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Investigating the role of dietary probiotics on athletic performance and health

Submission date	Recruitment status	[_] Prospectively registered
20/05/2026	No longer recruiting	[_] Protocol
Registration date	**Overall study status**	[_] Statistical analysis plan
29/06/2026	Ongoing	[_] Results
Last Edited	**Condition category**	[_] Individual participant data
11/06/2026	Nutritional, Metabolic, Endocrine	[X] Record updated in last year

Plain English summary of protocol

Background and study aims

Athletes often train hard with limited time to recover. Recent research shows that exercise can change the gut microbiome, the community of bacteria living in the gut, and this may influence performance and recovery. During intense exercise, the body produces lactate, which can build up and cause fatigue. Some gut bacteria can convert lactate into helpful substances called shortchain fatty acids (SCFAs), which may support energy use, recovery, and overall health. Early studies suggest that certain probiotics (beneficial live bacteria) might help this process and could even improve exercise performance, but there is very little evidence in active people.

This study aims to find out whether taking a daily probiotic for two weeks can help the body manage lactate during exercise, improve performance, and support gut and immune health. The study will test two probiotic strains developed by International Flavors & Fragrances Inc. to see whether they can benefit physically active men.

Who can participate?

Physically active male volunteers aged 20–40 years who train at least 4 times per week and can run a 5 km time trial in under 21 minutes (within the last 3 months).

What does the study involve?

Preliminary visit :

-Speed lactate test (submaximal exercise test consisting of 3 min stages incrementally increasing in speed; capillary tube of blood taken in between)

-Self-paced 5km treadmill time trial

Experimental visits (4 visits total) :

Pre-supplement and on day 14 of the supplement period:

- Collection of a stool sample before arrival at the laboratory
- Questionnaires on sleep, wellness, gastrointestinal symptoms and illness.
- Speed lactate test
- Selfpaced 5 km treadmill time trial
- Blood and saliva samples before, during, and after the exercise tests

Supplementation:
Participants will be given either a probiotic supplement or a tastematched placebo by chance. They will take 1 capsule per day for 12 days, then 5 capsules per day on days 13 and 14. Participants will take each supplement separately during 14-day periods separated by a period without any supplement, known as a wash-out (minimum of 2-weeks). Neither the researchers nor the participants will know the order of each 14-day supplement period. Weekly and daily questionnaires will also be completed during the supplementation periods.

What are the possible benefits and risks of participating?
Possible benefits:
-Insight into fitness, performance, microbiome and response to a probiotic supplement.
-Contribute to new research on probiotics, gut health, and exercise performance.
-Helping shape future nutrition and sports science research.

Possible risks:
-Some discomfort may be experienced during venepuncture for the blood sample. However, the venepuncture procedure has been risk-assessed and, in relation to current experience at NTU, is safe. Staff who perform the procedure are appropriately trained, and sterile procedures are used at all times.
-Although rare, the supplement may cause dose-dependent gastrointestinal side effects such as bloating.
-Although it is extremely unlikely, high-intensity exercise has been known to reveal unsuspected heart or circulation problems, and very rarely these have had serious or fatal consequences.
-Nausea, dizziness, and light-headedness can be experienced during and following maximal exercise.

Where is the study run from?
The study is being conducted at Nottingham Trent University, within the Sport Health and Performance Enhancement (SHAPE) Research Centre.

When is the study starting and how long is it expected to run for?
The study will run over several months, with each participant involved for approximately six to eight weeks, including the supplementation period and testing visits.

Who is funding the study?
1. The Biotechnology and Biological Sciences Research Council (BBSRC) INFORM Hub
2. Industry partner IFF (International Flavors & Fragrances Inc.)

Who is the main contact?
Dr Neil Williams, neil.williams@ntu.ac.uk

Contact information

Type(s)
Principal investigator, Public, Scientific

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Study information

Scientific Title
Investigating the role of dietary probiotics on athletic performance and health via lactate and SCFA metabolism

Acronym
PROPIONI Study

Study objectives
The objective of this project is to establish the efficacy of a dual strain probiotic from the genus's of Propionibacterium and Lacticaseibacillus on lactate and propionate metabolism during exercise, exercise performance, recovery, the gut microbiome, and biomarkers of gut damage, and immunity.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 30/03/2026, Nottingham Trent University’s Human Invasive Ethics Committee (Nottingham Trent University, Burton Street, Nottingham, NG1 4BU, United Kingdom; +44 (0)115 848 3461; dianne.levey@ntu.ac.uk), ref: 2538032

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Placebo

Assignment
Crossover

Purpose

Basic science

Study type(s)

Health condition(s) or problem(s) studied
Exercise performance and metabolism

Interventions
The study will be a 2-month double-blind, randomised, placebo-controlled crossover intervention trial in endurance-trained males.

All participants will complete the treatment (probiotic supplement) and control (placebo supplement) conditions of the study, the order of which will be randomly assigned using simple randomisation at the site of manufacture by the industry partner. Both the probiotic and placebo will be taken for 14 days in capsule form. A minimum of 2 weeks' wash-out will be completed between conditions.

Supplementation of probiotics: 3B Propionibacterium; 1 B Lactobacillus rhamnosus LC-705 for the first 12 days of the 14-day supplementation period (in 1 capsule/day), and 15B Propionibacterium; 5B Lactobacillus rhamnosus LC-705 for the last 2 days of the 14-day supplementation period (in 5 capsules/day).

Supplementation of placebo (taste and appearance matched): Capsule containing maltodextrin powder (1 capsule per day for days 1-12, followed by 5 capsules per day for days 13 and 14).

Pre and post supplementation periods, participants will visit the laboratory where they will complete a submaximal exercise test (speed lactate test) and an exercise performance trial (self-paced 5km time trial), both on a motorised treadmill. During the exercise tests, lactate concentration, heart rate, rating of perceived effort (RPE), and gastrointestinal (GI) symptoms will be recorded. The submaximal exercise test will proceed until the Onset of Blood Lactate Accumulation (OBLA; blood lactate concentration of 4mmol/L). At rest (pre), following the submaximal exercise test (during), and following the exercise performance trial (post), saliva (salivary IgA, cortisol) and venous blood samples (venous propionate, intestinal-fatty acid binding protein [I-FABP], lipopolysaccharide binding protein [LBP], testosterone) will be taken. Participants will also provide a stool sample pre and post supplementation period for the assessment of gut microbiome composition via DNA extraction and shotgun metagenomics, and will complete questionnaires related to illness (daily), sleep and wellness (weekly), and longitudinal GI symptoms (weekly).

Intervention Type
Supplement

Primary outcome(s)
1. Venous propionate measured using gas chromatography–mass spectrometry at pre and post intervention

Key secondary outcome(s)
1. Venous intestinal-fatty acid binding protein measured using enzyme-linked immunosorbent assay at pre and post intervention

2. Venous lipopolysaccharide binding protein measured using enzyme-linked immunosorbent assay at pre and post intervention

3. Venous testosterone measured using enzyme-linked immunosorbent assay at pre and post intervention

4. Salivary immunoglobulin A measured using enzyme-linked immunosorbent assay at pre and post intervention

5. Salivary cortisol measured using enzyme-linked immunosorbent assay at pre and post intervention

6. Gut microbiome composition measured using DNA extraction and shotgun metagenomics at pre and post intervention

7. Faecal short chain fatty acids measured using gas chromatography–mass spectrometry at pre and post intervention

8. Blood lactate measured using a biosen at pre and post intervention during a submaximal exercise test

9. Rating of perceived effort measured using the Borg (6-20) scale at pre and post intervention during exercise trials

10. Gastrointestinal symptoms measured using modified Visual Analogue Scale (VAS; Gaskell & Snipe, 2019) at pre and post intervention during exercise trials

11. Exercise performance measured using self-paced 5km time trial at pre and post intervention

12. Sleep quality measured using the Pittsburgh Sleep Quality Index (PSQI) at weekly intervals during supplementation period

13. Exercise recovery measured using the Recovery-Stress Questionnaire for Athletes (RSQA-Sport) at weekly intervals during supplementation period

14. Gastrointestinal discomfort measured using the Gastrointestinal Symptom Rating Scale (GSRS) at weekly intervals during supplementation period and during exercise trials

15. Common cold symptoms measured using the Jackson Cold Scale (JCS) questionnaire at daily intervals during supplementation period

Completion date
30/11/2026

Eligibility

Key inclusion criteria
1. Male
2. Aged between 20-40 years
3. Physically active and defined as “trained” in line with McKay et al. (2022)
4. Have a 5km time trial personal best of <21 minutes within the last three months

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
20 Years

Upper age limit
40 Years

Sex
Male

Total final enrolment
0

Key exclusion criteria
1. Routine consumption of ω-3 PUFA supplements and/or supplements with antioxidants
2. Routine consumption of prebiotic, and/or probiotic supplements
3. Routine consumption of collagen-based supplements
4. Use of antibiotics in the past 3 months
5. Milk allergy or lactose intolerance
6. Take a daily dose of aspirin or other NSAIDs
7. Intake of drugs which affect gastrointestinal mobility/laxatives in the 4 weeks before the study
8. Previously diagnosed with COPD, emphysema, chronic bronchitis or similar respiratory illness
9. History of heart failure, pulmonary hypertension, embolism, or other pulmonary heart disease
10. History of recurrent chest infections
11. Smoker
12. Acute infection within the last four weeks
13. Major operation within the past four months
14. History of gastrointestinal drug reaction
15. History or current evidence of gastrointestinal disease, e.g. chronic constipation, diarrhoea, irritable bowel syndrome, Crohn’s Disease

Date of first enrolment
14/05/2026

Date of final enrolment
19/10/2026

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Nottingham Trent University
Burton Street
Nottingham
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NG1 4BU

Sponsor information

Organisation
Nottingham Trent University

ROR
https://ror.org/04xyxjd90

Funder(s)

Funder type

Funder Name
Biotechnology and Biological Sciences Research Council

Alternative Name(s)
UKRI - Biotechnology And Biological Sciences Research Council, Agricultural and Food Research Council, Biotechnology & Biological Sciences Research Council, BBSRC, BBSRC UK, AFRC

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Funder Name
International Flavors & Fragrances Inc.

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available