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Examining the impact of food processing level and nutritional composition on energy intake

Submission date 23/09/2026	**Recruitment status** Recruiting	[X] Prospectively registered [X] Protocol [X] Statistical analysis plan [_] Results [_] Individual participant data [X] Record updated in last year
Registration date 29/09/2026	**Overall study status** Ongoing	
Last Edited 30/09/2026	**Condition category** Nutritional, Metabolic, Endocrine	

Plain English summary of protocol

Background and study aims
The study is designed to examine the effect that different types of diet have on the amount of energy we consume each day. In particular, the study examines whether diets that are higher in 'ultra-processed food' result in us eating more than similar diets which are (or are not) matched to the ultra-processed diet for nutritional factors like fat, salt and sugar. The study is happening because research suggests 'ultra-processed' food may increase the amount of energy consumed per day, but at present it is unclear whether this is due to the typical nutritional profile of ultra-processed foods.

Who can participate?
Healthy adults aged 18-64 years can take part. For more detailed inclusion and eligibility criteria see other sections.

What does the study involve?
It is important to note that this study will require attending the University of Liverpool several times a day for three 4-day periods of Mondays to Thursdays. The study will involve being provided with breakfast, lunch and dinner to be consumed in our laboratory from Monday to Thursday for 3 weeks. You will also be provided with snacks to take away and consume during these days. If you are interested in the study, we can provide you with a detailed participant information sheet.

What are the possible benefits and risks of participating?
There are no major anticipated risks. The presented foods will be commonly consumed in the UK and prepared adhering to Good Manufacturing Practice with appropriate risk analysis by individuals with a Level 2 Certificate in Food Safety and Hygiene. Because the study requires food consumption, we ask any potential participants with a food allergy not to participate. There are no intended benefits of taking part other than helping us develop a better understanding of diet and eating behaviour. If you complete all aspects of the study (three testing periods and relevant tasks) you will be reimbursed £300 for your participation in the form of a bank transfer (please note this can take up to 5 weeks).

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

When is the study starting and how long is it expected to run for?
October 2026 to September 2027

Who is funding the study?
The Economic and Social Research Council (UK)

Who is the main contact?
Dr Victoria Norton (V.L.Norton@liverpool.ac.uk) or if unavailable, Prof Eric Robinson (eric.robinson@liv.ac.uk)

Contact information

Type(s)
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Additional identifiers

Study information

Scientific Title
Examining the impact of food processing level and nutritional composition on energy intake: a randomised controlled trial

Study objectives
The primary objective will compare the effects of an ultra-processed food (UPF) diet vs less processed food (LPF) diets that are either less energy dense than the UPF diet ('unmatched') or a similar energy density and nutritional profile ('matched') diets on daily energy intake (ad libitum) over 4 days.

The secondary objective is to explore changes in appetite sensations (hunger, fullness, and thirst) between UPF and LPF diets.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 07/07/2026, University of Liverpool, Central University Research Ethics Committee D (University of Liverpool, Liverpool, L69 7ZX, United Kingdom; +44 (0)151 794 2000; ethics@liverpool.ac.uk), ref: 18294, 'Effects of diet on health'

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Active

Assignment
Crossover

Purpose
Basic science

Study type(s)

Health condition(s) or problem(s) studied
Effect of different dietary formulations on dietary intake (daily energy intake)

Interventions
Participants will receive each diet for 4 days with a 1-week washout period in between to minimise carry-over effects. Cohorts of participants will be randomly allocated within a block-based design (five blocks with six diet orders: ABC, ACB, BAC, BCA, CAB, CBA) using a computer-generated sequence (RANDBETWEEN function, Microsoft Excel, version 16.106).

The three diet arms will be presented ad-libitum (breakfast, lunch, dinner, snacks) to participants.
1. UPF diet: comprising of UPF purchased food or meal (Nova: group four) commonly consumed in the UK diet – example: a supermarket lasagne ready meal.
2. Unmatched LPF diet: a less processed (Nova: group one to three) homemade version of the selected UPF with lower energy density (<0.50 kcal/g) compared to the UPF – example: a lasagne made using a recipe adapted from diet three (e.g., more vegetables, less pasta without any UPF ingredients).
3. Matched LPF diet: a less processed (Nova: group one to three) homemade version of the selected UPF with equivalent nutritional composition [meal-level per 100g] (key nutrients [including energy, fat, carbohydrates, fibre, protein and salt]: <10% and energy density: <5%) – example: a lasagne made by manipulating ingredients in the unmatched LPF version to increase energy density and fat content to match the UPF version.

Intervention Type
Other

Primary outcome(s)
1. Energy intake measured using weight (pre-post consumption) of all meals and snacks from food boxes (grams) converted to energy intake (kcal): food consumed (grams) x energy density (kcal/g) (informed from pre-determined nutrition composition and relevant software) at daily (average) over 4-day testing period for each diet

Key secondary outcome(s)
1. Self-reported appetite sensations (e.g., hunger, fullness) measured using visual analogue scales (VAS) at pre-post each meal consumed in the laboratory over 4-day testing period for each diet

Completion date
12/09/2027

Eligibility

Key inclusion criteria
1. Aged 18 to 64 years
2. Body mass index (BMI) between 18.5 and 29.9 kg/m2
3. Read and speak English fluently
4. Willing to travel to the University of Liverpool

Healthy volunteers allowed

Yes

Age group
Adult

Lower age limit
18 Years

Upper age limit
64 Years

Sex
All

Total final enrolment
0

Key exclusion criteria
1. Dislike and/or not willing to consume study meals (reviewed during in-person screening and rate dislike [<4] on 9-point hedonic scale for any meal components)
2. Food allergies, intolerances or dietary requirements which cannot be adhered to due to study foods
3. Chronic conditions (e.g., diabetes, cancer, gastrointestinal disorders, kidney/liver disease, etc), poor oral health (including difficulties with eating/swallowing) or cognition impairments impacting memory (such as dementia)
4. History or current eating disorders and/or restrictive eating (including for religious reasons)
5. Following a weight-loss diet and/or not weight stable (5% change in past 3 months)
6. Current or recent smoker (including any tobacco, e-cigarettes, nicotine replacement therapy use in the past 3 months)
7. Pregnant or breastfeeding
8. Not regularly consuming three meals per day
9. Medication impacting study outcomes (including appetite, food intake, body weight, taste)
10. Unwilling to avoid drinking excessive amounts of alcohol (e.g., more than 14 units) per week during the three 4-day testing periods
11. Unwilling to refrain from too much strenuous exercise (e.g., >4 hours per week – that requires you to breathe hard and fast) during three 4-day testing periods and/or not follow an exercise routine similar to their habitual exercise habits during active study weeks
12. Participating in another research study involving food or alcohol consumption
13. Unable (or unwilling) to adhere to study requirements
14. Habitual intake considered implausible (24-hour recall)

Date of first enrolment
12/10/2026

Date of final enrolment
01/08/2027

Locations

Countries of recruitment

United Kingdom

England

Study participating centre
University of Liverpool
Kissileff Laboratory, Eleanor Rathbone Building, University of Liverpool, L69 7ZA
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Sponsor information

Organisation
University of Liverpool

ROR
https://ror.org/04xs57h96

Funder(s)

Funder type

Funder Name
Economic and Social Research Council

Alternative Name(s)
Social Science Research Council, ESRC, SSRC, UKRI ESRC

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study will be stored in a publicly available repository. We anticipate sharing data via Zenodo (https://zenodo.org/). Data shared will be participant level information on intervention allocation, outcome data and measured participant demographics. Data will be anonymised and participants agree to this when consenting into the study. The data will be stored in this repository indefinitely on final submission of the research study to a journal for publication.

IPD sharing plan summary

Stored in publicly available repository

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol file		23/09/2026	23/09/2026	No	No
Statistical Analysis Plan			30/09/2026	No	No