INFORMATION LETTER FOR PARTICIPANTS

COMPARISON BETWEEN HIGH AND LOW-INTENSITY ECCENTRIC CYCLING TRAINING OF EQUAL TOTAL VOLUME FOR MUSCLE AND CONNECTIVE TISSUE ADAPTATIONS

Thank you for your interest! Please read this information letter carefully before you decide to participate. If you decide not to participate, there will be no disadvantage for you of any kind and we thank you for considering participating. If you have any questions, please do not hesitate to ask us any time.

Researchers and contact details
This research project is part of the requirements of a Doctor of Philosophy in Sport and Exercise Science by Research at Edith Cowan University (ECU). The responsible researchers for this project are:

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Background
Muscles perform eccentric muscle contractions when they are lengthened and activated at the same time. Eccentric muscle actions are performed during every day activities, such as when you lower a weight slowly or walk downstairs. A relatively new way of performing eccentric contractions is eccentric cycling. Eccentric cycling is performed on a cycling ergometer that rotates the pedals of the bike backwards while you use your leg muscles to work against them. This type of work against the pedals requires your thigh muscles to perform eccentric muscle actions as they have to be activated while being lengthened. Eccentric cycling has been shown to elicit significant increases in both muscle strength and muscle mass after several weeks of training.

However, most previous research has focused on single-joint eccentric exercise, such as knee extension or elbow flexion, but has rarely focused on multi-joint exercise, such as eccentric cycling. Additionally, most studies have utilised a maximal-intensity protocol that may not be feasible for everyone. However, we still don’t know if muscle strength, size, and properties, health parameters as well as protein concentration in the muscles are affected more by the intensity or the duration of the eccentric exercise.

Purpose of this research project
There are great training effects with respect to muscle size and function when performing eccentric exercise training, that are evident after only a few weeks. Elderly or frail people, clinical or injured populations may greatly benefit from eccentric exercise training, but many of them are incapable of performing exercise at high intensities. For that reason, this research project aims to identify differences in the chronic adaptations in high- vs. low-intensity eccentric cycling with equal total volume. This new knowledge will provide the scientific and coaching communities with useful information to better design future long-term training programs.

Why were you contacted?
You have been selected as a potential participant for the study as you have indicated that you are a healthy male aged between 18 and 30 years. To qualify, you must not be currently participating in any resistance-type exercise (such as with dumbbells and weight machines) and must not have had any musculoskeletal or neurological injuries of the lower extremities in the last 6 months. You will be asked to complete a generic medical questionnaire consisting of questions about your health and physical condition. If you are then eligible for participating in the study, you will be invited to the first session.

What will be asked of you?
You will be asked to come to the Exercise Physiology Laboratory at the Edith Cowan University in Joondalup (Building 19.150) on 29 separate occasions (see Table 1). These will be:

1. One familiarisation session to get acquainted with the facilities and the testing procedures (2 hours).
2. Two measurement sessions (one for performance tests and the other for blood and biopsy samplings) before and two after the 8-week training protocol (a total of four of 2 hours each).
3. 24 training sessions of either high- or low-intensity eccentric cycling training (3 times per week for 8 weeks, 1 hour each).
Table 1: Outline of the study sessions:

<table>
<thead>
<tr>
<th>Familiarization (1 session)</th>
<th>Measurements (4 sessions)</th>
<th>Training (24 sessions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycling sprint</td>
<td>Performance tests</td>
<td>Eccentric cycling exercise</td>
</tr>
<tr>
<td>Strength tests with ultrasound</td>
<td>Full-body DEXA scan</td>
<td>Heart rate measurement</td>
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<tr>
<td>Ultrasound images of the thigh</td>
<td>Cycling sprint</td>
<td>Perceived effort during and after</td>
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<tr>
<td>Maximum jump height</td>
<td>Strength tests with ultrasound</td>
<td>eccentric cycling</td>
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<tr>
<td>Magnetic and electrical stimulation</td>
<td>Ultrasound images of the thigh</td>
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<td></td>
<td>Maximum jump height</td>
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<tr>
<td></td>
<td>Magnetic and electrical stimulation</td>
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<tr>
<td></td>
<td>Samples</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two 6 ml venous blood sample (2 drawings of two</td>
<td></td>
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<tr>
<td></td>
<td>tubes in total)</td>
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</tr>
<tr>
<td></td>
<td>One muscle biopsy in the thigh (2 in total)</td>
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</table>

**Familiarization session:** During the first session, we will explain and demonstrate all the equipment and testing procedures. You will complete a full body DEXA scan that will assess body composition (total body fat, bone mineral density, and muscle mass percentage), a maximal cycling sprint to assess your maximal cycling torque output, a maximal knee extension test to determine your maximal thigh muscle strength, transcranial magnetic and femoral nerve stimulation (i.e. a small electrical zap on the head and on the thigh) as well as electromyography (EMG) to assess your neuromuscular ability, a jump height test to determine your jumping capacity, and finally ultrasound imaging of your thigh muscle.

**Measurement session:** In the next session a few days later, all the measurements performed in the familiarization session will be repeated. You will be asked to come again in a following day for a blood drawing and a muscle biopsy. After the completion of the 8-week training protocol, you will have to repeat one more measurement session, including, in a separate day, blood drawing and muscle biopsies.

**Training sessions:** Twenty-four (24) exercise sessions will be completed within 8 weeks with a frequency of 3 times per week. On each training day, you will perform eccentric cycling of either high- or low-intensity, according to which group you will be assigned to, that will take about 1 hour. The intensity and duration of exercise will increase gradually. We will measure your heart rate using a strap around your chest, and your perceived effort during and after the exercise. You will not be able to do any other form of exercise during the entire experiment so as to examine purely the effects of eccentric cycling without interference.

**What are the potential risks? Will you experience any discomfort or inconvenience?**

- Maximal muscle actions during the strength testing and the eccentric contractions during cycling can, in exceptional circumstances, lead to feelings of breathlessness, nausea or slight fainting during the exercise. If this occurs, the exercise will be stopped immediately. Moreover, delayed onset muscle soreness, muscle damage and swelling can manifest in the days after exercise. You will be monitored at every session for several indirect markers of muscle damage. In the rare case of abnormal levels of muscle damage, you will be directed to a medical doctor.

- You will be tested using laboratory equipment such as cycling ergometers and force chairs. All equipment will be properly maintained, testing will be conducted by certified and experienced personnel, and you will be shown how to stop the operation of the equipment yourself. Anytime you feel uncomfortable or at risk, you can stop the machines and ask the investigator to adjust the settings.

- The two DEXA scans that will be conducted to measure your body composition and bone mineral density emit ionizing radiation to be able to analyse the tissues, but the dose is very small, almost insignificant compared to the natural radiation we receive when we walk outside. Please report to the investigator if you have any metallic implants before the test, as they will affect your results.

- During ultrasound measurements, a water-based gel will be applied on your skin. This gel is certified for use on human skin and no previous allergic reactions have occurred. If, however, an allergic reaction occurs, trained personnel will respond immediately with appropriate first aid treatment.
Before and after the 8-week training protocol, two 6 ml vials of venous blood will be collected from the forearm via a small cannula (needle). Bruising or discomfort to the area from which the blood is collected may occur. There is also a small risk of infection, but this will be minimised using aseptic procedures. Blood samples will be taken by either a trained qualified phlebotomist or a trainee under the supervision of a qualified phlebotomist. Two blood samples will be collected on the first measurement session and two more after 8 weeks of training, for a total of four blood samples being collected during the entire experiment. You will be able to choose the person you prefer to take your blood samples.

A total of two muscle biopsies (pictured) will be collected during the experiment. During the muscle biopsy, you may experience pain and discomfort, although they will be minimized through the application of topical anaesthetic cream. Allergic reaction to the anaesthetic cream may occur, therefore you must indicate possible allergic reactions you may have in the medical questionnaire. Bleeding during and after the biopsy procedure as well as bruising (hematoma) and/or tissue damage to your thigh muscle may also occur, although muscle biopsies is a procedure that is regularly being performed in our university by qualified practitioners and great care will be taken to ensure your safety. You may be asked to have one more biopsy taken from you in the baseline, but you are free to choose not to.

Transcranial magnetic (TMS) and femoral nerve stimulation are safe and well-documented procedures that are often used in our lab. A magnetic coil will be placed on your head and a magnetic field will be generated which activates the part of your brain that is responsible to activate your muscles. This technique will then be used to illicit a muscle “twitch” (your leg muscles will involuntarily contract without any pain or discomfort) and this will be accompanied by a click sensation in your head. Through TMS we will be able to measure the excitability of your nervous system. Headaches are a possible side effect, but this will be unlikely to happen. The electrical stimulation applied to the femoral nerve (on the inside of your thigh) will cause an involuntary muscle “twitch” in the target muscle. Some people find this stimulation unpleasant; however, this is a non-invasive procedure that does not cause damage to the nerve or other tissues. The skin under the electrodes will be shaved, abraded and cleaned with alcohol. This may cause small skin irritations in some participants during the following days. The researcher will also be wearing gloves during the protocol to eliminate any minor risk of infection.

What are the benefits to you?

- You will have a good opportunity to experience the use of state-of-the-art equipment to solve scientific problems, and learn about up-to-date research methods of exercise physiology that are not demonstrated at undergraduate levels.
- You will be able to get a full assessment of your body fat and muscle composition as well as your bone mineral density.
- You will have your maximum strength and jumping capacity tested.
- You will experience a very different, interesting and new form of cycling.
- For 8 weeks you will be training under highly sophisticated and professional supervision.
- You will be able to observe your thigh muscles using ultrasound imaging.
- Your legs will get very strong and they will increase in muscle mass.
- You will be able to learn more about how the intensity and duration of exercise affect training outcomes.
- You will be able to learn about your glucose control and lipid profile through the blood tests.
- You will be able to learn about the concentration of integrins in your legs, which are proteins in the membrane of your muscle cells responsible for many adaptations in response to training.

Confidentiality of information

All the information that you provide, and that will be collected during measurement sessions, will be used in a strictly professional and confidential manner. Anonymity will be assured as much as possible through encrypting your data by assigning codes to each participant. The identification codes and personal contact information will only be accessible by the chief investigator. Access to the raw and encrypted data will be limited to the chief investigator and supervisors. All your
If you are interested in taking part in this study, please read carefully and sign the consent form, and the medical questionnaire and return them to the chief investigator. Thank you for your time!