ISRCTN90010873 https://doi.org/10.1186/ISRCTN90010873

Impact of training status on bioavailability of flavanones

Submission date	Recruitment status	[_] Prospectively registered
22/10/2014	No longer recruiting	[_] Protocol
Registration date	**Overall study status**	[_] Statistical analysis plan
27/11/2014	Completed	[X] Results
Last Edited	**Condition category**	[_] Individual participant data
23/07/2019	Nutritional, Metabolic, Endocrine	

Plain English summary of protocol

Background and study aims
Flavonoids are compounds that have been proven to be beneficial to health. They are found in virtually all plants and are responsible for many of the different colours of our fruits and vegetables. Citrus juices, for example, have a high flavonoid content. They are antioxidants, mopping up reactive oxygen-containing molecules that would otherwise damage body cells. They are known to help reduce the risk of developing cardiovascular disease (for example, heart attack and stroke) and, in some cases, cancer. However, the uptake (absorption) of flavonoids from foods into the body is limited. Here, we want to see whether being physically active improves the absorption of flavonoids into the body.

Who can participate?
Distance runners, triathletes and cyclists, 18 years old or older, training regularly for at least 4 years and typically doing at least 5 hours of endurance training per week. All participants must be healthy , with normal blood pressure, non-smoking, and not taking any drug therapies. Screening of participants is performed with Health Screening Questionnaire, Physical Activity Readiness Questionnaire and VO2 max test. Only those with VO2 max >50 ml/kg body mass are included.

What does the study involve?
All participants do 2 experimental tests: one during a period of normal training and the other immediately following 1 week of not training. On the day of each test, the participants arrive at around 8.30am. A sample of blood is taken after which they are given 500 ml of orange juice and a polyphenol-free breakfast. Further blood samples are obtained at 3, 4, 5, 6, 7, 8 hours after drinking the juice. A total of 90 ml of blood is taken over the course of the day. At four hours after the first blood sample collection, the participants are given a white roll and butter. At the end of the test, they are given a polyphenol-free dinner. Participants are allowed to leave after dinner, told to avoid polyphenol containing foods during the rest of the day and record all food and drink consumed. They are asked to come back the next morning in a fasted state (that is, not having eaten or drunk anything other than clear fluids). One last blood sample is taken. Participants are provided with breakfast. They are also asked to collect urine into plastic bottles at between 0– 6 hours, 6 – 11 hours and then 11 – 24 hours after the drinking the juice. Other than specific tasks described above, for 2 days before each experimental test, participants are

asked to follow a polyphenol-free diet. A list with polyphenol-free food is provided below. Participants are also asked to record their food intake throughout these 2 days before the first experimental test and replicate this food intake before the second one. During the 24 h prior to the experimental test participants are asked to collect urine, at between 0– 6 hours, 6 – 11 hours and then 11 – 24 hours leading up to the tests. They are asked to fast for 12 hours beforehand too. From the day following the first experimental test participants are asked to not do any training until the second experimental test one week later.
Foods prohibited during the polyphenol free diet
1. Tea, coffee, drinking chocolate, alcohol (especially red wine, beer, apple cider), fruit juice
2. Fruits and vegetables
3. Chocolate and chocolate products
4. Cereals/ wholemeal bread/ grains
5. Spices (such as curry) and herbs
Foods allowed during the polyphenol free diet
1. White bread
2. Butter, vegetable oil (but avoid olive oil)
3. Pasta, rice
4. Meat, eggs, fish
5. Peeled potatoes (mash, crisps, French fries)
6. Digestive biscuits (not whole meal or chocolate)
7. Milk and milk products (plain yoghurts, cheese)

What are the possible benefits and risks of participating?
After the completion of the study, participants were paid £80. Since VO2max was measured participants received information on their cardiovascular fitness level.

Where is the study run from?
The Metabolic suite of the Human Nutrition department of the University of Glasgow which is based in the New Lister building of the Royal Infirmary in Glasgow (UK)

When is study starting and how long is it expected to run for?
May 2014 to March 2015.

Who is funding the study?
University of Glasgow (UK)

Who is the main contact?
Dr Thelma Polyviou
thelma.polyviou@glasgow.ac.uk

Contact information

Type(s)
Scientific

Contact name
Dr Thelma Polyviou

Contact details
University of Glasgow
ECG Core Lab

Level 3, New Lister Building
10 Alexandra Parade
Glasgow
United Kingdom
G31 2ER
-
thelma.polyviou@glasgow.ac.uk

Additional identifiers

ClinicalTrials.gov (NCT)
NCT02627547

Protocol serial number
N/A

Study information

Scientific Title
Impact of training status on bioavailability of flavanones: a longitudinal intervention trial

Acronym
N/A

Study objectives
Bioavailability of flavanones after administration of drinks rich in flavanones can be enhanced by participation in exercise training activity.

Ethics approval required
Old ethics approval format

Ethics approval(s)
College of Medical, Veterinary & Life Sciences Ethics Committee for Non-Clinical Research Involving Human Subjects, 21/06/2013

Study design
Longitudinal intervention trial

Primary study design
Interventional

Study type(s)
Quality of life

Health condition(s) or problem(s) studied
Effect of detraining on polyphenol absorption from orange juice.

Interventions
All participants were required to attend the laboratory for 8 hours in the trained state and after having not trained for 7 days. On both visits to the laboratory, participants were given an orange

juice following an overnight fast and 3 days of a low polyphenol diet, to assess the effects of detraining on the uptake of polyphenols.

Intervention Type
Supplement

Primary outcome(s)
To determine the effects of training status of endurance athletes on bioavailability of flavanones in endurance trained individuals.
1. Quantification of flavanone metabolites in the blood and urine:
Flavanone metabolites in the urine will be analyzed using a HPLC-MS/MS in the selected reaction monitoring mode. Urine samples will also be used for the measurements of DNA oxidation: 8-Oxo-7,8-dihydroxyguanine will be measured by HPLC with electrochemical detection.

Will be measured at baseline and following one week of detraining.

Key secondary outcome(s))
To find out whether changes in bioavailability of flavanones are related to changes in biomarkers of inflammation, oxidative stress, plasma lipids and insulin sensitivity.
1. Plasma analyses for cardio-metabolic risk factors:
The aliquoted EDTA plasma will be stored at 80oC for later analysis of insulin (Ultrasensitive Insulin ELISA, Mercodia AB, Uppsala, Sweden), glucose (Randox, Northern Ireland, UK), TAG, total and HDL-cholesterol (Roche Diagnostics GmbH, 6 Mannheim).
Glucose, TAG, total cholesterol, and HDL-cholesterol concentration will be analysed spectrophotometrically (Cobas Mira Plus, ABX Diagnostics, France). High-sensitivity ELISAs (R&D Systems Inc., Oxon, UK) will be used to measure plasma concentration of IL-6 and TNF-.

Will be meassured at baseline and following one week of detraining.

Completion date
01/03/2015

Eligibility

Key inclusion criteria
1. Adults over 18 years
2. Distance runners, triathletes or cyclist training regularly for at least 4 years with least 5 hours of endurance training per week
3. Healthy with normal blood pressure
4. Non-smokers
5. Not taking any drug therapies
6. VO2 max >50 ml/kg body mass

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group

Adult

Lower age limit
18 years

Sex
All

Key exclusion criteria
1. History of gastrointestinal disease
2. Vegetarian
3. Having unstable food habits
4. VO2 max < 50 ml/kg body mass

Date of first enrolment
01/06/2014

Date of final enrolment
01/03/2015

Locations

Countries of recruitment
United Kingdom

Scotland

Study participating centre
University of Glasgow
ECG Core Lab
Glasgow
United Kingdom
G31 2ER

Sponsor information

Organisation
University of Glasgow

ROR
https://ror.org/00vtgdb53

Funder(s)

Funder type
University/education

Funder Name
University of Glasgow (UK)

Alternative Name(s)

Funding Body Type
Private sector organisation

Funding Body Subtype
Universities (academic only)

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not provided at time of registration

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article	results	01/09/2017	23/07/2019	Yes	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes