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Studying the effects of psychological and bodily factors on eating habits

Submission date
09/04/2021

Recruitment status
No longer recruiting

Registration date
28/05/2021

Overall study status
Completed

Last Edited
26/05/2021

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
Health-harming over-consumption of food is a major contributor to disease and premature death. Widespread and easy environmental availability of aggressively marketed energy-dense foods has led to marked increases in average body mass and in the numbers of people deemed overweight and obese. But a proportion of people appear to be resistant to the environment causing these changes. The variation in susceptibility to these changes appears to be highly inherited and is mostly expressed in terms of neurobehavioural characteristics. The challenge in understanding the routes to over-consumption, is to characterise how metabolic, psychological and environmental factors combine to shape eating behaviours.

This study will investigate factors contributing to appetite and eating in healthy people and in patients for whom eating patterns may have become disrupted. Ultimately, the aim of this study is to understand over-consumption as well as patterns of consumption that have become disrupted as a consequence of disturbances in body-brain communication. In addition, this study will investigate how individual variations in metabolic, endocrine, cognitive and neural characteristics associate with appetite and health-harming patterns of consumption.

Who can participate?
Adult patients with a BMI of between 18.5 and 25 or with a BMI of 30 or above. Additionally groups of adult patients who are undergoing an operation to remove part or all of the stomach (known as a gastrectomy) and those with specific genetic mutations affecting a part of the brain involved in the regulation of appetite and food intake (known as the hypothalamus) will be invited to participate.

What does the study involve?
In this study, participants will be invited for a two day, overnight study in the Cambridge Clinical Research Centre at Addenbrooke's hospital. Over the two days, participants will be examined using a complementary set of cognitive, neural and behavioural measures, and the study team will characterise how these are influenced by hunger, obesity, clinical changes to metabolic /bodily signalling and changes of the brain processing of these signals.

What are the possible benefits and risks of participating?
There are no direct benefits of taking part in the study. The cognitive and interoceptive tasks are non-invasive and carry no risks. They may become tiring for participants so breaks will be possible throughout.

Magnetic resonance imaging carries risks due to the presence of a strong magnetic field. We have a standardised list of exclusion features (including the presence of metal in the body, implants, pregnancy) and participants will be carefully evaluated by the radiographer to ensure minimisation of risks. Venepuncture may carry small risks: this will be done in a clinical setting by trained staff.

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

When is the study starting and how long is it expected to run for?
From January 2017 to December 2022

Who is funding the study?
The Wellcome Trust (UK)

Who is the main contact?
Prof Paul Fletcher
pcf22@cam.ac.uk

Contact information

Type(s)
Scientific

Contact name
Prof Paul Fletcher

ORCID ID
https://orcid.org/0000-0001-8257-1517

Contact details
Clifford Allbutt Building
Addenbrooke's Hospital
Hills Road
Cambridge
United Kingdom
CB2 0SZ
+44 (0)1223 309128
pcf22@cam.ac.uk

Additional identifiers

Integrated Research Application System (IRAS)
251801

Study information

Scientific Title
Studying the psychological and interoceptive contributions to eating

Acronym
SPICE

Study objectives
1. Behavioural and neural markers of goal-directed and habitual responding will be altered in obese people compared to lean people, with a shift towards habitual responding in the former. Moreover, the flexible responding to current task demands will be attenuated in those who are less able to resist environmental drives to consumption.
2. The habit-goal balance is fundamentally shaped by current interoceptive state (altered by hunger/satiety) but that this modulation is perturbed in those with altered interoceptive signalling (following upper GI surgery) and with genetic alterations in leptin-melanocortin circuitry
3. The strength of the hormonal response to a fasted/fed manipulation will be associated with the capacity to control stimulus-driven consumption and this effect will be modulated by interoceptive sensitivity

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 05/02/2019, East of England - Cambridge Central Research Ethics Committee (Royal Standard Place Nottingham NG1 6FS; +44 (0)2071048384, +44 (0)207 104 8107, +44 (0)207 104 8388; cambridgecentral.rec@hra.nhs.uk), ref: 18/EE/0387

Primary study design
Observational

Study design
Single centre observational case-controlled study

Study type(s)
Prevention

Health condition(s) or problem(s) studied
Obesity, patients with monogenic obesity, and patients undergoing upper GI surgery

Interventions
This is an observational study that takes place over two days in the Cambridge Clinical Research Centre at Addenbrooke's hospital. The study combines a series of cognitive, behavioural neuroimaging, hormonal, and physiological measures in lean and obese people and in patients undergoing gastrectomy or with a mutation in the MC4R, LepR, or SIM1 genes. The measures comprise:
1. Cognitive assessments with a series of learning and decision-making tasks
2. Clinical scales assessing anxiety, depression, stress and eating behaviours
3. Functional and structural brain MRI

4. Metabolic measures (blood glucose, insulin) and gut hormone assays
5. Assessments of physiological indices of stress/arousal (heart rate, heart rate variability, respiration)

Intervention Type
Behavioural

Primary outcome(s)
Cognitive measures of habitual and goal-directed learning and their relationships to interoceptive measures of arousal and brain imaging measured using the following measures on the mornings of days 1 and 2:
1. Measures of habitual and goal-directed learning will be button pushes in responses to computer-presented picture cues (abstract shapes) reflecting participants' predictions about the stimuli (rewarding or neutral) associated with those cues. These are binary measures coded as either correct or incorrect and providing an averaged score of participant's learning of the contingent relationships between cues and associated stimuli. The degree to which participants' learning is driven by goal-directed as opposed to habitual (stimulus-driven) processes can be computed from an ensuing task in which the participants are requested to withhold predictions for stimuli that are no longer deemed rewarding. A measure of withholding (averaged across trials) is an index of the level of goal-directed behaviour.
2. Interoceptive measures relate both to cardiac and respiratory monitoring (heart rate, heart rate variability, respiratory rate) and to the participants' ability to estimate their own heart rate (so-called "interoceptive awareness"). Interoceptive awareness scores are measured in terms of the level of accuracy obtained by participants in their estimates. These measures are taken on two occasions: on the morning of the first day of testing and on the morning of the second day. The relationship between scores on interoceptive awareness and goal-directed responding will be calculated by asking whether people who are more accurate on the former have a greater tendency to be goal-directed on the cue-stimulus learning task above.

Key secondary outcome(s)
1. General cognitive function measured using task-induced blood oxygenation level signal which serves as a marker for regional brain activity as participants perform simple cognitive tasks over 1 h at approximately 3 pm on days 1 and 2
2. Eating behaviours measured using unobtrusive observation and measurement of the amount of calories consumed and the composition of foods chosen from a mixed buffet meal provided to participants at approximately 5 pm on days 1 and 2

Completion date
31/12/2023

Eligibility

Key inclusion criteria
All participants:
1. Aged 18-45 years
2. Written informed consent given
3. Estimated IQ ≥80 measured using the WASI-II Full Scale-2
4. Ambulatory
5. Normal or corrected-to-normal vision

Gastrectomy patient group:
1. Aged 18-60 years
2. If post-operative, clinically stable

Monogenic obesity patient group:
1. Identified mutation in MC4R, LepR, or SIM1 genes

Participant type(s)
Mixed

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 Years

Upper age limit
60 Years

Sex
All

Key exclusion criteria
All participants:
1. Not fluent English speaker
2. Current serious neurological or psychiatric illness, including neurodevelopmental disorders; schizophrenia spectrum and other psychotic disorders; bipolar and related disorders; substance-related and addictive disorders; obsessive-compulsive and related disorders; anorexia nervosa, bulimia nervosa, binge-eating disorder, or otherwise specified feeding or eating disorder; previous bariatric or gastric bypass (Roux-en-Y) surgery
3. Type 1 or Type 2 diabetes
4. Evidence of anaemia, metabolic or cardiovascular disease, or disease that may influence metabolism or blood measurements (such as cancer or thyroid disease)
5. Dietary restrictions that cannot be accommodated by the metabolic kitchen
6. Pregnancy or lactation
7. Contraindications to MRI scanning (such as pacemakers, metallic prostheses such as cochlear implants or heart valves, or shrapnel fragments)
8. Claustrophobic to a degree that they would feel uncomfortable in the MRI scanner

Lean group:
1. Left-handedness
2. BMI outside of the range 18.5-24.9 kg/m^2
3. Lifetime history of any of the following DSM-5 psychiatric conditions:
3.1. Obsessive-Compulsive and Related Disorders
3.2. Trauma- and Stressor-Related Disorders
3.3. Dissociative Disorders
3.4. Somatic Symptom and Related Disorders
3.5. Disruptive, Impulse-Control, and Conduct Disorders

4. Recent history (previous 6 months) of any of the following DSM-5 psychiatric conditions
4.1. Depressive Disorders
4.2. Anxiety Disorders
5. Current use of antidepressant or anxiolytic medication

Diet-induced obesity group:
1. Left-handedness
2. BMI <29.9 kg/m²
3. Lifetime history of any of the following DSM-5 psychiatric conditions:
3.1. Obsessive-Compulsive and Related Disorders
3.2. Trauma- and Stressor-Related Disorders
3.3. Dissociative Disorders
3.4. Somatic Symptom and Related Disorders
3.5. Disruptive, Impulse-Control, and Conduct Disorders
4. Recent history (previous 6 months) of any of the following DSM-5 psychiatric conditions
4.1. Depressive Disorders
4.2. Anxiety Disorders
5. Current use of antidepressant or anxiolytic medication

Gastrectomy and monogenic obesity patient groups:
1. Treating clinician has any concerns that participation in the study may have a deleterious effect on the participant’s health or ongoing treatment

Date of first enrolment
01/02/2020

Date of final enrolment
31/12/2022

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
Wellcome Trust-MRC Institute of Metabolic Science Translational Research Facility
Addenbrooke's Hospital
Hills Road
Cambridge
United Kingdom
CB2 0SZ

Sponsor information

Organisation
University of Cambridge

ROR
https://ror.org/013meh722

Funder(s)

Funder type
Research organisation

Funder Name
Wellcome Trust

Alternative Name(s)
Wellcome, WT

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

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
Study website	Study website	11/11/2025	11/11/2025	No	Yes