ISRCTN85926713 https://doi.org/10.1186/ISRCTN85926713

Investigation of the effects of beetroot juice supplementation on blood pressure in older overweight and obese subjects

Submission date
29/03/2014

Recruitment status
No longer recruiting

Registration date
28/05/2014

Overall study status
Completed

Last Edited
21/04/2016

Condition category
Nutritional, Metabolic, Endocrine

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
High blood pressure (BP) is currently affecting more than half of the British population aged 50 and older. Raised BP is an important risk factor for heart attacks (myocardial infarction), stroke and kidney failure. The treatment of high blood pressure is therefore very important to prevent such diseases. Past research shows that beetroot juice can reduce blood pressure; this effect seems to be related to the high content of molecules known as nitrates in beetroot. We hope to test whether beetroot juice reduces blood pressure after 3 weeks and see whether the decrease in blood pressure remains after supplementation stops.

Who can participate?
Healthy, non-smoking men and women aged 55-70.

What does the study involve?
We will contact you by phone to answer any questions you may have about the study. We will then ask you some questions about your medical history to check whether you can participate. If you are a suitable participant, we will invite you to attend the Food & Consumer Research Facility (NU-Food) at Newcastle University on three separate occasions for about 1-2 hours each time. You will arrive at the research facility early in the morning after an overnight fast of at least 8 hours (water is allowed). First you will have the opportunity to ask again questions about the study and, if you still decide to take part, you will be asked to sign a consent form. A copy of the consent will be given to you. We will then measure your weight and height to calculate your body mass index (BMI), as well as measure your blood pressure. These results will be needed to decide whether you can be included in the study or not. If your BMI and blood pressure readings are outside a specific range, you will not be able to take part in the study. If you are able to take part, we will continue the visit by taking a small urine and saliva sample. We will then measure waist circumference, the amount of body fat in your body, hand-grip strength, lung function and healthiness of your blood vessels. We will assess your diet and physical activity using questionnaires, which will not take more than 30 minutes. After, we will discuss which group you have been randomly assigned to (blackcurrant or beetroot juice) and provide you with all the information and materials (dietary instructions, beetroot or blackcurrant juice) you need to

continue the study at home, including training on how to use a portable, automatic BP machine. We will fit a small device around your waist and a cuff around your dominant arm to measure your BP over the next 24 hours. The device is completely harmless and fully automated; we will show you how to operate it and come collect it at your house the next day. We will also give you a wristwatch that will measure your physical activity levels over the next 6 days. Detailed instructions on how to operate it will be given to you. After the 24-hour BP measurements you will start drinking the juice (either blackcurrant or beetroot) for 21 days. You will also begin using the automated BP machine provided in the first visit to measure your BP (twice each time) at home in the morning and before going to bed for each of the 21 days. We will ask you to record the BP readings and time of the measurements. We will give you a call after 6 and 13 days to check whether you have any problem with the study. However, you can also call us at any time if you have any question or concern about the study. On the 7th day a member of the study team will arrange to collect a small urine sample and the wristwatch at a time and place that is convenient for you. After 21 days you will return to the research facility for a second visit to repeat the measurements from the first visit. After the second visit you will stop drinking the juice but you will still be asked to follow the dietary instructions you have been given until the end of the study. You will again be given the BP monitor to wear for 24 hours and the wristwatch to wear for 6 days. You will continue to measure your BP at home (morning and evening) using the device provided until the end of the study. Three days after the second visit we will give you a telephone call, and after 7 days you will return to the research facility for the final visit. We will repeat the same set of measurements (weight, body fat, blood pressure, lung function, blood vessel health, diet and physical activity questionnaires, urine and saliva samples, 24-hr BP monitor fitting), and collect all the devices (wristwatch, at-home BP monitor) and forms that you have been provided with during the study.

What are the possible benefits and risks of participating?
The direct benefits for each participant will be mostly related to the awareness of their BMI and blood pressure. There will be no other direct benefit to them. However, knowledge gained from this study will help our research into the understanding of the effects of diet, exercise and beetroot juice on blood pressure. Risks from this study are minor as it does not involve any invasive procedure. The only inconvenience for the participants will be the change in diet for the duration of the study and compliance to the daily recording of BP readings.

Where is the study run from?
University of Newcastle (UK)

When is the study starting and how long is it expected to run for?
March 2013 to December 2013

Who is funding the study?
Investigator initiated and funded (UK)

Who is the main contact?
Dr Mario Siervo
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Contact information

Type(s)
Scientific

Contact name
Dr Mario Siervo

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Additional identifiers

Study information

Scientific Title
Investigation of the effects of beetroot juice supplementation on blood pressure in older overweight and obese subjects: a randomised controlled trial

Study objectives
We believe that beetroot supplementation will reduce systolic and diastolic blood pressure (BP) in older overweight and obese subjects. The mechanisms underlying drops in BP could be linked to an increase in nitric oxide (NO) bioavailability. We also believe that with interruption of supplementation there will be no carry-over effect and BP will return to baseline values within one week.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Newcastle University - Faculty Of Medical Sciences Ethics Committee; ref. 00628/2013

Primary study design
Interventional

Study design
Single-centred open-label randomized placebo-controlled study

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Blood Pressure, Hypertension, Cardiovascular Disease, Nutrition, Vascular Health

Interventions

Group A: Receive nitrate supplementation via commercially available beetroot juice (BEET IT) that contains ~2000 mg of nitrate per liter. Participants drink 70 ml of concentrated beetroot juice per day, corresponding to an average supplementation of 500 mg of inorganic nitrate per day for a total of 21 days.

Group B (Control Group): Are provided with a placebo of 250 ml blackcurrant juice to drink every day for a total of 21 days.

Participants are asked to drink the beetroot or blackcurrant juice in the morning and are provided a sheet to record and monitor consumption. They will be considered not compliant to the intervention if they missed and/or did not complete three or more supplementation days. Participants are also asked to not change their physical activity levels and their consumption of alcohol or caffeinated drinks during the trial. Finally, all participants are given instructions to follow a low-nitrate diet for the full duration of the trial in order to standardize dietary nitrate intake across the groups.

Intervention Type
Supplement

Primary outcome(s)
1. The effect of nitrate supplementation on resting, daily and 24-hr BP and the stability of these effects on BP once supplementation is removed

Resting blood pressure: At baseline and at day 21 and 28 resting BP will be measured in triplicate using a manual BP monitor. Before the measurement participants will be invited to rest in a sitting position for at least 15 minutes. Subjects will be provided with an automated monitor for daily measurements of resting BP. Duplicate measurements will be conducted at home in a seated position after a 10-minute rest in the morning and in the evening before going to bed. Participants will be asked to write down the two measurements and the time of the measurement.

Ambulatory 24-hr blood pressure monitoring: The BP monitor will be fitted to each participant at baseline and at day 21 and 28 and he/she will be asked to wear it for 24 hours.

2. The effect of nitrate supplementation on endothelial function
3. Questionnaires: Before and after the intervention participants will complete questionnaires on general health and lifestyle and physical activity. In addition, participants' diet will be assessed using a self-administered food frequency questionnaire for the assessment of overall dietary and nitrate intake.
4. Body composition: Measurements will be performed at baseline and at the end of the beetroot and carry-over phases. Body composition will be assessed using a leg-to-leg bioelectrical impedance device (TANITA 300 MA). Body weight, height and waist and upper-arm circumferences will be measured using standardised protocols.

Key secondary outcome(s)
1. The effect of nitrate supplementation on muscle strength. Hand-grip strength will be assessed in both arms at baseline and the end of each phase to measure the maximum isometric strength of the hand and forearm muscles.
2. The effect of nitrate supplementation on free-living physical activity. Daily physical activity (PA) will be measured at the beginning and end of the study in free-living conditions. Participants will be asked to wear a wrist-worn accelerometer for 7 days.

3. The effect of nitrate supplementation on pulmonary function. Vascular health: a non-invasive device (laser doppler) will be used to assess the post-reactive hyperaemic responses at baseline and at day 21 and 28.

Completion date
01/12/2013

Eligibility

Key inclusion criteria
1. Non-smoking men and women
2. Healthy (no established diagnosis)
3. 55-70 years old
4. Body Mass Index (BMI) of 25-40 kg/m2

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Sex
All

Key exclusion criteria
1. Current participation in other clinical investigations
2. Physical disabilities, trauma or surgery that limit mobility and impede physical performance (i. e. not able to comply with the assessment of physical strength and influence on cardio-metabolic functions)
3. Vegetarianism (likely to have very high nitrate intake)
4. Aversion to beetroot consumption or inability to comply with the study diet (lack of compliance)
5. Weight change more than 3.0 kg in the last 3 months (important influence on systemic metabolism and vascular function)
6. Active cancer and any diagnosis of malignant cancer in the last 5 years (systemic effects on study outcomes)
7. Chronic and acute metabolic and inflammatory conditions interfering with the study outcome (systemic effects on study outcomes). For example, severe hypertension (SBP/DBP=>180 mmHg />110), kidney stones, gallstones or rheumatoid arthritis
8. Previous diagnosis of type 1 or type 2 diabetes treated with insulin (modification of regulation of intermediate metabolism)
9. Weight loss medications (sibutramine, orlistat, rimonabant) and history of bariatric surgery (weight loss related changes in systemic metabolism)
10. Drugs: oral corticosteroids, sildenafil, diuretics, laxatives, anticoagulants, nitrate-derived agents, anti-cholinergic (all drugs have either an effect on NO production or insulin sensitivity via different mechanisms)
11. Subjects on hormonal therapies (oestrogens, thyroxine, progesterone, oral hypoglycaemic agents), anti-hypertensive (beta-blockers, calcium antagonists, ACE inhibitors and angiotensin

receptor inhibitors), statins and any other anti-dyslipidaemic agent and psychiatric drugs (antidepressants, sedatives, antipsychotics) will be excluded if dose has been started/changed in the previous 3 months (make sure that these disorders are under strict control to avoid interference with the study outcomes)
12. Haematological disorders including severe anaemia (Hb < 10 mg/dL) (risk for the participant and effects on the study outcomes)
13. Major surgical operations interfering with the study outcomes (systemic effects on study outcomes)
14. Alcohol intake >21 units/week for men and >14 units/week for women
15. Non-English speakers or volunteers requiring translators or interpreters (since these services are not available for this study)

Date of first enrolment
01/03/2013

Date of final enrolment
01/12/2013

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Newcastle University
Newcastle upon Tyne
United Kingdom
NE1 4LP

Sponsor information

Organisation
Newcastle University (UK)

ROR
https://ror.org/01kj2bm70

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded (UK)

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	01/10/2014		Yes	No
Results article	results	01/08/2015		Yes	No