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Fibre, Barley and Cholesterol Study: Can eating barley containing higher levels of beta-glucan (a type of dietary fibre) reduce cholesterol levels in the blood?

Submission date
04/03/2019

Recruitment status
Suspended

Registration date
28/03/2019

Overall study status
Completed

Last Edited
12/05/2020

Condition category
Nutritional, Metabolic, Endocrine

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Cardiovascular disease (CVD, heart and circulatory disease) is the biggest cause of death worldwide and Scotland has one of the highest CVD-associated death rates in Western Europe. CVD can be caused by many factors, including diet. Research suggests that people who eat more wholegrain foods (WGF, foods based on unprocessed grains) have a lower risk of diseases such as coronary heart disease, high blood pressure and type 2 diabetes.
Eating barley can lower blood cholesterol, but it is difficult to eat the amount that is needed to do this on a daily basis. This study will investigate whether eating a smaller amount of a particular variety of barley that contains more of a substance that reduces cholesterol (called beta-glucan) could help overcome this while still providing health benefits.

Who can participate?
Adults between the ages of 30 and 65 years with high levels of cholesterol who are not currently taking any cholesterol-lowering medication.

What does the study involve?
Potential participants will be asked to visit the Human Nutrition Unit at the Rowett Research Institute (on the Foresterhill site). At the first visit, they will have the chance to ask any questions they may have. If they still want to go ahead with the study after asking questions, they will be asked to sign a consent form. Then the researchers will review their medical history and measure their blood cholesterol to make sure they are suitable to take part in the study.
The first visit will be followed by five more visits at 2, 8, 10, 14 and 20 weeks after the initial visit. Participants will be asked not to eat anything from midnight before each visit. Breakfast will be provided to participants once the tests are completed.

Below is what will happen at each of these visits:
1. Researchers will take a small amount of blood (20 ml, about 2 dessert spoons) from each participant.

2. Participants will be asked to complete a simple questionnaire (with help from the researchers if requested).
3. The participants' weight, height, blood pressure and blood vessel stiffness will be measured. Having blood vessel stiffness measured involves a simple and painless test, similar to having blood pressure taken.
4. Before each visit, participants will be asked to collect all the urine they produce over 24 hours prior to the appointments. The method of collecting the urine is very simple and clean and participants will be provided with a kit to help them do this.
5. Participants will also be offered the opportunity to provide a faecal (poo) sample but this is entirely optional. If they agree to provide stool samples, participants will be provided with stool collection kits to collect samples at home.

Participants will also be asked to fill a food diary four times during the study at week 3, 7, 13 and 17. the researchers expect that each visit will take up to an hour. They will also ask participants about their diet throughout the 20 weeks.

The study team will contact participants by email or phone several times during the study to check if they have any issues with the study, but participants can also contact the investigators at any time.

What will participants have to do?
• For the first two weeks of the study they will be asked to limit the wholegrain foods that they eat, but apart from that their diet will be the same. For example, this would mean consuming non-wholegrain breakfast cereals and white bread.
• After the first two weeks they will be asked to eat either one of two diets. These will be either a diet with wheat-based products for 6 weeks or a diet including a couple of servings of the special study barley for 6 weeks.
• After 6 weeks they will be asked to limit the wholegrain foods that they eat for 2 weeks and then eat the diet that they did not have before (wheat-based or barley) for the next 6 weeks. This will help the researchers to compare the effects of both diets in the same person.
• Participants will then go back to their normal diet and will be asked to come back for a last visit 4 weeks later.
• All the breakfast cereals participants need for the study will be provided to them. They will need to purchase their own bread, but researchers will ask them to eat only wholemeal bread or barley products for different parts of the study (wholemeal bread for the wheat diet and barley products for the barley diet).

What are the possible benefits and risks of participating?
The study may not help participants personally but the information collected may help to find ways of reducing other people’s risk of developing diseases such as heart disease. The dietary changes the researchers will ask participants to make for this study are small and they do not expect any major side effects, but if participants experience any they should contact the researchers. There are no known risks associated with the diet. There is small chance participants might experience minor constipation during the wholegrain-free period and/or some minor bloating/diarrhoea during the period eating barley. If that is the case, the research team will provide guidance on how to eliminate these side effects. For the blood sample, participants may experience slight discomfort when the sample is taken, and may feel light-headed. There may also be some bruising.

Where is the study run from?
The Human Nutrition Unit at the Rowett Research Institute (on the Foresterhill site), University of Aberdeen (UK)

When is the study starting and how long is it expected to run for?
July 2018 to July 2021 (updated 12/05/2020, previously: July 2020)

Who is funding the study?
The Rural Environment Science and Analytical Services (RESAS) programme from the Scottish Government.

Who is the main contact?
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Contact information

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Scientific

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Integrated Research Application System (IRAS)
253222

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
IRAS 253222

Study information

Scientific Title
The effect of a fibre- and barley-rich diet on blood cholesterol and gut microbiota composition and activity in borderline/non-treated hypercholesteraemic people

Acronym
FAB

Study objectives
Eating 100 g of cereals rich in a type of fibre called beta-glucan, such as barley, can reduce blood cholesterol. However, such a high amount is not easily achievable on a daily basis. Consuming a lower amount of barley containing higher amount of this specific fibre could overcome this barrier to consumption while still providing health benefits. The aim of this project is to investigate the potential of eating 65 g/day high beta-glucan barley to lower blood cholesterol concentrations and other risk markers for heart disease in people with high blood cholesterol levels. We will investigate whether consuming high beta-glucan barley can modulate the gut microbiota activity.
The known health benefit of eating barley relates primarily to its ability to reduce blood cholesterol concentration, ascribed to beta-glucan. A minimum daily intake of 3 g barley beta-glucan for optimal benefits is recommended and a required condition of the health claims that have been approved by food standard agencies worldwide. Optimal intakes of barley beta-glucan can reduce total cholesterol by 0.13 to 0.2 mmol/l, with a greater reduction in individuals with higher baseline cholesterol concentrations. The cholesterol reduction observed in studies with sufficient sample size ranged from 3 to 6% for total cholesterol, and 4 to 8% for LDL-cholesterol, which would translate to a 6 to 18% decrease in coronary heart disease risk. This would equate to substantial health benefit at the population level. Barley usually contains around 3% beta-glucan, and therefore the required amount of barley to be ingested daily to achieve the optimal beta-glucan intake would be close to 100 g. This large amount constitutes a major barrier to consumer consumption, and consuming barley with higher Beta-glucan content would reduce the quantity required to provide health benefits.
Hence this study intends to assess the effect of 6 weeks intervention with high-glucan barley in borderline/untreated hypercholesterolaemic volunteers on LDL, HDL and total cholesterol concentrations.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 18/02/2019, North of Scotland Research Ethics Committee (Summerfield House, 2 Eday Road, Aberdeen, AB15 6RE; 01224 558474; nosres@nhs.net), ref: 19/NS/0029

Study design
Randomised single-blind crossover trial

Primary study design
Interventional

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Untreated borderline hypercholesterolaemia

Interventions
74 men and women with elevated blood cholesterol will be recruited. There will be an initial visit during which volunteers will be screened for blood cholesterol to make sure they are suitable to take part to the study. Then blood and urine collections, blood vessel stiffness and blood pressure measurements will be performed six times during the study (at first visit, after two 2-week periods on a refined (no wholegrain) diet (run-in before intervention and after wash-out period between interventions), after 6-week interventions (week 8 and 16) and after a 4-week follow-up period. Blood vessel stiffness and central blood pressure will be also determined at these time points. Dietary assessment will be carried out four times during the study (at baseline, during both intervention periods and during the 4-week follow-up period). Blood and urinary markers of chemicals involved in cholesterol regulation and other markers for heart disease risk will be measured as required. Compliance to the interventions will be assessed by analysing food diaries and as well as by measuring plasma and urine alkylresorcinols (chemical compounds found in wholegrains). If the volunteers are willing, they will be asked to provide stool samples seven times during the study at weeks 2, 4, 8, 10, 12, 16 and 20. Our primary outcome is blood cholesterol (adjusted for baseline) after 6 weeks intervention, which will be compared between the two groups.

After 2 weeks on a wholegrain-free diet, half of the participants will eat 75 g of barley daily for 6 weeks while the other half will eat 65 g wholewheat-based diet. All will then eat a wholegrain free diet for 2 weeks. Then they will all switch to the other arm of the intervention (barley or wheat-based diet depending on which they started with). Volunteers will be asked to provide optional stool samples several times during the study to assess changes in gut microbiota composition. The subjects will be followed up for a further 4 weeks after the end of intervention to see if any changes are maintained or removed when beta-glucan rich barley is withdrawn from the diet. Urine and blood collection, blood pressure and blood vessel hardening measurements will be performed several times during the study.

The barley and wholegrain products are provided to the participants. The volunteers are provided with an information sheet on what to eat/avoid during the study period. During the wholegrain-free period, the participants are free to eat anything in their normal diet as long as they use the refined version. There is also a small list of foods they will be asked to avoid eg food or products containing statins. This information is made available to the participants in the form of an information sheet.

Intervention Type
Supplement

Primary outcome(s)

1. Plasma total cholesterol
2. Plasma HDL-cholesterol
3. ApoA1
4. ApoB100
5. Triacyclglycerol (TAG, triglycerides)
6. Glucose
All blood tests will be performed using standard laboratory analysis using blood samples taken at weeks 2, 8, 10, 16 and 20.

Key secondary outcome(s))
1. Participant-reported compliance to the intervention assessed by examining food diaries
2. Alkylresorcinol levels assessed by HPLC analysis of plaasma and urine samples taken at weeks 2, 8, 10, 16 and 20.
3. Markers of inflammation (GlycA, hsCRP, IL6, serum amyloid A, oxidised LDL) will be measured by immunoassays using blood samples taken at weeks 2, 8, 10, 16 and 20
3. Gut microbiota activity assessed using markers such as plasma trimethylamine oxide measured by by liquid chromatography/mass spectrometry using blood samples taken at weeks 2, 8, 10, 16 and 20

Completion date
31/07/2021

Eligibility

Key inclusion criteria
1. Aged 30-65 years
2. Borderline/untreated high cholesterol levels

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Sex
All

Key exclusion criteria
1. Systolic BP above 159 mmHg or below 90 mmHg, and/or with diastolic blood pressure above 89 mmHg or below 60 mmHg
2. Cardiovascular disease (CVD), diabetes or fasting blood glucose concentration >7.0 mmol/l, asthma or thyroid conditions
3. Eating disorders, high habitual intake of wholegrain food (>21 portions per week) or taking regular medication or supplements known to affect any dependant variable measured

Date of first enrolment
18/02/2019

Date of final enrolment
30/04/2021

Locations

Countries of recruitment
United Kingdom

Scotland

Study participating centre
Rowett Institute
University of Aberdeen
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Sponsor information

Organisation
The University of Aberdeen

ROR
https://ror.org/016476m91

Funder(s)

Funder type
Government

Funder Name
Rural and Environment Science and Analytical Services Division

Alternative Name(s)
Scottish Government's Rural and Environment Science and Analytical Services Division, Rural and Environment Science and Analytical Services Division, Scottish Government, RESAS

Funding Body Type
Government organisation

Funding Body Subtype

Local government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan
The data sharing plans for the current study are unknown and will be made available at a later date.

IPD sharing plan summary
Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
HRA research summary			28/06/2023	No	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes