ISRCTN67949258 https://doi.org/10.1186/ISRCTN67949258

Household introduction of new healthy and sustainable plant-based foods to assess diet incorporation and food acceptance among Portuguese and Swiss consumers

Submission date
24/03/2026

Recruitment status
No longer recruiting

Registration date
25/03/2026

Overall study status
Completed

Last Edited
25/03/2026

Condition category
Other

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

Plain English summary of protocol

Background and study aims

Current food consumption is harming both human health and the environment. While unhealthy diets are a major cause of diseases such as obesity, heart disease and diabetes, food production places a heavy burden on the planet, using large amounts of natural resources. For this reason, international organisations such as the World Health Organization (WHO), the European Commission and the Intergovernmental Panel on Climate Change (IPCC), recommend a shift towards healthier and more sustainable diets, with a stronger focus on plant-based foods. These recommendations aim to improve population health while reducing environmental impact. However, the intake of whole or minimally processed plant-based foods (such as whole grains, fruits, vegetables, and legumes) is frequently below recommended levels. As a result, important plant-based components such as dietary fibre are consumed in insufficient quantities compared to recommendations. Fibre is essential for good digestion and gut health, and it reduces the risk of major chronic conditions, such as heart disease, diabetes, obesity, and some types of cancer. Similarly, fermented foods are important contributors to a healthy gut microbiota and overall health, but are consumed unevenly across Europe, and are often not part of daily diets.

In the 'Sustain-a-bite' project, innovative and efficient processes are being developed to enable the production of new, minimally processed plant-based foods that are healthy, nutritious, and environmentally friendly. However, people may be unsure about new foods or unfamiliar production methods, which can jeopardise the success of these innovations.

The objective of this study is to understand how consumers accept and incorporate new healthy, sustainable plant-based foods, similar to those being developed in the 'Sustain-a-bite' project, into their daily diets. The study also aims to explore how repeatedly consuming plant-based, fibre-rich, fermented foods impacts consumers' diet quality, nutritional status, and health perceptions.

Who can participate?

Couples residing in Portugal or Switzerland for at least 10 years can participate, regardless of their marital status. Participants must be healthy, non-pregnant adults (20-60 years of age), have

no food allergies or intolerances related to the foods to test, eat meat and other animal-based foods, be familiar with kombucha and hummus, and be available to eat unknown plant-based foods and to collect all the study's necessary information with quality.

What does the study involve?
A minimum of 80 participants (40 couples) is recruited in each country. Before enrolment, an anonymous questionnaire will be administered to all interested couples to determine eligibility to participate. A study information session will be held at each participating centre in each country. Once couples' eligibility is verified and they provide informed consent, they are enrolled in the study and undergo the first moment of participants' characterisation, which includes data on sociodemographic and dietary patterns, as well as information on the participants' beliefs, opinions and knowledge towards food and health.
Before the beginning of the intervention (week 0), participants will attend the first sensory lab evaluation, in which they will taste and evaluate four plant-based food products: Hummus (traditionally middle Eastern paste made from cooked chickpeas), Kombucha (fermented tea beverage originally from East Asia), Mämmi (traditional Finnish pudding-like food, based wholegrain rye flour and rye/barley malt) and Börs (traditional Romanian fermented beverage made from wheat bran). Then, they will be provided with two weekly portions of each product per person for 4 weeks. During this time, each participant must consume each product twice a week, being free to choose the day, time, meal, mode of consumption and amount consumed. In each moment of consumption, they must fill a questionnaire in which they evaluate the product consumed and give details on its consumption. Another three sensory lab sessions will be carried out in the middle (end of week 2), end (week 5), and one month after the end (week 9) of the intervention. Throughout the study period, additional information on the participants' eating behaviour and food choices will be collected, and anthropometric data will be measured. Finally, individual interviews will be conducted in one member of each couple at the end (week 5) and one month after the end (week 9) of the intervention to assess their overall experience, including their opinions about the products, drivers and barriers to consumption.

What are the possible benefits and risks of participating?
All foods used in this intervention are commercially available in Europe. As such, they comply with European food safety regulations. The sensory lab evaluations of the intervention foods will be conducted by qualified staff and overseen by technical and scientific experts. At the beginning of the study, participants are fully informed about the food products' characteristics, namely ingredients, allergens, nutritional composition, shelf-life and adequate use and storage practices. They will also be provided with contact information of dedicated team members, who will be available for any further assistance throughout the study. As such, no risks or discomforts are expected for participants, other than the time and commitment required to participate in the study.
Couples will receive financial compensation for their participation. The findings from this study will be used to develop more efficient techniques for producing affordable, nutritious plant-based foods. This will, in turn, promote healthier, more sustainable diets among European adults.

Where is the study run from?
This study is run from the Faculty of Sciences of the University of Porto (Porto, Portugal) and Bern University of Applied Sciences (Bern, Switzerland).

When is the study starting, and how long is it expected to run for?
November 2025 to May 2026

Who is funding the study?
This project has received funding from the European Union's Horizon Europe Research and

Innovation programme under Grant Agreement No 101180399 (Project Sustain-a-bite), and by the Swiss State Secretariat for Education, Research and Innovation (SERI).

Who is the main contact?
Professor Luís Miguel Cunha, lmcunha@fc.up.pt
Professor Thomas Brunner, thomas.brunner@bfh.ch

Contact information

Type(s)
Principal investigator, Scientific

Contact name
Prof Luís Miguel Cunha

ORCID ID
https://orcid.org/0000-0002-4590-7533

Contact details
Geociências, Ambiente e Ordenamento do Território
FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DO PORTO
Campus Agrário de Vairão, Edf. FCV2
Rua da Agrária, 747
Vila do Conde
Portugal
4485-646
+351-917772498
lmcunha@fc.up.pt

Type(s)
Public

Contact name
Dr Sofia Sousa

ORCID ID
https://orcid.org/0000-0001-8389-1758

Contact details
FACULDADE DE CIÊNCIAS DA UNIVERSIDADE DO PORTO
Campus Agrário de Vairão, Edf. FCV2
Rua da Agrária, 747
Vila do Conde
Portugal
4485-646
+351-968823143
sofia.sousa@fc.up.pt

Additional identifiers

HORIZON-CL6-2024-FARM2FORK-01
101180399

Study information

Scientific Title
A 4-week home-based intervention to assess diet incorporation and food acceptance of new minimally-processed, fibre-rich, and fermented plant-based foods among healthy adults from Portugal and Switzerland

Acronym
Pro3F-Fit

Study objectives
Unhealthy dietary patterns are a leading contributor to non-communicable diseases, including obesity, cardiovascular disease, and type 2 diabetes, while current food systems place substantial pressure on environmental sustainability. International organisations, including the World Health Organization (WHO), the European Commission and the Intergovernmental Panel on Climate Change (IPCC), recommend a transition towards healthier and more sustainable dietary patterns, characterised by higher consumption of plant-based foods. However, the intake of whole and minimally processed plant-based foods (such as legumes, whole grains, fruits, and vegetables) remains below recommended levels across Europe, while meat and other animal-based products are commonly overconsumed.
In the 'Sustain-a-bite' project, innovative processes are being developed to produce novel, minimally processed plant-based foods that are both nutritious and environmentally sustainable. However, consumer acceptance of such foods, particularly those produced using unfamiliar methods, remains uncertain and may represent a barrier to their adoption.
The main objective of this intervention is to introduce new healthy, sustainable plant-based foods, similar to those being developed in the 'Sustain-a-bite' project, into the daily diets of healthy adults, to study how they accept and incorporate these food products, and to identify the main drivers and barriers of consumption. The study will also explore how repeated exposure to plant-based fibre-rich and fermented foods impacts consumers' diet quality, nutritional status and health perceptions.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 23/01/2025, Ethical committee of the Faculty of Sciences, University of Porto (Rua do Campo Alegre , s/n, Porto, 4169-007, Portugal; +351 220402000; comissao.etica@fc.up.pt), ref: Proc. CE2024/p182

Primary study design
Interventional

Allocation
N/A: single arm study

Masking
Open (masking not used)

Control
Uncontrolled

Assignment
Single

Purpose
Basic science, Prevention, Better understand how unfamiliar fibre-rich and fermented food products are adopted by consumers

Study type(s)

Health condition(s) or problem(s) studied
Low consumption of minimally-processed, fibre-rich and fermented plant-based foods associated with unhealthy and unsustainable dietary patterns frequently observed in Western populations.

Interventions
A 10-week single-arm home-based intervention trial will be conducted in Portugal and Switzerland. A study information session will be held at each country's participating centres for all interested couples who meet the eligibility criteria. In these sessions, researchers will explain the study objectives, methodology and data to be collected. An information brief containing the main product details from the respective labels, including the ingredients list, allergen information, nutrition declaration, and storage conditions, will also be provided. After signing the informed consent, participants are enrolled in the study.
Over four weeks (intervention period, week 1 to week 4), participants will be repeatedly exposed to four plant-based food products, corresponding to two fibre-rich foods and two fermented beverages. Two are unfamiliar products from other European countries: (1) Mämmi, a traditional Finnish pudding-like food, based on wholegrain rye flour and rye/barley malt; and (2) Börs, a traditional Romanian fermented beverage made from wheat bran. The other two are products of similar typology that have already become popular across Europe: (1) Hummus, a traditionally Middle Eastern paste made from cooked chickpeas; and (2) Kombucha, a fermented tea beverage originally from East Asia. The latter will be used as a comparison point to identify the drivers of their success in the European market.
Every week, participants will receive two portions of each of these food products. They will be asked to consume each product twice a week, with no restrictions on order, mode of consumption, or amount consumed, ranging from a minimal taste to a full portion. At each consumption moment, they will complete a questionnaire, providing data on overall liking, acceptance, emotional response, amount consumed and contextual details (including time, location, meal occasion, social and situational contexts). In addition, participants will upload photographic records documenting the mode and circumstances of consumption, including accompanying foods and/or beverages, if any. A total of four tasting sessions will be conducted at the sensory laboratory at baseline (week 0), mid-intervention (end of week 2), post-intervention (week 5), and one-month follow-up (week 9), to assess hedonic and emotional responses and identify main sensory descriptors. Furthermore, individual qualitative interviews with one member of each couple will be conducted at weeks 5 and 9, to explore participants' overall experience, perceptions, drivers and barriers to consumption.
Comprehensive characterisation of participants (e.g., sociodemographics, food neophobia, food choice criteria, nutrition knowledge) will be conducted using online questionnaires, to assess potential factors influencing diet incorporation and acceptance of these foods. To evaluate dietary and anthropometric changes, validated food frequency questionnaires will be completed

at baseline (week 0) and one-month follow-up (week 9), and anthropometric measures will be collected immediately before (week 0) and after (week 5) the intervention.

Intervention Type
Behavioural

Primary outcome(s)
1. Diet incorporation of new, minimally-processed fibre-rich and/or fermented plant-based foods measured using amount consumed, mode of consumption (meal, time, place and context), and photographic records collected through self-administered questionnaires completed at each moment of consumption over the intervention period (weeks 1 to 4), as well as through individual qualitative interviews at weeks 5 and 9.

2. Food acceptance of new, minimally-processed fibre-rich and/or fermented plant-based foods measured using hedonic and emotional response scales at each moment of consumption over the intervention period (weeks 1 to 4) and in every sensory laboratory session, conducted at baseline (week 0), mid-intervention (end of week 2), post-intervention (week 5), and one month post-intervention (week 9), as well as through individual qualitative interviews at weeks 5 and 9

Key secondary outcome(s)
1. DIET - Diet quality scores (e.g., Heathy Diet Indicator; Mediterranean Diet Score) measured using validated food frequency questionnaires collected at baseline (week 0) and one-month follow-up (week 9)

2. DIET - Consumption of plant-based and animal-based food groups in absolute (g/day) and relative contribution to total daily dietary intake (%) measured using validated food frequency questionnaires collected at baseline (week 0) and one-month follow-up (week 9)

3. DIET - Adequacy of dietary intake of key nutrients (e.g., fiber, carbohydrates, free sugars, protein) relative to international recommendations, measured using validated food frequency questionnaires collected at baseline (week 0) and one-month follow-up (week 9)

4. NUTRITIONAL STATUS - Body Mass Index (kg/m²) measured using weight and height, collected by a trained and licensed nutritionist using the same calibrated balance scale and stadiometer at baseline (week 0) and at the end of the intervention (week 5)

5. NUTRITIONAL STATUS - Body composition parameters (fat mass and fat-free mass) measured using a Dual-Frequency Bioelectrical Impedance Analysis, performed by a trained and licensed nutritionist at baseline (week 0) and at the end of the intervention (week 5)

6. HEALTH-RELATED PERCEPTIONS - Perceptions about the products' health-related attributes (e.g. healthiness, naturalness, processing extent, nutritional value), measured using 7-point semantic differential scales at the beginning (week 1) and at the end of the intervention (week 4)

7. HEALTH-RELATED PERCEPTIONS - Perceptions about the participants' own health status measured using a 7-point Likert scale at baseline (week 0), the end of intervention (week 5) and one-month follow-up (week 9), as well as through individual qualitative interviews at weeks 5 and 9

Completion date
15/05/2026

Eligibility

Key inclusion criteria
DEMOGRAPHICS
1. Age: 20-60 years
2. Household composition: couples (i.e., two adults in a conjugal relationship and living together)
DIET
3. Dietary pattern: includes meat and other animal-based foods (i.e., omnivorous or flexitarian)
4. Familiarity: having consumed kombucha and hummus before
ABILITIES, RESOURCES AND COMMITMENT
5. Independent users of each country's official languages
6. Independent internet users
7. Owners of an electronic device compatible with the requirements for home-based data collection
8. Have sufficient time, skills and resources to adhere to the study protocol, namely to complete all self-assessments, to pick up all provisions as scheduled and to safely store the food products
9. Willingness to consume unfamiliar plant-based foods
10. No simultaneous participation in another trial during the study period
11. No planned absences from home (≥ 3 consecutive days) during the study period
12. Informed consent to participate

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
20 Years

Upper age limit
60 Years

Sex
All

Total final enrolment
180

Key exclusion criteria
1. Self-reported diagnosis of acute or chronic diseases requiring continuous medical treatment or dietary therapy
2. Food allergies or intolerances to the study food products and their ingredients
3. Pregnancy or intention to conceive during the study period
4. Residence in Portugal/Switzerland for less than 10 years
5. Failure to meet the predefined data quality criteria (e.g., incomplete or inconsistent responses, errors in data quality checks)

Date of first enrolment
01/11/2025

Date of final enrolment
28/02/2026

Locations

Countries of recruitment
Portugal

Switzerland

Study participating centre
GreenUPorto - Research Centre on Sustainable Agrifood Production; Department of Geosciences, Environment and Planning, Faculty of Sciences, University of Porto
Rua da Agrária 747
Vila do Conde
Portugal
4169-007

Study participating centre
Department of Food Science & Management, School for Agricultural, Forest and Food Sciences HAFL , Bern University of Applied Sciences
Länggasse 85
Zollikofen
Switzerland
CH-3052

Sponsor information

Organisation
Universidade do Porto

ROR
https://ror.org/043pwc612

Funder(s)

Funder type

Funder Name
HORIZON EUROPE Framework Programme

Alternative Name(s)
Horizon Europe, Horizon Europe Programme, Framework Programme, Horizon Europe, EU Framework Programme, Horizon, Horizonte Europa

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location

Funder Name
Swiss State Secretariat for Education, Research and Innovation (SERI)

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available