentration, motivation, stress and arousal. A researcher will ask you to rate your feelings on scales of 6-20, 1-10, and on visual analog scales before, during, and after each session.

Passive Cycling Session
In this session, you will sit on a cycle ergometer (i.e., a stationary bike) and the pedals on the cycle ergometer will be mechanically driven and your legs will passively move with the movement of the pedals. You do NOT need to engage any of your muscles. The speed of the pedals will be set to 70 rpm and the exercise will last for 20 minutes.

Stationary Cycling Session
In this session, you will then be asked to cycle at a light intensity (i.e., 55% predicted maximum heart rate (i.e., 220-age)) for a period of 20 minutes at 70 rpm.

Active Resistance Exercise Session
In this session, you will sit in a chair and have your feet placed under a knee extension machine. You will then complete sets of 10 knee extensions with breaks in between for a period of 20 minutes at a resistance level perceived to be "light" as defined via the Borg scale.

Muscle Stimulation Session
In this session, you will sit in a chair and have your feet flat on the ground. Small adhesive pads (electrodes) will be placed on the skin over your leg muscles to conduct electrical muscle stimulation (EMS) for a period of 20 minutes at an intensity defined by your response to the Borg scales described above. EMS is a technique that uses gentle electrical impulses to activate muscles. These impulses cause the muscles to contract, mimicking natural movement. The

procedure is safe, non-invasive, and typically well tolerated, with only a mild tingling sensation during use.

Surface Muscle Activity Monitoring

Electromyography (EMG) is a non-invasive technique to measure the electrical activity of muscles. Small sensors will be placed on the skin over muscles of your legs (i.e., thighs, quads) to measure signals when muscles contract and relax. This will occur during each session. The procedure is safe, painless, and commonly used in both clinical and research settings.

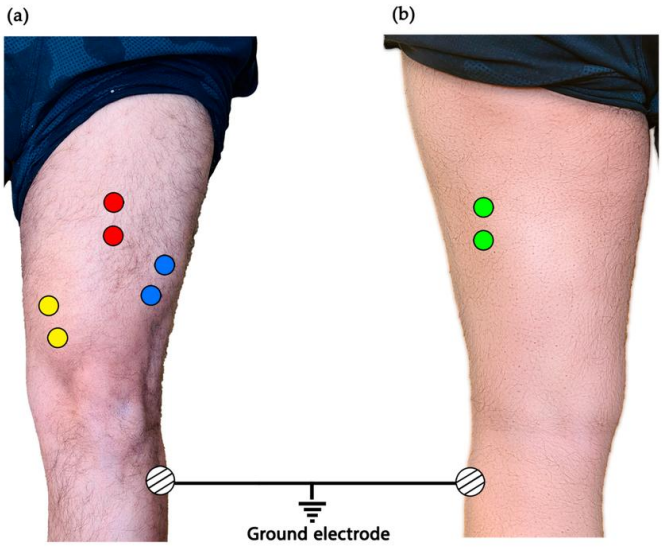


Figure representing EMG placement from Al Amer et al. 2025 - https://doi.org/10.3390/healthcare13080920

Heart Rate, Blood Pressure, Ventilation, Gas-Exchange

Breath-by-breath gas exchange variables, ventilation, heart rate, and blood pressure will be collected via CPET, and Somnotouch devices, respectively, which will be worn during the intervention period. These are all non-invasive techniques that are safe, painless and commonly used.

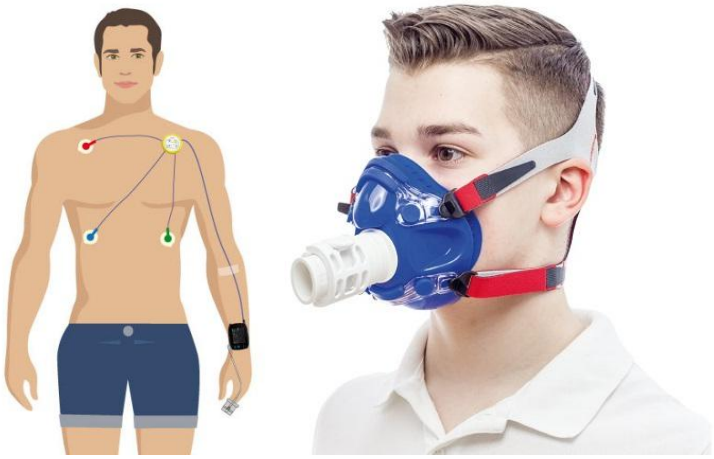
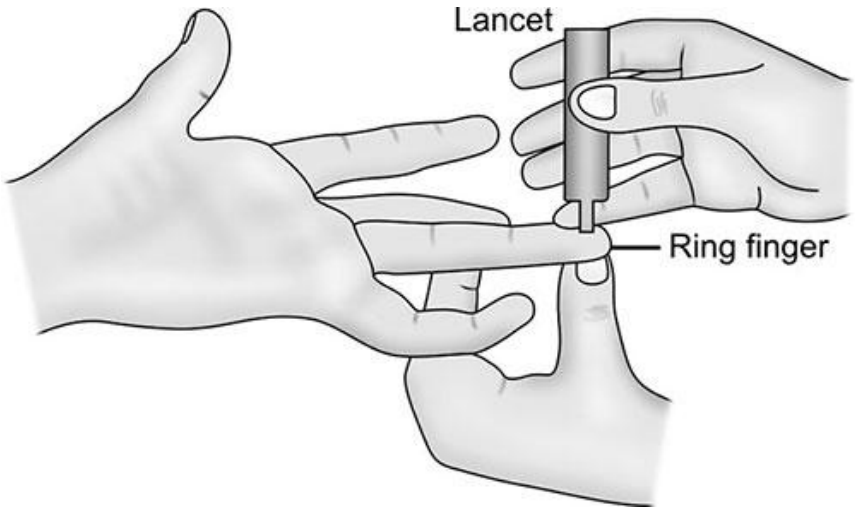


Figure representing Somnotouch placement (left) and CPET mask (right) from Cuffless-Solution - SOMNOtouch™ NIBP - A new era and Dormed Hellas – Geratherm CPET - Ergospirometry, respectively.

Finger Prick Blood Sampling

Finger prick blood sampling is a quick and safe method used to collect a small amount of blood. A tiny, sterile lancet is used to make a small puncture on the fingertip, and a few drops of blood (typically up to 0.2 mL) are collected for testing. We will analyse lactate and glucose concentrations and will collect 4 samples each session, and samples will not be drawn from the same finger (total 0.8 mL per session; 3.2 mL total overall). The procedure may cause brief discomfort, but it is generally well-tolerated and does not require a visit to a clinic or hospital. You will be given a tissue to cover your finger after testing, and if needed you will be provided with a plaster.

To minimise the risk of possible contamination/infection, members of the research team responsible for collecting blood samples will do so with medical-grade gloves. These will be powder-free and latex-free in case of any allergies. We will ask you about any allergies to latex/other relevant materials to minimise risk.



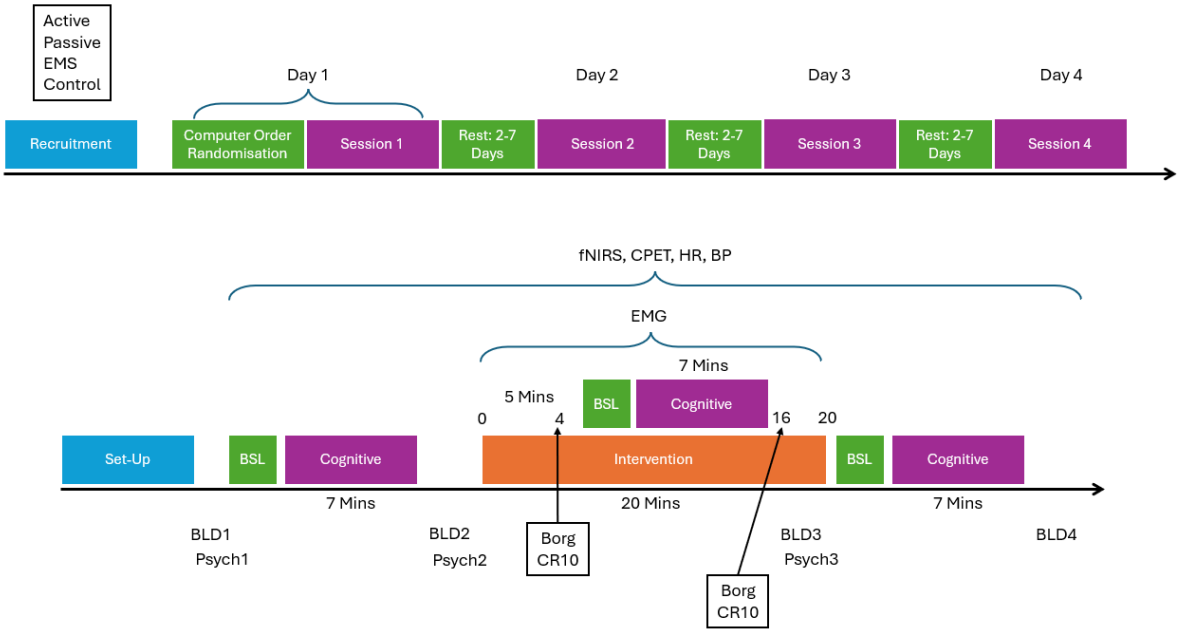
An example finger prick test from JaypeeDigital | Practical Hematology for BDS

Brain Imaging

During the entire session duration (i.e., including cognitive tests), you will be fitted with a functional near-infrared spectroscopy (fNIRS) cap. fNIRS is a safe, non-invasive technique used to measure brain activity. It works by shining near-infrared light through the scalp and detecting changes in blood oxygen levels in the brain. These changes reflect how different areas of the brain are working during tasks such as thinking, speaking, or moving. fNIRS is silent, portable, and comfortable to wear, making it especially useful in a wide range of research settings.

An example of an fNIRS cap from [NIRS devices — Artinis Medical Systems | (f)NIRS devices](#).

Flow Diagram



Note: BLD = blood testing; Psych = Psychological Assessment, Borg/CR-10 = Borg scales, BSL = baseline; fNIRS = functional near-infrared spectroscopy; CPET = cardiopulmonary exercise testing; HR = heart rate; BP = blood pressure

Note: The Sessions will be randomised on the day of testing, and the researchers and participants will not know which session is occurring until that time.

6. What are the possible disadvantages and risks of taking part?

There are minor risks associated with exercise completion, muscle stimulation, finger pricks, and/or non-invasive physiological data collection, but these adverse events in healthy individuals (as determined by screening) are exceedingly rare. In the unlikely event of an adverse event, the ISEH is equipped with first-aide equipment and staffed by trained personnel who can administer aide. In the unlikely event of a more serious adverse event, emergency services will be contacted during the administration of first aide.

As with any activity which requires computer activity/storage, there is the minor risk of a data breach. Note that your personal data will not be made available to anyone besides the study team and will be recorded on paper. Stored data will be pseudonymised and will not be able to identify you. In the event of a data breach, we will follow standard procedures found here (Data Protection | Data Protection - UCL – University College London).

It may be possible that blood testing will reveal a previously un-known health condition (e.g., especially high or low levels of glucose that may be an indicator of diabetes). In this event, we will contact you as soon as possible to schedule a Teams call and advise you to seek the opinion of your general practitioner or another trained health practitioner. You will be removed from the study as per procedures outlined above. We note that it would be very unlikely that you would be unaware of this condition prior to participation in this study.

7. **What are the possible benefits of taking part?**
While there are no immediate benefits of taking part in the study, you will be contributing to ground-breaking research about how exercise supports executive function in healthy adults.

8. **What if something goes wrong?**
If you are unhappy with any aspect of the study and wish to make a complaint, you should contact The Principal Researcher / Supervisor – f.ronca@ucl.ac.uk
However, if you feel your complaint has not been handled to your satisfaction, you can contact the Chair of the UCL
Research Ethics Committee – ethics@ucl.ac.uk
If you are harmed during the process of data collection there is no set compensatory action in place, however, if someone has been negligent in any way to account for this then you will have grounds for legal action.

9. **Will my taking part in this project be kept confidential?**
All the information that we collect about you during the course of the research will be kept strictly confidential. You will not be able to be identified in any ensuing reports or publications.

10. **Limits to confidentiality**
Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.

11. **What will happen to the results of the research project?**
Data collected will be analysed and presented in research projects undertaken by UCL staff and students, and in articles published in scientific journals. All data will be entirely anonymised and analysed at the group level. The data collected will be securely deleted 5 years after the project has been published.

12. **Local Data Protection Privacy Notice**

Notice:
The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk

This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice:

For participants in research studies, click here.

The categories of personal data used will be as follows:

- Name
- Study ID
- Date of Birth/Age
- Email

The lawful basis that will be used to process your personal data is: 'public task'.

Your personal data will be processed so long as it is required for the research project. If we are able to anonymise or pseudonymise the personal data you provide we will undertake this and will endeavour to minimise the processing of personal data wherever possible.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

13. Who is organising and funding the research?

This research study is organised by UCL and the ISEH.

14. Contact for further information

Should you require further information please do not hesitate to contact Dr Flaminia Ronca (f.ronca@ucl.ac.uk) or Dr Benjamin Tari (btari@ucl.ac.uk).

If you would like to participate in this study, please contact Dr Benjamin Tari (btari@ucl.ac.uk).

Thank you for reading this information sheet and for considering to take part in this research study.