Participant Information Sheet

LJMU's Research Ethics Committee Approval

Reference: 19/SPS/054

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of Study:
The Effect of Resistance Training with Vitamin C-Enriched Collagen Supplementation on Changes in Muscle and Tendon Properties in Healthy Young Men

Name and Contact Details of the Principal Investigator:
Mr. Joonsung Lee
e: J.Lee1@2017.ljmu.ac.uk

Name and Contact Details of Supervisor:
Dr. Robert Erskine
t: +44 (0)151 904 6256 e: R.M.Erskine@ljmu.ac.uk

You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. Ask us if there is anything that is not clear or if you would like more information. Take time to decide if you want to take part or not.

Information of Covid-19 related

Due to the outbreak of this pandemic, this study will be always performed with the university guidance of Covid-19 as safety of both participants and researchers are priority. Briefly, you will be asked to

- Wear protective equipment (a face covering, protective goggles and disposable apron) all the times when you are inside such as a laboratory
- Measure your body temperature
- Tell researchers if you have symptoms of Covid-19 (a high temperature, new and continuous cough loss and/or change to your sense of smell or taste) BEFORE coming to the university of gym.

Those will be applied to researchers as well. Detailed information is on the LJMU website (https://www.ljmu.ac.uk/microsites/moving-forward/information-for-students).

1. What is the purpose of the study?

Tendons, which attach muscle to bone play an important role in body movement by transmitting the force produced by skeletal muscles and collagen is abundant in tendons. Like skeletal muscles, tendons adapt to resistance exercise and nutrition. Recent evidence suggests that collagen supplementation with vitamin C increases collagen synthesis following exercise. Therefore, Resistance exercise with collagen supplementation might have a synergetic effect on tendons, which is linked to better athletic performance and quality of life for both men. However, the combined effect of resistance exercise and

collagen supplementation over a period of time is not known. Our aim is to investigate how 6-week resistance training with or without collagen supplementation have the synergetic effect on tendon health in young men.

2. Do I have to take part?

No. 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 – if applicable. You can withdraw at any time by informing the investigators without giving a reason and without it affecting your rights/any future treatment/service you receive.

3. May I be excluded from the study?

Yes. You can be excluded from the study at any time point if you do not adhere to the study conditions.

4. Why have I been invited to participate?

You are likely to be eligible for this study if you fulfil the following criteria.

- Healthy young man
- Age 18-39 years
- No history of patellar tendon injuries in the past 6 months
- No history of lower limb musculoskeletal injuries in the past 6 months
- Non-smokers (including e-cigarettes)
- Free from cardiovascular and metabolic diseases

You MUST NOT take part in this study if:

- You are younger than 18 or older than 39 years
- Vegan and vegetarian (collagen is derived from mammals and fish)
- You consume any muscle building (e.g. protein/amino acids powder) or antioxidant (e.g. vitamin C) supplements
- You are a smoker (including e-cigarettes)
- Having a history or family history of kidney stones
- Having a meat allergy
- BMI over 30 kg/m^2

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

You will be asked to visit laboratories located in Liverpool John Moores University for two separate visits (please see Figure 1).

Baseline Test	Training Intervention	Post-training Test
1st Visit 1 day (Week 1) % Bodyfat MTU Measurement H:Q ratio test	6 weeks (2d/wk) Regular Resistance Training with Collagen Supplementation	2nd Visit 1 day (Week 7) The Same as 'Baseline Testing'

Figure 1. An overview of the study intervention periods and measurements. MTU, muscle-tendon unit assessment; %Bodyfat, percentage of body fat measurement; H:Q ratio, the hamstring-to-quadriceps muscle strength test.

Baseline Test

The baseline testing session comprises three tests (muscle and tendon measurements and body fat percentage, all assessed via ultrasound), and the completion of three questionnaires. None of these assessments will be invasive or painful in any way.

1) Filling in questionnaires

- The Readness to Exercise Screening questionnaire (to screen your health statues and injury history)
- The Physical Activity Readiness Questionnaire (to measure your physical activity level)

2) Muscle-tendon assessment

You will be required to sit on an isokinetic dynamometer (specialized eqiupment for measuring maximal strength) and perform a few maximal muscle contractions such as knee extension (kicking forward) and flexion (pulling back). While you perform the aforementioned muscle contractions, an ultrasound probe will be placed below your kneecap to measure patellar and tendon properties and electromyography electrodes will be attached to your thigh in order to measure the electical activity in your muscles during muscle contractions. Only the dominant leg will be assessed. Also, you will be asked to lie on a massage bed in a rested condition. The ultrasound probe will be placed on your upper thigh muslce to assess muscle architecture, which is associated with force production.

Isokinetic Dynamometer

Ultrasound Machine

Electromyography Electrode

3) Percantage of body fat measurement

By using the ultrasound machine, fat thichkness will be measured at 2 differnent sites for men (the belly and fornt thigh). This estimates the total percentage of body fat on your body.

4) Filling in the food and drink diary

End of baseline test, a food and drink diary will be provided in order to measure your energy intake and assess relationship between energy intake and body fat percentage. You will be asked to record the diary for three days (Thursday, Friday and Saturday) at the start and end of the day. You will be instructed how to complete the diary by the researcher and detailed instruction is on the first page of the diary.

Resistance training with collagen intake

You will perform 6-week resistance training and the researcher will give collagen or maltodextrin immediately before each training session. The training intensity will be 5 sets of 10 reps at 10-repetition maximum load (the load you can lift for 10 repetitions) and the intensity will be increased in a weekly basis. You will perform three resistance exercise targeting the thigh muscles (e.g. leg press and leg extension). You will be assigned one of two groups: collagen or control. The collagen group will be given a drink containing hydrolyzed collagen, while the control group's drink will contain maltodextrin and no collagen. This is a blinded study (you will not know which nutritional supplementation you will be given) but you will receive individual verbal debriefing at the end of the study about which group you were in.

Nutritional Supplementation

During the training period, you will be given a supplement to be consumed with each resistance training session (2 times per week). The supplements used in this study will comprise either 30 g **hyrolysed collagen** (HC, derived from bovine skin, so vegans, vegetarians and anyone who suffers from a meat allergy will not be able to participate in this study) or 30.5 g **maltodextrin** (a commonly used high-glycaemic food additive derived from starch in potato, rice, and corn), with the latter being consumed by the control group. Both HC and maltodextrin supplements will each be mixed with 50 mg **vitamin C** and 3 g non-calorie **sweetener** (comprising a food additive derived from the stevia leaf) in 300 mL water. Both the HC and maltodextrin doses are considered to be low, with 30 g HC constituting 20-25% of the recommended daily intake of protein and 30.5 g maltodextrin comprising 10% of the recommended daily amount of carbohydrate in adults. The vitamin C and sweetener doses are extremely low and come with no known adverse risks or side-effects at such low doses. Although there is no documented evidence of a deleterious effect from the ingestion of collagen, a rare allergy, sensation of unpleasant taste or feeling of heaviness in the stomach might occur. If any of these transpire, please inform the

researchers immediately. The low dose of maltodextrin carries minimal risk or adverse effects, although the high-glycaemic index of this food additive can cause an increase in blood sugar levels, **so diabetics should be aware of this**. However, due to the exercise-induced transportation of blood glucose into the muscle, the insulin response to the increase in blood glucose following maltodextrin ingestion is likely to be blunted. Much larger doses of maltodextrin than that used in this study have been associated with bloating, flatulence and in severe cases, diarrhoea. However, this risk is very low with the highest dose used in this study.

Post-training tests
All testing procedures are the same as 'Baseline Test'.

6. Are there any risks/benefits involved?

Benefits
In participating in this study, it is expected that your strength and muscle size will be increased and your tendon health improved.

Possible risks

Risk of muscle pain caused by resistance exercise
Injuries during resistance training are unlikely to occur as training will be supervised by the researcher, and you will learn the proper techniques for each resistance exercise, and complete a well-structured warm-up beforehand.

7. What will happen to the data provided and how will my taking part in this projec t be kept confidential?

The information you provide as part of the study is the **study data**. Any study data from which you can be identified (e.g. from identifiers such as your name, date of birth, audio recording etc.), is known as **personal data**. This includes more sensitive categories of personal data (**sensitive data**) such as your race; ethnic origin; politics; religion; trade union membership; genetics; biometrics (where used for ID purposes); health; sex life; or sexual orientation. Throughout the study your personal information will be kept entirely confidential. Instead of your name, your data will be given an identification code, so that you will not be identifiable. Your personal data will be destroyed four years after the testing is complete. The results of this study are expected to be published in a scientific journal, but names of participants will not be published. In addition, responsible members of Liverpool John Moores University may be given access to personal data for monitoring and/or audit of the study to ensure that the study is complying with applicable regulations.

8. What will happen to the results of the research project?

The results of this study are expected to be published in a scientific journal, but names of participants will never be published.

9. Who is organising the study?

This study is organised by Liverpool John Moores University

10. Who has reviewed this study?

This study has been reviewed by, and received ethics clearance through, the Liverpool John Moores University Research Ethics Committee (19/SPS/054).

11. What if something goes wrong?

If you have a concern about any aspect of this study, please contact the relevant investigator who will do their best to answer your query. The researcher should acknowledge your concern within 10 working days and give you an indication of how they intend to deal with it. If you wish to make a complaint, please contact the chair of the Liverpool John Moores University Research Ethics Committee (researchethics@ljmu.ac.uk) and your communication will be re-directed to an independent person as appropriate.

12. Data Protection Notice

The data controller for this study will be Liverpool John Moores University (LJMU). The LJMU Data Protection Office provides oversight of LJMU activities involving the processing of personal data, and can be contacted at secretariat@ljmu.ac.uk. This means that we are responsible for looking after your information and using it properly. LJMU's Data Protection Officer can also be contacted at secretariat@ljmu.ac.uk**.** The University will process your personal data for the purpose of research. Research is a task that we perform in the public interest. Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. You can find out more about how we use your information by contacting secretariat@ljmu.ac.uk. If you are concerned about how your personal data is being processed, please contact LJMU in the first instance at secretariat@ljmu.ac.uk. If you remain unsatisfied, you may wish to contact the Information Commissioner's Office (ICO). Contact details, and details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/

This study has received ethical approval from LJMU's Research Ethics Committee (19/SPS/054).

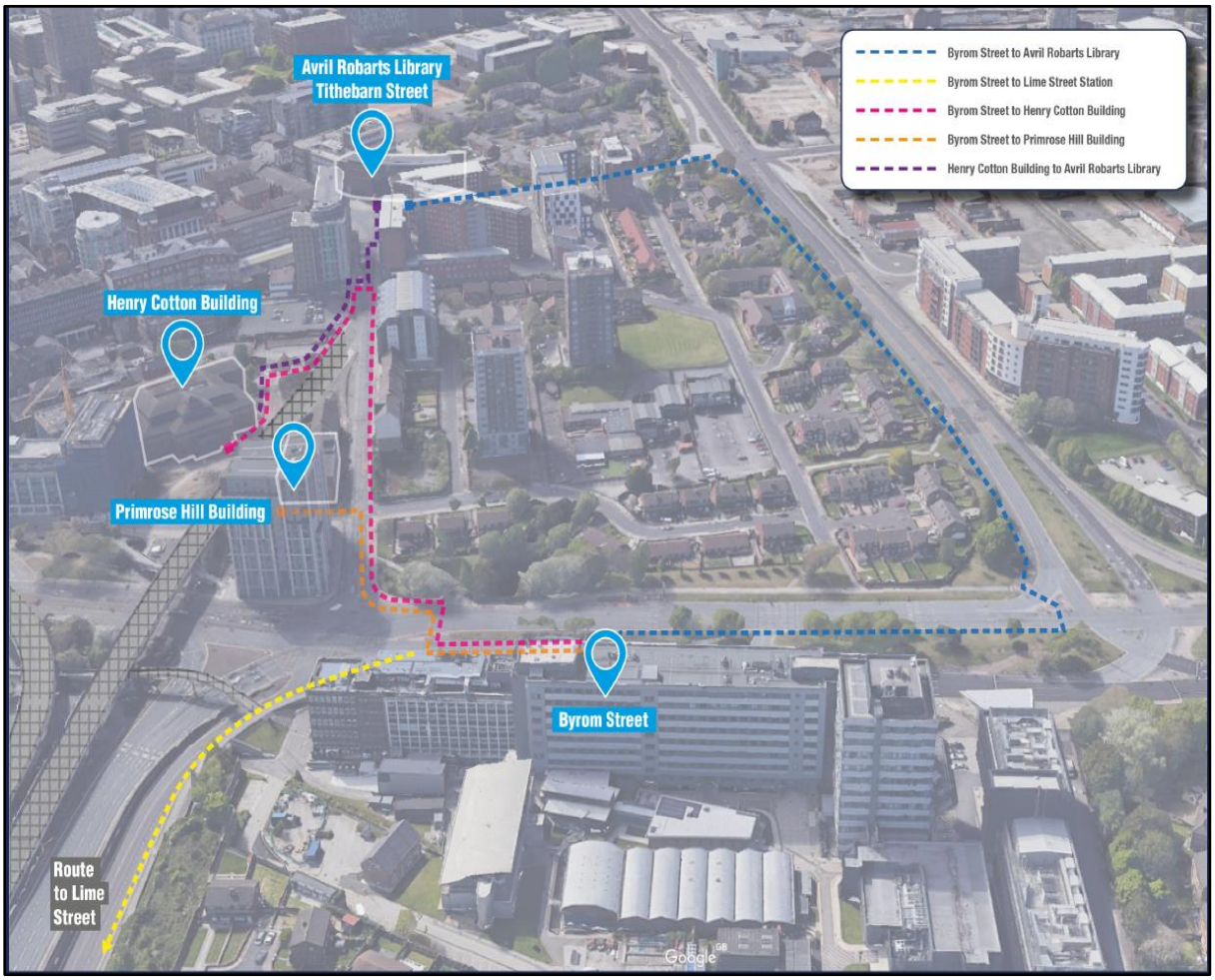
13. Contact for further information

Joonsung Lee (Researcher)
Research Institute for Sport & Exercise Sciences
Liverpool John Moores University
Byrom Street
Liverpool
L3 2AF
Tel
E-mail: J.Lee1@2017.ljmu.ac.uk

Dr Rob Erskine (Academic Supervisor)
Research Institute for Sport & Exercise Sciences
Liverpool John Moores University
Byrom Street
Liverpool
L3 2AF
Tel: +44 (0)151 904 62
E-mail: R.M.Erskine@ljmu.ac.uk

14. Location

Address: Tom Reilly Building, Byrom Street, Liverpool L3 5AF



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

Note: A copy of the participant information sheet should be retained by the participant with a copy of the signed consent form.

PIS Date: 08/12/20 PIS Version No: 0.3