STUDY PROTOCOL

Study title: Socioeconomic position and the effect of kcal labelling and PACE labelling on self-served portion size

Short title: Portion size labelling study

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1. BACKGROUND AND RATIONALE

Socio-economic position (SEP) has a key-role in health and several studies have highlighted differences in dietary behaviour between people of lower and higher SEP as potential mediators of this relationship [1]–[3]. It has been shown that people of lower SEP are more likely to behave in ways that increase the likelihood of developing cardiovascular diseases and obesity (e.g., higher consumption of meat and fatty foods, alcohol consumption and smoking) [4], [5]. In developed countries, the prevalence of obesity and other chronic diseases has dramatically increased within all the socio-economic groups [6] but to a larger extent among poorer and less educated groups [7]. This social gradient might be explained by lower SEP being associated with increased energy intake [8]–[10].

Nutritional labelling is one of the most common intervention that has been implemented to reduce energy intake [11]. Nutritional labels provide consumers with different types of information (e.g. nutritional composition, energy content) in various ways (e.g. numerical, daily recommended intake, traffic lights) and may have a positive impact on food choices and energy intake [11]. However, Sarink et al. (2016) investigated the impact of kcal labelling in people of lower vs. higher SEP and showed that it may benefit more people of higher SEP than people of lower SEP, which may in turn increase health inequalities [12].

A novel form of labelling is Physical Activity Calorie Equivalent (PACE) which may be an alternative to numerical energy labelling [13]. PACE labelling aims to encourage healthier eating behaviours by providing an interpretation of the energy content of a food in terms of energy expenditure: how many minutes (time) or how many kilometres/miles (distance) of physical activity (e.g. walking, running, swimming, bicycle) are needed to burn off the corresponding energy [13]. PACE might be easier to understand compared to other nutritional labels because consumers do not need health literacy or have advanced numeracy skills to understand PACE [14]. However, in a recent study, Antonelli & Viera (2015) showed a stronger effect of PACE among people of higher compared to lower SEP, in particular among richer people [15].

The food choices of people of higher SEP are more motivated by health than those of people of lower SEP [16]. As information-based interventions typically rely on people being motivated by health in their food choices [17], the presence of nutritional labels may lead to healthier eating behaviours primarily among people of higher SEP.

2. OBJECTIVES, OUTCOMES MEASURES AND HYPOTHESES

OBJECTIVES	OUTCOME MEASURES	HYPOTHESES
Primary objective To investigate the effect of labelling (kcal or PACE) on the total self-served energy among participants of lower and higher SEP.	Total self-served energy in kcal from hypothetical meals	Labelling (kcal or PACE) will influence the size of self-served portion and result in reduced total self-served energy among both participants of lower and higher SEP. Kcal and PACE labelling will exert a stronger effect on self-served energy among participants of higher compared to lower SEP.

		PACE labelling will exert a stronger effect on self-served energy than kcal labelling.
Secondary objectives To investigate the psychological processes that may explain the different effect of the intervention and whether health motivation and physical activity level mediate the differential effect of labelling (kcal or PACE) on total self-served energy among participants of lower and higher SEP.	Executive function (tasks) Health motivation in food choices (questionnaire)	Participants of higher SEP will have better executive function than participants of lower SEP, which will moderate the relationship between SEP and the effect of energy/PACE labelling on the total energy of the selected meal. Kcal/PACE labelling will exert a stronger effect on self-served energy among participants of higher SEP because they will be more motivated by health in their food choices than participants of lower SEP.

3. EXPERIMENTAL DESIGN

Participants will take part in an online survey. They will be asked to choose the amount of food they would like to eat based on pictures of 18 dishes sequentially displayed on the screen. They will be randomly allocated to four different groups: kcal labelling, PACE labelling (minutes to walk to burn off the calories), kcal and PACE labelling combined, no labelling, in a between subject design.

4. PARTICIPANTS AND RECRUITMENT

4.1. Recruitment

Participants will be recruited through Prolific, an online recruitment platform in which participants are compensated proportionate to the time it takes to complete the online study (≈ 5£/hour reward participants). Participants' recruitment will be stratified by gender (50% male, 50% female), student status (3.5% yes and 96.5% no) [18] and qualification levels (50% A level or below, 50% above A level) in order to recruit participants of lower and higher SEP.

4.2. Inclusion criteria

- UK residents, age ≥ 18
- Fluent in English
- Have access to a computer and Internet

4.3. Exclusion criteria

- Having any dietary restriction:
    - Vegetarian
    - Vegan

  - Gluten-free
  - Sugar-free
  - Diary/lactose-free
  - Food allergy (e.g. milk, eggs, nut, wheat, fish, etc.)

- Taking part more than once:
  Prolific is designed to avoid the same participant to take the same survey twice (i.e., one participant cannot access the study link twice). Each participant recruited on Prolific has a unique ID. If for some reasons a participant takes the survey twice, we will delete the second submission from the dataset by checking the ID duplicates. For the same reason, to avoid one participant takes the survey twice with different accounts, we will delete the second submission from the dataset by checking the IP duplicates.
- Failing an attention check (**Appendix G, item 9; Appendix H, item 10; Appendix O, item 4**).
- Completing the main task too fast, i.e., less than 2 sec per dish = less than 36 sec in total, that will be interpreted as careless or insufficient effort responding [19], [20].

5. METHODS

5.1. Portion selection task

Procedure

Participants will be randomly allocated to one of the following groups:

  - kcal labelling (*kcal+/PACE-*);
  - PACE labelling (*kcal-/PACE+*);
  - kcal and PACE labelling (*kcal+/PACE+*);
  - no labelling (*kcal-/PACE-*).

They will be asked to choose the amount of food they would like to eat in 18 hypothetical meals sequentially displayed on the screen. The first picture of each dish will show 20 kcal of this dish on a white plate. Participants will be able to virtually 'serve themselves' the amount of food they would like to eat by increasing or reducing the quantity on the plate using the arrow keys on their keyboard (to increase = right key; to decrease = left key). Energy content will increase by 20 kcal each time they will tap the right arrow key (max. 1000 kcal). Participants will have to increase the portion size at least once (i.e., at least one tap on the right arrow key) to be able to confirm their choice using the spacebar. The 18 dishes will be randomised in order.

Foods

The food stimuli are based on a previously published work by Whitelock et al. (2018) (**Appendix A**). For each dish, 50 pictures have been taken to reflect the increase in portion size. The number of calories increases 20 kcal by 20 kcal from a minimum of 20 kcal (first picture) to a maximum of 1000 kcal (50th picture) [21].

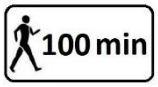
Interventions

For each portion and dish, participants will see on the screen a label showing the number of calories, physical activity calories equivalent or both. Labels are adapted from Swartz et al., 2013 [22].

Kcal labelling (kcal+/PACE-)

Participants allocated to this group will see on the screen the amount of food increasing or decreasing based on how many times they tap on the corresponding keys and a real-time kcal counter synchronised with the food amount changes (i.e., increasing/decreasing).

PACE labelling (kcal-/PACE+)



Participants allocated to this group will see on the screen the amount of food increasing or decreasing based on how many times they tap on the corresponding keys and a real-time PACE counter (as minutes needed to walk to burn off the calories) synchronised to the food amount changes (i.e., increasing/decreasing) with 4 min being equivalent to 20 kcal [13].

Kcal and PACE labelling (kcal+/PACE+)

Participants allocated to this group will see on the screen the amount of food increasing or decreasing based on how many times they tap on the corresponding keys and a real-time kcal and PACE counters synchronised to the food amount changes (i.e., increasing/decreasing).

No labelling (kcal-/PACE-)

Participants allocated to this group will only see on the screen the amount of food increasing or decreasing based how many times they tap on the corresponding keys.

5.2. Measures of socioeconomic position

Five measures of socioeconomic status will be included. Participants will be asked to report:

- their highest educational qualification;
- their number of years in higher education;
- their current employment status;
- their household income and their household composition;
- a subjective measure of their socioeconomic position using the MacArthur Scale of Subjective Social Status (SSS) [23].

5.3. Measures of executive functions (EF)

Cognitive measures of EF

Inhibition is the ability to suppress impulsive or automatic responses (e.g., not choosing unhealthy foods). A Stroop task will be used to measure inhibition (≈2min.30sec.). In this task, participants are given colour words written in colour and are asked to indicate the colour of the word (not its meaning) by key press as fast as they can without making too many errors. The task included three types of trials:

- Congruent trials: colour word and the colour it is presented in are the same;
- Incongruent trials: colour word and the colour it is presented in are not the same;
- Control trials: coloured rectangles.

The task includes 4 colours (red, green, blue, black) x 3 colour-stimuli congruency (congruent, incongruent, control) x 7 repetitions = 84 trials randomly sampled.

Working memory is the ability to monitor the relevance of incoming stimuli and update information in memory as required and is implied in goal-shielding (e.g., stick to healthy eating goals). A backwards digit-span task will be used to measure working memory (≈7 min.). This task will require participants to repeat series of digits of increasing length in the reversed order. Depending on performance, participants move up a level or down a level. The first trial is a sequence of two visual digits. Assessment is 14 trials in total.

5.4. Measure of health motivation in food choices

The ***Food Choice Questionnaire***, developed by Steptoe et al. (1995), measures the motives related to food choice, including health. We will use the 'Health' and 'Weight control' subscales of this questionnaire [24].

5.5. Measure of physical activity level

The ***International Physical Activity Questionnaire – Short Version*** (IPAQ-SF) will be used to assess the physical activity level. The IPAQ-SF includes 7 items and records the activity of four intensity levels: 1) vigorous-intensity activity such as aerobics, 2) moderate-intensity activity such as leisure cycling, 3) walking, and 4) sitting [25]. Although the original authors recommended to ask about the last 7 days of recalled physical activity, due to the context in which this study will be run, i.e., self-isolation of UK population due to COVID-19 propagation preventive measures, we will ask about a usual week of recalled physical activity: number of days per week and how much time per day a participant usually does each of the four types of activity.

5.6. Familiarity and liking of the test foods

Participants will be presented with the picture of the 600 kcal portion of each food, as UK public health guidelines recommend energy consumption ≤600 kcal for a main meal [26], and asked:

- "Have you ever eaten this food?" Answers: yes or no *(familiarity)*
- "How much do you like this food?" Answers on a 100-point visual analogue scale (anchors: not at all, extremely) *(liking)* [21]

6. STUDY FLOW

RECRUITMENT ***(Prolific)***	▪ Predefined screening questions of Prolific website will be used to target the sample (**Appendix B**) ▪ Participants who meet the inclusion/exclusion criteria will be emailed by Prolific and/or offered to complete our study on their Prolific account (**Appendix C**) ▪ Eligible participants who want to take part on the study will click on the start button and be redirected to our study website (Inquisit)
INFORMED CONSENT	▪ Participants will read the information sheet (**Appendix D**) ▪ Participants who want to proceed will tick a consent box (**Appendix E**)
RANDOMISATION	▪ Participants will be equally randomised and allocated to one of the four experimental groups using Inquisit software
BASELINE ASSESSMENTS	▪ Participants will complete a baseline questionnaire on demographics (**Appendix G**)
MEAL CHOICE TASK	▪ Instructions will be displayed (**Appendix H**) ▪ Meals will be displayed in randomised order

	Energy labelling *(kcal+/PACE-)*	PACE labelling *(kcal-/PACE+)*	Energy and PACE labelling *(kcal+/PACE+)*	No labelling *(kcal-/PACE-)*
EXECUTIVE FUNCTION	Tasks randomised in order: ▪ Inhibition (Stroop task) ▪ Working memory (backwards digit-span task)			
HEALTH MOTIVATION	▪ Health and weight control subscales from the Food Choice Questionnaire (**Appendix I**)			
PHYSICAL ACTIVITY LEVEL	▪ International Physical Activity Questionnaire – Short Version (IPAQ-SF) (**Appendix J**)			
FAMILIARITY AND LIKING	▪ For each dish: o Familiarity (**Appendix K**) o Liking rating (**Appendix L**)			
DEBRIEFING QUESTIONNAIRE	▪ Aim guessing in an open-ended response format (**Appendix M**) ▪ Questionnaire (**Appendix M**)			
ADDITIONAL MEASURES	▪ Interoception preliminary survey[1] (**Appendix N**)			
DEBRIEFING TEXT	▪ Tell the participants what the study was about (**Appendix O**)			
DATA MANAGEMENT	▪ The result files will contain: o Participant unique ID o Experimental condition participant is directed to o Amount of self-served food o Answers to questionnaires			

7. STATISTICAL ANALYSES

All statistical analyses will be performed using SAS version 9.3 (SAS Institute, Inc., 2012 SAS® 9.3. Cary, NC). The level of significance will be set at $p < 0.05$ for the main and sensitivity analyses, $p < 0.01$ for secondary analyses and $p < 0.001$ for exploratory analyses unless otherwise specified. Linear mixed models will be fitted with PROC MIXED.

7.1. Variables description

Primary outcome

The main outcome variable is the **total self-served energy** (in kcal).

Other outcomes:

Derived from the debriefing questionnaire:

1. Kcal influence (item 1): whether kcal content influences the quantity of self-served food;
2. PACE influence (item 2): whether physical activity energy equivalent influences the quantity of self-served food.

Answers to each item will be coded as: 1 = Strongly disagree; 2 = Disagree; 3 = Slightly disagree; 4 = Neutral; 5 = Slightly agree; 6 = Agree; 7 = Strongly agree.

Independent variables

SEP

[1] These data are collected to inform a future study and will not be analysed as part of this study.

Highest educational qualification will be coded from 1 to 9: 1 = No formal qualifications; 2 = 1–3 GCSEs; 3 = 4+ GCSEs; 4 = A level; 5 = Certificate of higher education (CertHE); 6 = Diploma of higher education (DipHE); 7 = Bachelor; 8 = Master's degree; 9 = Doctorate, and as a binary variable as *lower* (values: 1, 2, 3, 4) or *higher* (values: 5, 6, 7, 8, 9).

Years in higher education, as a continuous variable.

Level of education (composite score): Assuming that highest educational qualification and years in higher education will be significantly correlated (tested using Pearson's r), we will z-score the two variables and create an average of the two to form a level of education composite score.

Equivalised household income: The OECD-modified equivalence scale will be used to adjust household income considering household size and composition [27]. Equivalised household income is calculated by dividing the after-tax household (including all the earner to the nearest £1000) by the sum of the equivalence value of all the household members (1 = first adult; 0.5 = additional adult or child >14 years old; 0.3 = child aged 0-13 years old).

Subjective SEP: The measure of the Subjective Social Status using the MacArthur Scale will be coded from 1 (lower SSS) to 10 (higher SSS).

Executive function measures

Inhibition – Stroop task: The median reaction times (RTs) will be calculated for correct responses in incongruent and congruent trials. The interference effect will be calculated as the difference between the median RTs of the incongruent trials and the congruent trials. A larger interference score is indicative of poorer inhibition. RTs data are commonly skewed, reflecting lapses of attention or eye blinks during the task [28]. To resolve this, median will be used instead of means. Median is less affected by extreme scores than the mean and provides a better estimate of central tendency for skewed distributions [29], [30]. We will also calculate the proportion of correct responses in incongruent trials because this outcome has been previously linked to the frequency of fatty food consumption [31].

Working memory – backwards digit-span task: The two-error maximum length will be calculated. It is the last digit-span a participant gets correct before making two consecutive errors and the traditional measure of a participant's backward digit span [32]. We will also calculate the maximum length i.e., the maximal backward digit span that a participant recalled correctly during all 14 trials.

Familiarity

When the answer to the question "Have you ever eaten this food?" will be 'yes', the food will be coded as familiar for a participant.

Liking

For each participant and each food a liking score from 0 to 100 will be recorded (anchors: not at all, extremely).

Health motivation in food choices

Both health and weight control motivation scores will be computed by averaging ratings for individual items in each dimension (health motivation: 6 items; weight control motivation: 4 items). They will range from 1 to 4: 1 = Not at all important; 2 = A little important; 3 = Moderately important; 4 = Very important. Cronbach's alpha will be calculated as an indicator of internal consistency in order to compare our data with the original study that developed this measure [24].

Other variables

BMI will be calculated as weight (kg) / height (m^2). BMI data will be trimmed for implausible values excluding weight for less than 30 kg and more than 250 kg, height for less than 145 cm and more than 3m, BMI < 14 or BMI > 48 [33], [34].

Physical activity level will be estimated based on IPAQ-SF answers as MET-minutes per week[2]: self-reported physical activity in minutes*MET score [walking = 3.3, moderate intensity = 4.0, vigorous intensity = 8.0]*number of days [25].

Aim guessing: Participants who identify the aim of the study as being to examine the influence of kcal or PACE labelling on self-served food portion size will be coded as being aware of the study aims. Responses will be independently coded by two researchers, with discrepancies in coding decisions resolved by a third researcher.

7.2. Missing data

We do not anticipate missing data on the primary outcome and dependant variables because the online study will not allow missing answers. Data from participants who start but not finish the study will not be analysed. Submissions of participants who fail the attention checks or do not pass eligibility criteria will not be analysed. Any *a posteriori* withdrawal will be reported and reasons for withdrawal will be documented (e.g. incorrect answers, technical problems).

7.3. Participant's characteristics

We will report the baseline characteristics overall and for participants of lower and higher education including gender, age, ethnic group, employment status, highest educational qualification, years in higher education, equivalised household income, subjective socioeconomic status, BMI, dieting status and physical activity in MET-minutes for vigorous-intensity activity, moderate-intensity activity, walking and in total. Continuous variables will be summarised using means and standard deviations and differences between the two groups will be tested using t-tests. Categorical variables will be summarised using counts and percentages and differences between the two groups will be tested using Chi-square tests.

7.4. Familiarity and liking

We will report the percentage of dishes that participants are familiar with and the average liking score across foods overall and for participants of lower and higher education. Differences in familiarity between the two groups will be tested using Chi-square tests and differences in liking using t-tests.

7.5. Main analyses

The primary aim of the statistical analyses will be to test the effect the labelling intervention and SEP on self-served energy. Secondary analyses will be run in order to investigate the role of potential mediators to explain the relationship SEP-self-served energy. The measure of SEP used in our main analyses will be the *highest educational qualification* (binary variable: *lower vs. higher*) because previous research showed that people of higher education were more likely to use nutrition labels [35], [36].

[2] MET-minutes: Metabolic Equivalent of Task of an activity × minutes performed.

Linear mixed effect models will be run in order to test the effect of the labels and of highest educational qualification on the self-served energy, with participants and dishes set as random effects to account for correlation between repeated measures by the same participant and across the different food items. The main model will test the effect of the labelling intervention (four levels: kcal labelling, PACE labelling, kcal and PACE labelling, no labelling), highest educational qualification (two levels: lower, higher) and the interaction between labelling intervention and highest educational qualification. If the interaction is significant, analyses will be stratified by *highest educational qualification* (*lower* and *higher*) and two linear mixed models will be fitted to examine the effect of the labelling intervention on self-served energy.

If there is a main effect of the labelling intervention in one of the above linear mixed models we will follow up this main effect by conducting the following pairwise comparisons:

- Self-served energy in each of the three labelling conditions compared to no labelling condition:
    - No labelling vs. kcal labelling
    - No labelling vs. PACE labelling
    - No labelling vs. kcal and PACE labelling combined
- Self-served energy in the combined labelling condition compared to single labelling conditions
    - Kcal and PACE labelling combined vs. kcal labelling
    - Kcal and PACE labelling combined vs. PACE labelling
- Self-served energy in one single labelling condition compared to the other single labelling condition:
    - Kcal labelling vs. PACE labelling

We will apply a Bonferroni correction to the level of significance based on the number of pairwise comparisons made (e.g., 12 comparisons: 0.05/12=0.004).

7.6. Sensitivity analyses

We will conduct sensitivity analyses to examine whether the pattern of results from the main analyses differ when:

- excluding the aim guessers from the main analyses, or if more than 20% of participants guess the aim of the study, including an 'aim guessing' variable (two levels: yes, no) as a covariate in the main model;
- substituting highest educational qualification by level of education (composite score) in the main model;
- including hunger and liking as covariates in the main model as these two variables are likely to influence how much one serves oneself of a dish;
- excluding any dish that is familiar to less than 50% of participants or that is scored < 50 in liking on average (mid-way of the scale) to examine whether results are consistent when only well liked and familiar foods are used.

We will report whether sensitivity analyses result in deviations from the pattern of significance to the main analyses (i.e., any significant differences between conditions becoming not significant, and vice versa).

7.7. Secondary analyses

To account for multiple testing the alpha level for secondary analyses will be set at $p = 0.01$.

Alternative measures of SEP

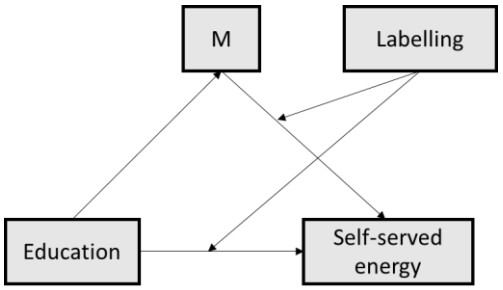
The main analyses will be repeated using alternative measures of SEP to investigate whether different measures lead to the same pattern of results. Highest educational qualification will be substituted by 1/ equivalised income, and 2/ SSS.

Moderated mediation analyses

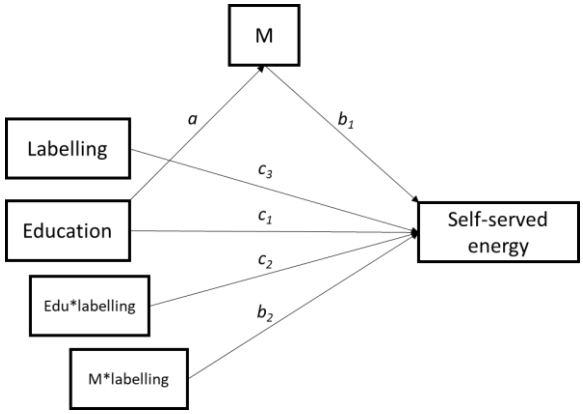
We will report and compare the measures of inhibition, working memory, healthiness and weight control motivation in food choices overall and for participants of lower vs. higher education level using means, standard deviations and t-tests.

If the main analyses suggest that highest educational qualification moderates the effect of labelling intervention (i.e., the labelling intervention*highest educational qualification is significant), moderated mediation analyses will be performed in order to explain the different effect of labelling intervention in participants of lower vs. higher education level. We will test as mediators the measures of inhibition, working memory, healthiness and weight control motivation in food choices only if we find individual differences on these measures between participants of lower and higher education level. Moderated mediation analyses will examine the extent to which they mediate the effect of highest educational qualification on self-served energy in each labelling condition (kcal labelling, PACE labelling, kcal and PACE labelling, no labelling).

Conceptual diagram:



Statistical diagram:



Conditional indirect effect of highest educational qualification on self-served energy through a mediator M will be calculated as $a*(b_1+ b2*labelling)$.

The moderated mediation will be tested by estimating the conditional indirect effect of highest educational qualification through M for kcal labelling, PACE labelling, kcal and PACE labelling, no labelling conditions and testing the conditional indirect effect for those conditions using bias-corrected bootstrap. We will use the PROCESS macro (Model 15) on SAS version 9.3 that provides asymmetric bias-corrected bootstrap confidence intervals for inference about the conditional indirect effects using 5,000 bootstrap samples [37]. Moderated mediation will be tested by determining whether or not the confidence interval for the difference between conditional indirect effects for kcal labelling, PACE labelling, kcal and PACE labelling versus no labelling contains zero.

7.8. Exploratory analyses

To account for multiple testing the alpha level for exploratory analyses will be set at $p = 0.001$.

Analysis of potential moderators of the effect of the labelling intervention

We will explore if the other variables we will measure could individually moderate the effect of the labelling intervention on self-served energy independently of SEP. We will substitute highest educational qualification in the main analyses by measures of inhibition, working memory, healthiness and weight control motivation in food choices, physical activity in MET-minutes for walking and in total.

Debriefing questionnaire

Answers to all the items of the debriefing questionnaire will be described as mean ± SD overall and for participants of lower and higher education. Differences between the two groups will be tested using t-tests. Two ANOVAs will be run to test the effect of the labelling intervention and of highest educational qualification on the first two items: kcal influence and PACE influence.

7.9. Sample size

A meta-analysis of six studies investigating the impact of kcal labelling on energy consumed from a single food did not demonstrate a statistically significant effect [11]. However the designs of these studies were different from the present study: the food options were mainly snacks (only one study offered to consume main meals [38]) and participants were not aware of the amount of kcal they actually consumed (the label was placed on the container or packaging, adjacent to the food, or presented on a display board). In our design, we expect a significant effect of kcal labelling with a reduction of 8.4% of self-served energy per meal may occur, which is the effect size found in a meta-analysis investigating the impact of kcal labelling on energy consumed during a meal with a range of available food options – i.e., the most similar design to the present study. The most up to date evidence of an effect of PACE labelling on energy consumed from foods/drinks is a meta-analysis of two studies and showed a significant reduction of 14.4%. Due to the small number of participants included in this meta-analysis, we conservatory powered our study to be able to detect an 8% reduction for both type of labels (kcal, PACE or kcal and PACE).

We will run a two-level mixed model including 18 trials (level 1) per participant (level 2) and compare self-served energy in each of the four trial arms (control, kcal labelling, PACE labelling, kcal and PACE labelling). We estimate SD of 300 kcal for self-served energy at level 1 and level 2 based on average SD of energy consumed during experimental meals [11]. A sample size of 1,600 participants with $\alpha = 0.05$ will allow to detect a 8% energy reduction between any of the four groups at power = 0.80. It will also allow to detect a small effect (f=0.07) of the interaction between the interventions and higher educational qualification education at power = 0.80 (MLPowSim) [39].

In a previous study we conducted at virtual fast food restaurants [40], we found small-to-medium correlation between level of education and healthiness motivation (r=0.17) and small-to-medium correlation between healthiness motivation and kcal ordered (r=-0.25). Because evidence of a relationship between SEP and physical activity is mixed [41], we hypothesize small-to-medium correlation. Empirical estimates of sample sizes needed for 0.8 power in mediation analyses indicate that samples of ≈ 380 are sufficient to detect mediation through pathways that are small and small-to-medium in statistical size using bias-corrected bootstrap tests [42]. Thus, a sample of 1,600 participants (i.e., 400 per experimental condition) would allow for adequate power in our planned moderated mediation analysis.

We will recruit a sample of 1,800 participants (who consent to take part in the study) to account for potential data loss due to dropouts and failed quality controls (approx. 10%) resulting in a minimum sample of 1,600 participants for analyses. However, if we experience a greater loss of data than

expected, we will continue to recruit participants until we achieve the required sample size of 1,600 participants.

8. REFERENCES

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9. APPENDIX A: FOOD STIMULI DESCRIPTION

FOOD	1st picture 20 kcal	25th picture 500 kcal	Last (50th) picture 1000 kcal
Beef in black beans sauce with rice *130 kcal/100g*	Beef 8.7 g Rice 6.7 g	Beef 217.6 g Rice 167 g	Beef 435.2 g Rice 334.0 g
Beef stew with dumplings *167 kcal/100g*	Beef 8.07 g Dumplings 3.9 g	Beef 201.77 g Dumplings 97.6 g	Beef 403.53 g Dumplings 195.27 g
Chicken and bacon pasta *139 kcal/100g*	14.4 g	359.7 g	719.4 g
Chicken, chips and beans *225 kcal/100g*	Chicken 3.1 g Chips 4.2 g Beans 2.84 g	Chicken 80.5 g Chips 108.9 g Beans 74.05 g	Chicken 154.8 g Chips 209.5 g Beans 142.41 g
Chicken korma with rice *154 kcal/100g*	Chicken 7.1 g Rice 5.9 g	Chicken 177.3 g Rice 147.4 g	Chicken 354.5 g Rice 294.8 g
Chicken salad *98.31 kcal/100g*	Cucumber 7.3 g Salad 5.6 g Chicken 4.4 g Croutons 1.4 g Dressing 1.2 g Parmesan 0.5 g	Cucumber 182.3 g Salad 129.5 g Chicken 100.8 g Croutons 31.7 g Dressing 27.3 g Parmesan 10.8 g	Cucumber 364.5 g Salad 281.6 g Chicken 219 g Croutons 68.8 g Dressing 59.4 g Parmesan 23.5 g
Cous cous and salad *179.38 kcal/100g*	Cous cous 10.2 g Salad 0.9 g	Cous cous 255.3 g Salad 23.4 g	Cous cous 510.6 g Salad 46.8 g
Fish, chips and peas *171.56 kcal/100g*	Fish 3.25 g Chips 5.85 g Peas 2.54 g	Fish 81.44 g Chips 146.25 g Peas 63.74 g	Fish 162.88 g Chips 292.5 g Peas 127.50 g
Grilled white fish (41.24%) **with tomato and bean salad** *75.68 kcal/100g*	Fish (cooked) 10.9 g Salad 15.5 g	Fish (cooked) 272.5 g Salad 388.1 g	Fish (cooked) 545 g Salad 776.3 g
Ham and mushroom carbonara *199 kcal/100g*	10.1 g	251.3 g	502.5 g
Lasagne and peas (9.25%) *144.23 kcal/100g*	Lasagne 11.9 g Peas 2.7 g	Lasagne 310.5 g Peas 70.73 g	Lasagne 597 g Peas 136 g
Macaroni cheese *183 kcal/100g*	10.9 g	273.2g	546.4 g
Mushroom risotto *130 kcal/100g*	15.4 g	384.6 g	769.29 g
Peperoni pizza *272 kcal/100g*	7.35 g	183.82 g	367.64 g
Sausage (55.93%), **mashed potatoes** (33.55%) **and peas** (10.52%) *163.417 kcal/100g*	Sausage 4.7 g Potatoes 9.7 g Peas 3.09 g	Sausage 122.2 g Potatoes 252.8 g Peas 80.44 g	Sausage 235 g Potatoes 486.2 g Peas 154.7 g
Spaghetti Bolognese *141 kcal/100g*	14.1 g	354.61 g	709.2 g
Spinach & Ricotta tortellini with tomato sauce *316 kcal/100g*	15.7 g (cooked)	393.4 g (cooked)	786.9 g (cooked)
Vegetable biryani *127 kcal/100g*	15.7 g	393.7 g	787.4 g

10.

11. APPENDIX B: TARGETED AUDIENCE (PROLIFIC WEBSITE)

1. ***Age***
    - 18 years old or above

2. ***Current country of residence***
    - UK

3. ***Fluent language***
    - English

4. ***Diet restriction***
    - None

5. ***Gender***

    50% of participants
    - Male

    50% of participants
    - Female

6. ***Students***

    96.5% of participants
    - No

    3.5% of participants
    - Yes

7. ***Highest education level completed***

    50% of participants
    - No formal qualifications
    - Secondary education (e.g. GED/GCSE)
    - High school diploma/A-levels

    50% of participants
    - Technical/community college
    - Undergraduate degree (BA/BSc/other)
    - Graduate degree (MA/MSc/MPhil/other)
    - Doctorate degree (PhD/other)

12. APPENDIX C: RECRUITMENT TEXT

"This is a study examining eating behaviour. You will be asked to choose how much of several dishes you would serve yourself if you were eating it as a main meal and to fill some questionnaires in about yourself.

Overall, the study will take about 25 minutes.

If you would like to take part, please make sure that:

- You have 25 minutes to complete this study, it must be taken in one sitting and you cannot exit and return to the study.

- You read the instructions carefully and answer the questions as accurately as possible.

- You agree to install a plugin to run the tasks. Instructions will be provided for how to install and uninstall the plugin.

Failure to comply with these instructions may result in your submission being rejected. Attention checks have been included, failing them will result in your submission being rejected."

13. APPENDIX D: INFORMATION PAGE

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. We would like to stress that you should only agree to take part if you want to.

What is the purpose of the study?

The purpose of the study is to understand eating behaviours.

Why have I been chosen to take part?

We are recruiting volunteers who fulfil the following criteria:

1. Aged ≥ 18 years
2. Fluent English speaker
3. Reside in the UK
4. Do not have any dietary restriction

Do I have to take part?

No. Participation in this research is completely voluntary. You are free to withdraw at any time without explanation and without incurring a disadvantage.

What will happen if I take part?

You will provide some information about yourself (e.g., age, gender), before then completing a portion selection task and filling in questionnaires about eating and bodily sensations. So that your awareness of the study hypotheses does not affect your behaviour in the study we provide more detailed information about the study aims at the end of the study. If you feel uncomfortable about this then you are free not to participate in this study. Overall the study will take 25 minutes.

How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of advancing education, learning and research for the public benefit. University of Liverpool employee Victoria Heath (V.Heath@liverpool.ac.uk) acts as the Data Protection Officer for this study and any queries relating to the handling of your personal data can be sent to her or the principal investigator (see contact details below). Further information on how your data will be used can be found below.

How will my data be collected?	Through an online questionnaire.

How will my data be stored?	On a password protected computer server.
How long will my data be stored for?	Your personal data will be stored for up to 28 days and then deleted. All other information will be stored indefinitely.
What measures are in place to protect the security and confidentiality of my data?	We will store all data on password protected computer servers and we never share any of your personal data outside of the research team for this project.
Will my data be anonymised?	After the study your personal information will be stored separately from your other questionnaire responses to create an anonymised data set. After 28 days all personal information will be deleted, but up to this point you can contact us and ask to see your information or have it deleted.
How will my data be used?	Your anonymised data will be combined with other participants' data in order to be analysed.
Who will have access to my data?	The research team for this project will have access to your data.
Will my data be archived for use in other research projects in the future?	After the research team have anonymised your data and completed this research project, they will place the anonymised data sets on an archive (e.g. Open Science Framework) in case any other researchers want to use it for future research purposes.
How will my data be destroyed?	Your personal data will be destroyed electronically (deleting the files and removing them from the computer server).

Are there any risks in taking part?

There are no anticipated risks to you if you take part in the study.

Are there any benefits in taking part?

There are no direct benefits, other than the small monetary payment.

What will happen to the results of the study?

We intend to publish the results from this study in a scientific journal. However, as explained above any personal information you provide is deleted before this and you would therefore not be identifiable in report. If you are interested in the results of the study, please let us know and we will share the results of the study with you when we publish it.

What will happen if I want to stop taking part?

You are under no obligation to take part in this study; it is completely your choice. If you do decide to take part, you are free to withdraw at any time and without giving any reason or explanation. Data collected up until the period you withdraw may be used, but only if you are happy for this to be done. Otherwise you may request that your data be destroyed and no further use is made of them.

What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Dr Lucile Marty (contact details below) and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Governance Officer on 0151 794 8290 (ethics@liv.ac.uk). Please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

Who can I contact if I have further questions?

Please contact the principle investigator:
Dr Lucile Marty
2.41b, Eleanor Rathbone Building
Bedford Street South
University of Liverpool,
Liverpool,
L69 7ZA,
UK
email: lucile.marty@liverpool.ac.uk

or the data protection officer:
Victoria Heath
The Foundation Building,
765 Brownlow Hill,
University of Liverpool,
Liverpool,
L69 7ZX,
UK,
email: V.Heath@liverpool.ac.uk

I confirm I have read the information sheet

- Yes

14. APPENDIX E: CONSENT PAGE

I confirm that I have read and have understood the information sheet for the study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that taking part in the study involves completing online tasks and questionnaires.

I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. I also understand that I have the right to lodge a complaint.

I understand that the information I provide is for research purposes and it will be held securely in line with data protection requirements at the University of Liverpool. In addition, I understand that personal information collected about me that can identify me will never be shared beyond the study team.

I understand that shortly after completing the study, researchers will keep my personal data and store it separately from my other questionnaire responses for up to 28 days on a computer, so that my anonymised questionnaire responses can later be deposited in an online data archive for sharing and used by other authorised researchers to support other research in the future.

I understand that I can ask for access to any of the information I provide and I can request the destruction or alteration of that information if I wish for up to 28 days after participating in the study. I understand that following this I will no longer be able to request access to or withdrawal of the information I provide because this information will have been deleted.

I provide my consent as a legal basis for the processing of my data as detailed previously, including the purposes of data processing, recipients of data and the right to withdraw my data.

I agree and consent to take part in the above study

- Yes

15. APPENDIX F: REQUIREMENTS

1. ***.Are you a fluent English speaker?***
   - Yes
   - No

If answer "No", participant cannot take part of the study

2. ***Do you currently reside in the UK?***
   - Yes
   - No

If answer "No", participant cannot take part of the study

3. ***Do you have any dietary restriction?***
   - ☐ None
   - ☐ Vegetarian
   - ☐ Vegan
   - ☐ Gluten-free
   - ☐ Sugar-free
   - ☐ Diary/lactose-free
   - ☐ Food allergy (e.g. milk, eggs, nut, wheat, fish, etc.)
   - ☐ Other dietary restriction

If answer other than "None", participant cannot take part of the study

If the participant cannot take part in the study, the following message will appear on the screen:

"Sorry, you are ineligible to take part in this study.
Please, go back to your Prolific page, return your submission and update your personal information."

16. APPENDIX G: BASELINE QUESTIONNAIRE

1. ***Gender***
    - Male
    - Female
    - Other

2. ***Age***
    - _ _ (free text; range of 18-99)

3. ***Ethnicity***
    - White
    - Black
    - Asian
    - Mixed
    - Other

4. ***What is your current employment status?***
    - Full or part-time
    - Student
    - Retired
    - Temporary or permanently sick or disabled
    - Looking after home/family
    - Other unemployed

5. ***What is your highest educational qualification? If you are a student please select the diploma being studied for.***
    - No qualification
    - 1-3 GCSEs
    - 4+ GCSEs
    - A level
    - CertHE
    - DipHE
    - Higher education or Bachelor's degree
    - Post-Graduate degree
    - Doctoral or professional degree

6. **After leaving school (i.e. at 16 years old), how many further years of higher education (i.e. a formal course) did you study for?**
   Examples:
   If you left school and did not go on to study further in higher education, your answer would be 0.
   If you left school and then studied for two years for A levels, your answer would be 2.
   If you completed A levels over two years and then also studied for a three-year undergraduate degree, your answer would be 5.
    - _ _ (free text)

7. ***What is your annual household income (after tax), including all earners in your household, in GBP (to the nearest £1000)?***

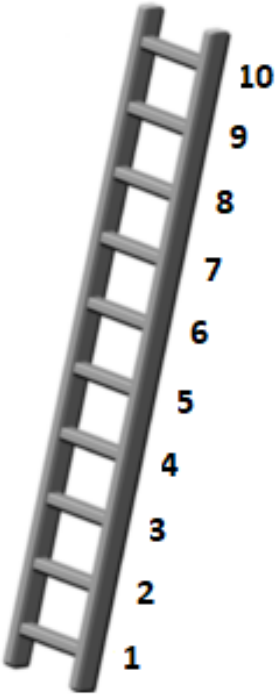
£_ _ _ _ _ _ (free text; range 0-999,999)

8. ***How many adult(s) or child(ren) aged 14 and over live at your house, including you?***
   _ _ (free text; range of 1-20)

9. ***How many child(ren) aged under 14 live at your house, including you?***
   _ _ (free text; range of 1-20)

10. ***This is an attention check. How many times have you visited the planet Mars?***
    - Several times
    - Just once
    - Never

11. ***Think of a ladder (see the image below) as representing where people stand in society. At the top of the ladder are the people who are best off—those who have the most money, most education and the best jobs. At the bottom are the people who are worst off—who have the least money, least education and the worst jobs or no job. The higher up you are on this ladder, the closer you are to people at the very top and the lower you are, the closer you are to the bottom. Where would you place yourself on the ladder?***



Choose the number whose position best represents where you would be on this ladder:

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

12. ***Are you currently dieting?***
    - Yes
    - No

13. ***Weight***
    Select the unit:
    - kg
    - st and lb

    _ _ _

14. ***Height***
    Select the unit:
    - cm
    - ft and in

    _ _ _

15. ***How hungry do you feel?***

---

0 100

Not at all hungry Extremely hungry

17. APPENDIX H: MEAL CHOICE TASK INSTRUCTIONS

Kcal-/PACE- group

Before the task begins

Portion selection task

In this task, you will be shown pictures of 18 different dishes. For each dish, you will be asked to decide how much you would like to eat as if you were eating it as main meal.

You can change the quantity using the arrow keys on your keyboard:

- tap on the right arrow to increase the quantity, on the left one to decrease the quantity

- use the space bar to select the portion size you would like to eat.

Before you make your choice, take the time to explore the full range of portion sizes.

You need to increase the amount of food at least once to be able to select a portion and continue.

Tap the spacebar to start.

During the task

How much would you like to eat?

Use the arrow keys to change the portion size.
Use the spacebar to select the amount you would like to eat.

Kcal+/PACE- group:

Before the task begins

Portion selection task

500 kcal

In this task, you will be shown pictures of 18 different dishes. For each dish, you will be asked to decide how much you would like to eat as if you were eating it as main meal. For each portion, the label on the left will show you the calorie content.

You can change the quantity using the arrow keys on your keyboard:

- tap on the right arrow to increase the quantity, on the left one to decrease the quantity

- use the space bar to select the portion size you would like to eat.

Before you make your choice, take the time to explore the full range of portion sizes.

You need to increase the amount of food at least once to be able to select a portion and continue.

Tap the spacebar to start.

During the task

How much would you like to eat?

500 kcal

Use the arrow keys to change the portion size.
Use the spacebar to select the amount you would like to eat.

On average women need 2,000 kcal per day and men need 2,500 kcal per day.

Kcal-/PACE+ group:

Before the task begins

Portion selection task

In this task, you will be shown pictures of 18 different dishes. For each dish, you will be asked to decide how much you would like to eat as if you were eating it as main meal. For each portion, the label on the left will show you the physical activity calorie equivalent, as the number of minutes of walking needed to burn off the calories in the meal.

You can change the quantity using the arrow keys on your keyboard:

- tap on the right arrow to increase the quantity, on the left one to decrease the quantity

- use the space bar to select the portion size you would like to eat.

Before you make your choice, take the time to explore the full range of portion sizes.

You need to increase the amount of food at least once to be able to select a portion and continue.

Tap the spacebar to start.

During the task

How much would you like to eat?

Use the arrow keys to change the portion size.
Use the spacebar to select the amount you would like to eat.

According to physical activity recommendations, adults should aim to take part in at least 150 minutes of moderate intensity physical activity per week (brisk walk, swim, cycle).

Kcal+/PACE+ group:

Before the task begins

Portion selection task

In this task, you will be shown pictures of 18 different dishes. For each dish, you will be asked to decide how much you would like to eat as if you were eating it as main meal. For each portion, the label on the left will show you the calorie content and the physical activity calorie equivalent, as the number of minutes of walking needed to burn off the calories in the meal.

You can change the quantity using the arrow keys on your keyboard:

- tap on the right arrow to increase the quantity, on the left one to decrease the quantity

- use the space bar to select the portion size you would like to eat.

Before you make your choice, take the time to explore the full range of portion sizes.

You need to increase the amount of food at least once to be able to select a portion and continue.

Tap the spacebar to start.

During the task

How much would you like to eat?

Use the arrow keys to change the portion size.
Use the spacebar to select the amount you would like to eat.

On average women need 2,000 kcal per day and men need 2,500 kcal per day.

According to physical activity recommendations, adults should aim to take part in at least 150 minutes of moderate intensity physical activity per week (brisk walk, swim, cycle).

18. APPENDIX I: HEALTH AND WEIGHT CONTROL FOOD CHOICE MOTIVES

Instruction: *"Several different factors influence our choice of food. Read each item carefully and decide how important the item is to you. There are no right or wrong answers, we are interested in what is important to you."*

It is important to me that the food I eat on a typical day…
(items will be showed in randomised order)

		Not at all important 1	*A little important 2*	*Moderately important 3*	*Very important 4*
Health					
1.	*contains a lot of vitamins and minerals*	○	○	○	○
2.	*keeps me healthy*	○	○	○	○
3.	*is nutritious*	○	○	○	○
4.	*is high in protein*	○	○	○	○
5.	*is good for my skin/teeth/hair/nails etc.*	○	○	○	○
6.	*is high in fibre and roughage*	○	○	○	○
Weight control					
7.	*is low in calories*	○	○	○	○
8.	*helps me control my weight*	○	○	○	○
9.	*is low in fat*	○	○	○	○
10.	*This is an attention check. Please choose the answer (2) 'A little important'*	○	○	○	○

19. APPENDIX J: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

Instruction: *"Think about a usual week and answer to the following questions.*

Please answer each question even if you do not consider yourself to be an active person. Think about the activities you do at work, as part of your house and yard work, to get from place to place and in your spare time for recreation, exercise or sport."

"Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you usually do for at least 10 minutes at a time."

1. During a usual week, on how many days do you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_ _ _ _ *days per week*

2. How much time do you usually spend doing vigorous physical activities on one of those days? If you answered 0 above, enter 0 here.

_ _ _ _ *minutes per day*

Think about all the moderate activities that you do during a usual week. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During a usual week, on how many days do you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_ _ _ _ *days per week*

4. How much time do you usually spend doing moderate physical activities on one of those days? If you answered 0 above, enter 0 here.

_ _ _ _ *minutes per day*

Think about the time you spent walking during a usual week. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During a usual week, on how many days do you walk for at least 10 minutes at a time?

_ _ _ _ *days per week*

6. How much time do you usually spend walking on one of those days?
If you answered 0 above, enter 0 here.

_ _ _ _ *minutes per day*

Think about the time you spent sitting on weekdays during a usual week. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During a usual week, on how many days do you spend sitting on a week day?

_ _ _ _ *minutes per day*

20. APPENDIX K: FAMILIARITY

Instructions:

> *"In this task, you will see 18 pictures of dishes. For each dish, you will be asked whether you have ever eaten this food and how much you like it. If you have never eaten a specific dish before, think about a similar food you have already tried and rate how much you think you would like it."*

Questionnaire:

1. **Have you ever eaten this food before?**

○ Yes ○ No

2. **Have you ever eaten this food before?**

○ Yes ○ No

3. **Have you ever eaten this food before?**

○ Yes ○ No

4. **Have you ever eaten this food before?**

○ Yes ○ No

5. **Have you ever eaten this food before?**

○ Yes ○ No

6. **Have you ever eaten this food before?**

○ Yes ○ No

7. **Have you ever eaten this food before?**

○ Yes ○ No

8. **Have you ever eaten this food before?**

○ Yes ○ No

9. **Have you ever eaten this food before?**

○ Yes ○ No

10. **Have you ever eaten this food before?**

○ Yes ○ No

11. **Have you ever eaten this food before?**

○ Yes ○ No

12. **Have you ever eaten this food before?**

○ Yes ○ No

13. **Have you ever eaten this food before?**

○ Yes ○ No

14. **Have you ever eaten this food before?**

○ Yes ○ No

15. **Have you ever eaten this food before?**

○ Yes ○ No

16. **Have you ever eaten this food before?**

○ Yes ○ No

17. **Have you ever eaten this food before?**

○ Yes ○ No

18. **Have you ever eaten this food before?**

○ Yes ○ No

21. APPENDIX L: LIKING

For each dish:

I like this dish

_____

0 100

Not at all Extremely

22. APPENDIX M: DEBRIEFING

Aim guessing:

What do you think we were expecting to find in this study?

[Free text]

Questionnaire:

The questions 3, 4, 5, 6 will be randomised in order.

1. ***The quantity I served myself for each dish was influenced by how many calories I thought were in the dishes.***

○	○	○	○	○	○	○
Strongly disagree	Disagree	Slightly disagree	Neither agree or disagree	Slightly agree	Agree	Strongly agree

2. ***The quantity I served myself for each dish was influenced by how much physical activity I thought I would have to do to burn off the calories that were in the dishes.***

○	○	○	○	○	○	○
Strongly disagree	Disagree	Slightly disagree	Neither agree or disagree	Slightly agree	Agree	Strongly agree

3. ***On a typical day, knowing how many calories are in my meals would influence how much I eat.***

○	○	○	○	○	○
Very unlikely	Unlikely	Quite unlikely	Quite likely	Likely	Very likely

4. ***On a typical day, knowing how many calories are in my meals would influence how much physical activity I do.***

○	○	○	○	○	○
Very unlikely	Unlikely	Quite unlikely	Quite likely	Likely	Very likely

5. ***On a typical day, knowing how much physical activity I would have to do to burn off the calories that are in my meals would influence how much I eat.***

○	○	○	○	○	○
Very unlikely	Unlikely	Quite unlikely	Quite likely	Likely	Very likely

6. ***On a typical day, knowing how much physical activity I would have to do to burn off the calories that are in my meals would influence how much physical activity I do.***

○	○	○	○	○	○

Very unlikely Unlikely Quite unlikely Quite likely Likely Very likely

7. ***What is your highest educational qualification? If you are a student please select the diploma being studied for.*** **consistency check**
    - No qualification
    - 1-3 GCSEs
    - 4+ GCSEs
    - A level
    - CertHE
    - DipHE
    - Higher education or Bachelor's degree
    - Post-Graduate degree
    - Doctoral or professional degree

23. APPENDIX N: ADDITIONAL MEASURES

IAS

Below are several statements regarding how accurately you can perceive specific bodily sensations. Please rate on the scale how well you believe you can perceive each specific signal. For example, if you often feel you need to urinate and then realise you do not need to when you go to the toilet you would rate your accuracy perceiving this bodily signal as low.
Please only rate how well you can perceive these signals without using external cues, for example, if you can only perceive how fast your heart is beating when you measure it by taking your pulse this would not count as accurate internal perception.

		Strongly disagree 1	*Disagree 2*	*Neither agree nor disagree 3*	*Agree 4*	*Strongly agree 5*
1.	*I can always accurately perceive when my heart is beating fast*	○	○	○	○	○
2.	*I can always accurately perceive when I am hungry*	○	○	○	○	○
3.	*I can always accurately perceive when I am breathing fast*	○	○	○	○	○
4.	*I can always accurately perceive when I am thirsty*	○	○	○	○	○
5.	*I can always accurately perceive when I need to urinate*	○	○	○	○	○
6.	*I can always accurately perceive when I need to defecate*	○	○	○	○	○
7.	*I can always accurately perceive when I encounter different tastes*	○	○	○	○	○
8.	*I can always accurately perceive when I am going to vomit*	○	○	○	○	○
9.	*I can always accurately perceive when I am going to sneeze*	○	○	○	○	○
10.	*I can always accurately perceive when I am going to cough*	○	○	○	○	○
11.	*I can always accurately perceive when I am hot/cold*	○	○	○	○	○
12.	*I can always accurately perceive when I am sexually aroused*	○	○	○	○	○

13.	*I can always accurately perceive when I am going to pass wind*	○	○	○	○	○
14.	*I can always accurately perceive when I am going to burp*	○	○	○	○	○
15.	*I can always accurately perceive when my muscles are tired/sore*	○	○	○	○	○
16.	*I can always accurately perceive when I am going to get a bruise*	○	○	○	○	○
17.	*I can always accurately perceive when I am in pain*	○	○	○	○	○
18.	*I can always accurately perceive when my blood sugar is low*	○	○	○	○	○
19.	*I can always accurately perceive when someone is touching me affectionately rather than non-affectionately*	○	○	○	○	○
20.	*I can always accurately perceive when something is going to be ticklish*	○	○	○	○	○
21.	*I can always accurately perceive when something is going to be itchy*	○	○	○	○	○

<u>Body Awareness subscale of SPQ short-form</u>
During most situations, I am aware of:

		Never 1	*Occasionally 2*	*Sometimes 3*	*Usually 4*	*Always 5*
1.	*Swallowing frequently*	○	○	○	○	○
2.	*An urge to cough to clear my throat*	○	○	○	○	○
3.	*My mouth being dry*	○	○	○	○	○
4.	*How fast I am breathing*	○	○	○	○	○
5.	*Watering or tearing of my eyes*	○	○	○	○	○
6.	*Noises associated with my digestion*	○	○	○	○	○

7.	*A swelling of my body or parts of my body*	○	○	○	○	○
8.	*An urge to defecate*	○	○	○	○	○
9.	*Muscle tension in my arms and legs*	○	○	○	○	○
10.	*A bloated feeling because of water retention*	○	○	○	○	○
11.	*Muscle tension in my face*	○	○	○	○	○
12.	*Goose bumps*	○	○	○	○	○
13.	*Stomach and gut pains*	○	○	○	○	○
14.	*Stomach distension or bloatedness*	○	○	○	○	○
15.	*Palms sweating*	○	○	○	○	○
16.	*Sweat on my forehead*	○	○	○	○	○
17.	*Tremor in my lips*	○	○	○	○	○
18.	*Sweat in my armpits*	○	○	○	○	○
19.	*The temperature of my face (especially my ears)*	○	○	○	○	○
20.	*Grinding my teeth*	○	○	○	○	○
21.	*General jitteriness*	○	○	○	○	○
22.	*The hair on the back of my neck "standing up"*	○	○	○	○	○
23.	*Difficulty in focusing*	○	○	○	○	○
24.	*An urge to swallow*	○	○	○	○	○
25.	*How hard my heart is beating*	○	○	○	○	○
26.	*Feeling constipated*	○	○	○	○	○

<u>ABQ subscales</u>

Please read each statement and tick the box most appropriate to you

		Strongly disagree 1	*Disagree 2*	*Neither agree nor disagree 3*	*Agree 4*	*Strongly agree 5*

1.	*I often feel so hungry that I have to eat something right away*	○	○	○	○	○
2.	*I often notice my stomach rumbling*	○	○	○	○	○
3.	*If I miss a meal I get irritable*	○	○	○	○	○
4.	*If my meals are delayed I get light-headed*	○	○	○	○	○
5.	*I often feel hungry*	○	○	○	○	○
6.	*I eat more when I'm annoyed*	○	○	○	○	○
7.	*I eat more when I'm worried*	○	○	○	○	○
8.	*I eat more when I'm upset*	○	○	○	○	○
.9	*I eat more when I'm anxious*	○	○	○	○	○
10.	*I eat more when I'm angry*	○	○	○	○	○
11.	*I often leave food on my plate at the end of a meal*	○	○	○	○	○
12.	*I often get full before my meal is finished*	○	○	○	○	○
13.	*I get full up easily*	○	○	○	○	○
14.	*I cannot eat a meal if I have had a snack just before*	○	○	○	○	○

Intuitive Eating Scale

For each item, please select the answer that best characterizes your attitudes or behaviours.

		Strongly disagree 1	*Disagree 2*	*Neither agree nor disagree 3*	*Agree 4*	*Strongly agree 5*
1.	*I try to avoid certain foods high in fat, carbohydrates, or calories.*	○	○	○	○	○
2.	*I have forbidden foods that I don't allow myself to eat.*	○	○	○	○	○

3.	*I get mad at myself for eating something unhealthy*	○	○	○	○	○
4.	*If I am craving a certain food, I allow myself to have it.*	○	○	○	○	○
5.	*I allow myself to eat what food I desire at the moment.*	○	○	○	○	○
6.	*I do NOT follow eating rules or dieting plans that dictate what, when, and/or how much to eat.*	○	○	○	○	○
7.	*I find myself eating when I'm feeling emotional (e.g., anxious, depressed, sad), even when I'm not physically hungry.*	○	○	○	○	○
8.	*I find myself eating when I am lonely, even when I'm not physically hungry.*	○	○	○	○	○
9.	*I use food to help me soothe my negative emotions.*	○	○	○	○	○
10.	*I find myself eating when I am stressed out, even when I'm not physically hungry.*	○	○	○	○	○
11.	*I am able to cope with my negative emotions (e.g., anxiety, sadness) without turning to food for comfort.*	○	○	○	○	○
12.	*When I am bored, I do NOT eat just for something to do.*	○	○	○	○	○
13.	*When I am lonely, I do NOT turn to food for comfort.*	○	○	○	○	○
14.	*I find other ways to cope with stress and anxiety than by eating.*	○	○	○	○	○
15.	*I trust my body to tell me when to eat.*	○	○	○	○	○
16.	*I trust my body to tell me what to eat.*	○	○	○	○	○
17.	*I trust my body to tell me how much to eat.*	○	○	○	○	○
18.	*I rely on my hunger signals to tell me when to eat.*	○	○	○	○	○
19.	*I rely on my fullness (satiety) signals to tell me when to stop eating.*	○	○	○	○	○
20.	*I trust my body to tell me when to stop eating.*	○	○	○	○	○
21.	*Most of the time, I desire to eat nutritious foods.*	○	○	○	○	○
22.	*I mostly eat foods that make my body perform efficiently (well).*	○	○	○	○	○
23.	*I mostly eat foods that give my body energy and stamina.*	○	○	○	○	○

DASS21

Please read each statement and rate how much the statement applied to you over the last year. There are no right or wrong answers. Do not spend too much time on any statement.

		0 *Did not apply to me at all*	*1* *Applied to me to some degree, or some of the time*	*2* *Applied to me to a considerable degree or a good part of time*	*3* *Applied to me very much or most of the time*
1.	*I found it hard to wind down*	○	○	○	○
2.	*I was aware of dryness of my mouth*	○	○	○	○
3.	*I couldn't seem to experience any positive feeling at all*	○	○	○	○
4.	*I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)*	○	○	○	○
5.	*I found it difficult to work up the initiative to do things*	○	○	○	○
6.	*I tended to over-react to situations*	○	○	○	○
7.	*I experienced trembling (e.g. in the hands)*	○	○	○	○
8.	*I felt that I was using a lot of nervous energy*	○	○	○	○
9.	*I was worried about situations in which I might panic and make a fool of myself*	○	○	○	○
10.	*I felt that I had nothing to look forward to*	○	○	○	○
11.	*I found myself getting agitated*	○	○	○	○
12.	*I found it difficult to relax*	○	○	○	○
13.	*I felt down-hearted and blue*	○	○	○	○
14.	*I was intolerant of anything that kept me from getting on with what I was doing*	○	○	○	○
15.	*I felt I was close to panic*	○	○	○	○
16.	*I was unable to become enthusiastic about anything*	○	○	○	○
17.	*I felt I wasn't worth much as a person*	○	○	○	○
18.	*I felt that I was rather touchy*	○	○	○	○
19.	*I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)*	○	○	○	○

20.	*I felt scared without any good reason*	○	○	○	○
21.	*I felt that life was meaningless.*	○	○	○	○

Weight stigma

		Strongly disagree 1	*Disagree 2*	*Disagree somewhat 3*	*Neither agree nor disagree 4*	*Agree somewhat 5*	*Agree 6*	*Strongly agree 7*
1.	*I am less attractive than most other people because of my weight.*	○	○	○	○	○	○	○
2.	*I wish I could drastically change my weight.*	○	○	○	○	○	○	○
3.	*Whenever I think a lot about being overweight, I feel depressed.*	○	○	○	○	○	○	○
4.	*I hate myself for being overweight.*	○	○	○	○	○	○	○
5.	*I don't feel that I deserve to have a really fulfilling social life, as long as I'm overweight.*	○	○	○	○	○	○	○

6. How would you describe your weight?

- Very underweight
- Underweight
- About right
- Overweight
- Very overweight

7. How often have you been mistreated, discriminated against or treated unfairly because of your weight?

- Never
- Once in your life
- Several times in your life
- About once a year
- Several times per year
- About once a month
- Several times per month
- About once a week
- Several times per week
- Daily

8. I am concerned that other people's opinion of me will be based on my weight.

Strongly disagree	*Disagree*	*Disagree somewhat*	*Neither agree nor disagree*	*Agree somewhat*	*Agree*	*Strongly agree*
○	○	○	○	○	○	○

Diagnosis of a psychiatric condition

Have you ever been diagnosed with a psychiatric condition (e.g. Depression, Schizophrenia)?

- ○ Yes
- ○ No

Diagnosis of chronic health condition

Do you have any chronic medical conditions that affect your health (e.g. Diabetes, Heart Disease)?

- ○ Yes
- ○ No

24. APPENDIX O: DEBRIEFING TEXT

"Thank you very much for your participation. In this study we were interested in the effect of energy labelling on the size of self-served food portions.

All the participants saw the same 18 dishes, but in different randomised order and in four different conditions. In the first condition, the dishes were all presented without any labelling. In the second condition, the dishes were presented alongside with energy labelling in kcal showing the number of calories for each portion size. In the third condition, the dishes were presented with an exercise equivalent energy labelling showing the number of minutes needed to walk to burn off the calories for each portion size. In the fourth condition, the dishes were presented with a combination of energy in kcal and exercise equivalent energy labelling showing the number of calories and the number of minutes needed to walk to burn off the calories for each portion size.

We will compare self-served energy by participants in the four conditions. The results will help to identify the effective interventions to reduce energy intake.

You also answered questionnaires about your food choices motivations and physical activity. We will test if the ones who are the most motivated by health in their food choices and who are more physical active were more likely to use energy information when deciding how much to eat.

You also filled in questionnaires about bodily sensations and intuitive eating that will help us to design a future study investigating the link between attention to bodily state and eating behaviour."