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A new way to develop a smart personal nutrition system

Submission date	Recruitment status	[X] Prospectively registered
04/10/2021	No longer recruiting	[X] Protocol
Registration date	**Overall study status**	[_] Statistical analysis plan
20/10/2021	Completed	[X] Results
Last Edited	**Condition category**	[_] Individual participant data
12/02/2025	Nutritional, Metabolic, Endocrine	

Plain English summary of protocol

Background and study aims

Since preventing chronic diseases is currently a major concern and one of the UN Sustainable Development Goals, changing the gut microbiome (microorganisms) through the diet has been drawing much interest. There is where Stance4Health comes in, building a mathematical algorithm able to predict gut microbial behaviour in response to a specific diet and vice versa. The gut microbiota has a strong influence on human health and can be modified by diet. Intestinal bacterial communities are diverse and vary from person to person but are endowed with substantial stability over time within an individual and share a high degree of functional capabilities across healthy individuals. Environment, lifestyle and diet are the critical factors determining the intestinal microbiota while genetics seems to play a lesser role. Dietary effects on the intestinal microbiota can occur in short and long time frames. A large intake of energy and nutrients can induce bacterial blooms in the human gut within a short time frame but long-term dietary patterns seem to be responsible for the gene and species richness of the gut microbiota. Stance4Health will develop a complete Smart Personalised Nutrition (SPN) service based on the use of mobile technologies (a nutritional app) as well as tailored food production that will optimize the gut microbiota and long-term consumer engagement.

Who can participate?

Normal weight and overweight healthy adults aged 20 - 65 years, and four groups of children aged 5-11 years: normal weight, overweight, with celiac disease and with a food allergy

What does the study involve?

Participants will be assigned to one of two levels of intervention and further divided into “control” and “treated” groups.

The nutritional app i-Diet will give participants specific advice about nutrition and lifestyle according to their dietary needs, either taking or not into account gut microbiota composition for the treated or the control group, respectively. The nutritional app will suggest a complete menu, which participants can modify and the app will recalculate the menu. In this way i-Diet will allow researchers to obtain the nutritional information of the food eaten by users.

Participants will learn to use i-Diet (through instruction/training) and will include in the app their preferences about the number of meals per day, the number of dishes included in the main meals and the desired portion size (from the photographs database), as well as their favourite

and disliked recipes, so that the app will adjust its suggestions to improve user adherence and sustainability over time.
After a 2-week run-in period, the participants will be randomly assigned to a 12-week intervention with two different levels of personalised nutrition: Level 1 will involve the use of the i-Diet software and the analysis of gut microbiota and metabolites. Level 2 will involve the use of the i-Diet app and analysis of gut microbiota and metabolites, plus the use of a wearable band and the intake of placebo (control group) or personalised foods enriched in tannins (treated group). The wearable will be used to record physical activity, sleeping hours, body mass index, and body composition. In the case of personalised foods, they will be produced and distributed in a customised way for each individual, including different types and levels of tannin extracts.
There will be clinical evaluations at the beginning and at the end of the interventions to measure blood pressure, gut microbiota, short-chain fatty acids (SCFAs) and bile acid levels in faeces, previous diseases, height, weight, waist circumference, fat mass, muscle mass, dietary, lifestyle (smoking habits, physical activity and sleep patterns), and socioeconomic status.

What are the possible benefits and risks of participating?
Participants will receive for free the nutritional app i-Diet, fortified foods or supplements, and a wearable band.

Where is the study run from?
The Stance4Health consortium consists of 19 partners from eight European countries (Spain, Germany, Denmark, Romania, Italy, Greece, Belgium, UK). The nutritional intervention will be performed in Germany, Greece and Spain.

When is the study starting and how long is it expected to run for?
December 2017 to March 2023

Who is funding the study?
European Union Horizon 2020

Who is the main contact?
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Contact information

Type(s)
Scientific

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Additional identifiers

Protocol serial number
816303 (Project Number)

Study information

Scientific Title
Smart Technologies for personAlised Nutrition and Consumer Engagement (Stance4Health)

Acronym
Stance4Health

Study objectives
The Stance4Health project thanks to a nutritional intervention programme, aims to evaluate the efficacy of a smart personalised nutrition (SPN) service in modifying gut microbiota (GM) composition and improving consumer empowerment through technology adoption.

Ethics approval required
Old ethics approval format

Ethics approval(s)
1. Approved 10/06/2020, Ethics Committees for Investigation of the University of Granada (Cuesta del Hospicio S/N, 18071, Granada, Spain; +33 (0)958 246180; fovalle@ugr.es), ref: 1080 /CEIH/2020
2. Approved 04/06/2020, Scientific Committee of the University Hospital of Ioannina (Stavrou Niarhou, 45500 - Ioannina, Greece; +30 (0)26510 99519; epsymb@uhi.gr), ref: protocol number 382, decision number 10/3-6-2020
3. Approved 22/07/2020, Ethics Committee University Hospital of Patras (Rion-Patras, 26504, Greece; +30 (0)2613603101; kefiap@pgnp.gr), ref: 261/16-6-20
4. Approved 14/04/2020, Epistimoniko Symvoulio - Attikon Hospital (Rimini 1, Athens 12462, Greece; +30 (0)210 5831000; greps@attikonhospital.gr), ref: 159/3-4-2020

Study design
Multicenter single-blind placebo-controlled randomized controlled trial

Primary study design
Interventional

Study type(s)
Prevention

Health condition(s) or problem(s) studied

Nutrition and lifestyle

Interventions

The personalised nutrition intervention will be developed through a Smart Personalised Nutrition (SPN) service using a randomised controlled trial targeting gut microbiota (GM) composition and functionality, consumer empowerment through technology adoption and long-lasting adoption of healthy and sustainable diets.

The clinical study will be conducted in a single-blind randomised manner in two different study populations:

Study population 1 (normal-weight and overweight adults)

Individuals from Germany and Spain will be assigned to one of two levels of intervention and further divided into “control” and “treated” groups. The random allocation sequence will be provided and managed by an investigator who will not take part in the participants’ recruitment. The study will use a parallel design and will be characterised by the use of the nutritional app i-Diet. i-Diet will give participants specific advice about nutrition and lifestyle (taking or not into account gut microbiota composition, respectively for treated or control group) according to their dietary needs. The nutritional app will suggest a complete menu, which participants can modify and the app will recalculate the menu. In this way i-Diet will allow researchers to obtain the nutritional information of the food ingested by users.
Participants will learn to use i-Diet (through instruction/training) and will include in the app their preferences about the number of meals per day, the number of dishes included in the main meals and the desired portion size (from the photographs database), as well as their favourite and disliked recipes, so that the app will adjust its suggestions to improve user adherence and sustainability over time.
After a 2-week run-in period, the eligible participants will be randomly assigned to a 12-week intervention with two different levels of personalised nutrition: Level 1 (entry level, n = 50 Spanish and 50 German subjects in the control and treated groups; total n = 200) will consist of the use of the i-Diet software and the analysis of gut microbiota and metabolites. Level 2 (advanced level, n = 50 Spanish and 50 German subjects in the control and treated groups; total n = 200) will consist of the use of the i-Diet app and the analysis of gut microbiota and metabolites (as in the entry level), plus the use of a wearable band, and the intake of placebo (control group) or personalised foods enriched in tannins (treated group). The wearable will be used to record physical activity, sleeping hours, body mass index, and body composition. In the case of personalised foods, they will be produced and distributed in a customised way for each individual, including different types and levels of tannin extracts, looking for a deeper modulation of the gut microbiota composition and functionality. All data recorded in i-Diet and wearable band and the results of the analysis will be recorded in specific databases.
Before the intervention, there will be two clinical evaluations of the study population: at the beginning (T0) and at the end of the interventions (T1). Both at T0 and T1 health (blood pressure, gut microbiota composition and gene expression, metabolomics profile from gut microbiota, short-chain fatty acids (SCFAs) and bile acid levels in faeces, previous pathologies), anthropometric (height, weight, waist circumference, fat mass, muscle mass), dietary, lifestyle (smoking habits, physical activity and sleep patterns), and socioeconomic status information will be collected in specific data-sheets.

Study population 2 (Greek children with obesity (a), with gluten disease (b), non-cow’s milk consumers (c), normal weight (d))
Updated 22/07/2022: (Greek children with obesity (a), with gluten-related disorders (b), with allergy/intolerance to cow’s milk (c), normal weight (d))

Individuals in each of the aforementioned (a, b, c, and d) groups will be assigned to the “control” and “treated” subgroups. The random allocation sequence will be provided and managed by an investigator who will not take part in the participants’ recruitment. i-Diet will provide nutritional information on food (including branded food and fast food) so that users can make better choices in retailers, and specific advice about nutrition and lifestyle (taking or not into account gut microbiota composition respectively for the treated or control group). i-Diet will be also used as a novel personalised nutrition tool. To do so, participants and/or their parents/carers will learn to use the i-Diet app (through instructions/training) in order to indicate to the app which of the suggested meals the user has finally eaten and which ones he/she has substituted (and with which recipe he/she has replaced it), and selecting the corresponding serving size (portion) from the photographs database.
After a 4-week run-in period, the eligible participants will be randomly assigned to a 12-week intervention with two different levels of personalised nutrition. They will all use the i-Diet software and undergo analysis of gut microbiota and metabolites. However, those in the “treated” subgroups will also receive personalised fortified foods (tannin extracts, looking for a deeper modulation of the gut microbiota composition and functionality) whereas the “control” group will receive placebo. All data recorded in the i-Diet and the results of the analysis will be recorded in specific databases. Intervention procedures will be pre-tested in at least five participants.
There will be two clinical evaluations of the study population: at the beginning (T0) and at the end of the interventions (T1). Both at T0 and T1 health (blood pressure, gut microbiota composition and gene expression, metabolomics profile from gut microbiota, SCFAs and bile acids levels in faeces), anthropometric (height, weight, waist circumference, fat mass, muscle mass), dietary, lifestyle (physical activity and sleep patterns), and the family’s socio-economic status information will be collected in specific data-sheets.

Intervention Type
Mixed

Primary outcome(s)
1. Variation in alpha diversity determined by 16S gene-targeted sequencing at baseline and 12 weeks
2. Consumer empowerment through technology adoption and long-lasting adoption of healthy and sustainable diet, measured using questionnaire and Food Frequency Questionnaire (FFQ) at baseline, 12 and 24 weeks

Key secondary outcome(s))
1. Food intake measured using FFQ and nutritional app at baseline and 12 weeks
2. Body weight self-measured using a scale at baseline, 4, 8, 12, 24 weeks
3. Blood pressure self-measured using a sphygmomanometer at baseline, 4, 8, 12, 24 weeks
4. Body composition, physical activity levels and sleep duration measured using a wearable band at baseline, 4, 8, 12, 24 weeks
5. Short-chain fatty acids and secondary bile acids in faeces measured using targeted metabolomics by means of mass spectrometry at baseline and 12 weeks
6. Urine metabolomics measured using an in vitro metabolomics diagnostic test at baseline and 12 weeks

Completion date
31/03/2023

Eligibility

Key inclusion criteria
Study population 1 (normal-weight and overweight adults):
1. Age 20 - 65 years
2. Apparently healthy
3. BMI 20-28 kg/m²
4. Weight stable
5. Use of smartphone
6. Internet connection

Study population 2:
1. BMI ≥95 percentile for age, gender and height, males 6-11 years, females 6-11 years
2. Diagnosed with celiac disease, aged 6-11 years, on elimination (gluten-free) diet and allergic to gluten (very few), on elimination (gluten-free) diet
3. Age males 6-11-years, females 6-11 years and one of the following:
3.1. IgE-mediated milk allergy, on elimination diet from infancy
3.2. Lactose intolerance (symptoms plus breath hydrogen positive test)
3.3. Overgrown IgE-mediated milk allergy but current aversion for milk
3.4. Nondefinable phenotype (children who avoid milk but do not belong to any of the previous phenotypes)
4. BMI >5th and <85th percentile for age, gender, and height, age: males 6-11 years, females 6-11 years

Updated 22/07/2022:
Study population 2:
1. BMI ≥95 percentile for age, gender and height, males 5-11 years, females 5-11 years
2. Diagnosed with celiac disease, aged 5-11 years, on elimination (gluten-free) diet and allergic to gluten (very few), on elimination (gluten-free) diet
3. Age males 5-11 years, females 5-11 years and one of the following:
3.1. IgE-mediated milk allergy, on elimination diet from infancy
3.2. Lactose intolerance (symptoms plus breath hydrogen positive test)
3.3. Overgrown IgE-mediated milk allergy but current aversion for milk
3.4. Nondefinable phenotype (children who avoid milk but do not belong to any of the previous phenotypes)
4. BMI >5th and <85th percentile for age, gender, and height, age: males 5-11 years, females 5-11 years

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
5 years

Upper age limit
65 years

Sex

All

Total final enrolment
408

Key exclusion criteria
Study population 1 (normal-weight and overweight adults):
1. Diagnosis of chronic GI disorders, diabetes, celiac disease, or chronic diseases
2. Present pregnancy or lactation (<6 weeks prior to study start), or planning to get pregnant
3. Recent inflammation and/or long-term use of anti-inflammatory drugs
4. Medically prescribed diet or specific dietary regimens for any reasons (i.e. high-protein diet, vegetarianism, veganism, etc)
5. Antibiotic treatment (<3 months prior to study start)
6. Intake of antioxidant, pre- or probiotic supplements (< 1 month prior to study start)
7. Intense physical activity (>10 h/week)
8. Alcohol consumption >21 drinks/week for men and >14 drinks/week for women

Study population 2:
1. GI disease, endocrinopathies, probiotics in the last 2 weeks
2. Never symptoms
3. Other gastrointestinal comorbidities
4. Chronic GI disorders, any other chronic disease, elimination diet, probiotics in the last 2 weeks

Date of first enrolment
01/11/2021

Date of final enrolment
31/12/2022

Locations

Countries of recruitment
Germany

Greece

Spain

Study participating centre
University of Granada (UGR)
Faculty of Pharmacy
Campus Universitario Cartuja
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Study participating centre
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45110

Study participating centre
University of Patras
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26504

Study participating centre
National and Kapodistrian University of Athens
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Sponsor information

Organisation
University of Granada

ROR
https://ror.org/04njjy449

Organisation
Institute of Food Science

ROR
https://ror.org/0013zhk30

Funder(s)

Funder type
Not defined

Funder Name
European Commission

Alternative Name(s)
European Union, Comisión Europea, Europäische Kommission, EU-Kommissionen, Euroopa Komisjoni, EC, EU

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are/will be available upon request from Prof. José Ángel Rufián-Henares (jarufian@ugr.es).

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol article		19/05/2022	31/05/2022	Yes	No
Basic results	Spanish adults	06/09/2023	06/09/2023	No	No
Other publications	App development	05/01/2023	12/02/2025	Yes	No
Other publications	Harmonisation efforts carried out to obtain the Stance4Health food composition tables	24/11/2021	12/02/2025	Yes	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes
Study website	Study website	11/11/2025	11/11/2025	No	Yes