

STUDY PROTOCOL

Study title: Socioeconomic position and the effect of portion size reduction: a 1-day dietary behaviour experimental study

Short title: SEP and portion size effect

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Funder: European Research Council

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1. BACKGROUND AND RATIONALE

A substantial contributor to social inequalities in health is diet [1], [2]. The diet of people of lower socioeconomic position (SEP) is more likely to consist of foods of lower nutritional value [3], [4] and this may also result in passive overconsumption because portion sizes of these types of foods have grown in recent times [5], [6].

Offering larger portions compared to small portions increases energy intake. There is robust and reliable evidence of this phenomenon, also known as the ‘portion size effect’ (PSE) [7], [8]. It is unclear who is most susceptible to the PSE [9]. A recent online trial showed that the PSE on intended consumption of unhealthy snacks was 18-24% larger for participants of lower SEP compared to participants of higher SEP [10]. However, to our knowledge, no laboratory study has yet investigated whether people of lower SEP are more susceptible to the influence of portion size on eating behaviour than people of higher SEP.

There is emerging evidence that lower SEP is associated with increased energy intake [11], [12] and/or inadequate energy compensation [13] but little is known about whether lower SEP is associated with a greater susceptibility to external influences on eating like portion size and about the potential mechanisms that could lead disadvantaged people to overeat in response to external influences like portion size. If lower SEP is associated with a greater susceptibility to the PSE then potential explanations include higher impulsivity, lower response inhibition, and larger portion size norms in people of lower vs. higher SEP [14-16]. Serving larger portions (compared to smaller portions) has also been shown to lead to a more pronounced increase in energy intake among participants with lower satiety responsiveness [17]. In addition, people of lower SEP might not compensate for increased energy intake because a positive energy balance is an ‘insurance’ in response to threatened food supply that is associated with lower SEP [18], [19] because their life history (e.g., exposure to harshness and unpredictability during childhood) promotes eating in the absence of hunger or energy need [20], [21]. A tendency to clear one’s plate has been investigated as a potential moderator of the PSE in a small number of studies [41-43], and those with lower SEP may be more likely to clear their plate despite an absence of hunger to avoid food waste (with food waste a higher priority for those with lower income, e.g. [44]). Higher SEP individuals may have stronger health motivation than lower SEP individuals [45,56]. This may reduce the impact of portion size on food intake because individuals with strong health motivation may be concerned about how much they are eating (and avoid overeating when served larger portions). Finally, a tendency to endorse compensatory health beliefs – the belief that energy in the form of calories can be compensated for by restricting or increasing energy intake or expenditure over the course of the day – may be associated with the likelihood of compensating for low calorie meals [46]. To our knowledge no study has investigated compensatory health beliefs as a potential moderator of the PSE.

From a public health perspective, investigating how people of lower SEP respond when exposed to smaller vs. larger portions of foods is of interest because there is a need for equitable interventions that influence dietary behaviour in a way that reduces health inequalities [22], [23]. If people of lower SEP are more prone to being influenced by the external or ‘structural’ aspects of their food environment [15], [24] then reducing portion sizes of commercially provided food may be of particular benefit to lower SEP populations and therefore narrow SEP-based inequalities in diet.

2. OBJECTIVES, OUTCOMES MEASURES AND HYPOTHESES

OBJECTIVES	OUTCOME MEASURES	HYPOTHESES
Primary objective To examine the impact of portion size on energy intake among participants of lower vs. higher SEP.	Energy intake (kcal)	Total energy consumption will be higher from larger compared to smaller portions (PSE). The PSE will be larger in participants of lower vs. higher SEP.
Secondary objectives To examine the reasons why the PSE may vary based on participants' SEP. If no relationship exists, we will examine whether the individual difference measures moderate the PSE	Impulsivity Inhibition Portion size appropriateness Satiety responsiveness Plate clearing tendencies Perceived food insecurity Resource availability in childhood Food choice motives Compensatory health beliefs	The relationship between SEP and PSE may be mediated by individual difference measures.

3. EXPERIMENTAL DESIGN

Participants will be randomised into a cross-over design with two study days corresponding to two conditions: larger portion size condition or smaller portion size condition. Each study day will last one day and be separated by a minimum 1-week and maximum 6-week washout period. The two study days will be scheduled for the same day each week. On both days, participants will be served all meals *ad libitum* in the lab (including breakfast and second helpings) and will be provided with snacks to consume outside of the lab – but only the size of the initial portion of the main meal provided for lunch and dinner will be manipulated. Energy intake from all meals and snacks will be recorded.

4. PARTICIPANTS AND RECRUITMENT

4.1. Recruitment

Recruitment advertisements will be placed on social media (Facebook, Instagram, Twitter), online noticeboards (Gumtree, Call for Participants), and University of Liverpool (and other local universities') staff and students announcements and mailing lists. Flyers and posters will be distributed around the University of Liverpool campus, and if needed in local businesses and via letterbox drops in local residences with a particular focus on the most deprived areas based on the Index of Multiple Deprivation (IMD). Participants will be reimbursed for their time and expenses (£70 at the end of the study).

Recruitment will be stratified by highest educational qualification achieved or currently studying for as follows:

- 50% lower qualification levels

- No formal qualifications
- 1–3 GCSEs or equivalent
(*Level 1: first certificate; GCSE – grades 3, 2, 1 or grades D, E, F, G; level 1 award; level 1 certificate; level 1 diploma; level 1 ESOL; level 1 essential skills; level 1 functional skills; level 1 national vocational qualification (NVQ); music grades 1, 2 and 3*)
- 4+ GCSEs or equivalent
(*Level 2: CSE – grade 1; GCSE – grades 9, 8, 7, 6, 5, 4 or grades A*, A, B, C; intermediate apprenticeship; level 2 award; level 2 certificate; level 2 diploma; level 2 ESOL; level 2 essential skills; level 2 functional skills; level 2 national certificate; level 2 national diploma, level 2 NVQ; music grades 4 and 5; O level – grade A, B or C*)
- A level or equivalent
(*Level 3: A level; access to higher education diploma; advanced apprenticeship; applied general; AS level; international Baccalaureate diploma; level 3 award; level 3 certificate; level 3 diploma; level 3 ESOL; level 3 national certificate; level 3 national diploma; level 3 NVQ; music grades 6, 7 and 8; tech level*)
- 50% higher qualification levels
 - Certificate of higher education (CertHE) or equivalent
(*Level 4: certificate of higher education (CertHE); higher apprenticeship; higher national certificate (HNC); level 4 award; level 4 certificate; level 4 diploma; level 4 NVQ*)
 - Diploma of higher education (DipHE) or equivalent
(*Level 5: diploma of higher education (DipHE); foundation degree; higher national diploma (HND); level 5 award; level 5 certificate; level 5 diploma; level 5 NVQ*)
 - Bachelor or equivalent
(*Level 6: degree apprenticeship; degree with honours – for example bachelor of the arts (BA) honours, bachelor of science (BSc) honours; graduate certificate; graduate diploma; level 6 award; level 6 certificate; level 6 diploma; level 6 NVQ; ordinary degree without honours*)
 - Master's degree or equivalent
(*Level 7: integrated master's degree, for example master of engineering (Meng); level 7 award; level 7 certificate; level 7 diploma; level 7 NVQ; master's degree, for example master of arts (MA), master of science (MSc); postgraduate certificate; postgraduate certificate in education (PGCE); postgraduate diploma*)
 - Doctorate or equivalent
(*Level 8: doctorate, for example doctor of philosophy (PhD or Dphil); level 8 award; level 8 certificate; level 8 diploma*)

We will also aim to stratify recruitment by age (50% 18–25 years; 50% 26+ years), with equal proportions of each age group in each education group (lower, higher).

4.2. Inclusion criteria

- Female only
- UK residents, age ≥ 18
- BMI between 22.5 and 32.5 kg/m²; as approximately 70% of adults in England have a BMI within this range [25]
- Proficiency in English language
- Self-report liking each of the test foods

4.3. Exclusion criteria

- Current medication use which affects appetite
- Pregnancy (as it may affect appetite)
- Current or historic diagnosed eating disorder
- Currently on a diet

- Dietary restriction:
 - Vegetarian
 - Vegan
 - Gluten-free
 - Sugar-free
 - Dairy/lactose-free
 - Food allergy (e.g. milk, eggs, nut, wheat, fish, etc.)

5. METHODS

5.1. Test meals

The portion-manipulated test meals will consist of a pasta-based dish for lunch (3 cheese pasta), and a dish served with rice for dinner (chilli con carne), see Table 1 for more information about the dishes. The portion sizes are informed by pilot studies, including pilot studies conducted to assess the norm range, with portions in the larger portion size condition from the mid-higher end of the range, and portion sizes in the smaller portion size condition from the lower end of the norm range (see **Appendix A**).

Table 1. Portion sizes for each portion-manipulated dish in g and kcal

	Larger portion size (100%)			Smaller portion size (67%)		
	g	kcal	£	g	kcal	£
<i>Lunch</i>						
3 cheese pasta	563	816	2.46	375	544	1.64
<i>Dinner</i>						
Chili con carne & rice	437	509	0.90	291	339	0.60
Dinner including cheese and vegetables on the side (totals)	557	737	1.24	411	568	0.94

On each study day, all participants will receive the same *ad libitum* breakfast in the lab (initial serving providing 1437 kcal) and the same snack box for consumption away from the lab throughout the day (providing 906 kcal). At lunch, participants will have the opportunity to serve themselves more of the main dish. At dinner, participants will be served their main dish with a side of vegetables and they will also have the opportunity to request seconds of the main dish. After their dinner a dessert buffet with three options will be provided (providing 1528 kcal). Chilled water (500mL) will be served with each in-lab meal. The complete study menu can be found in SEP_portion_size MENU_UPDATED_TL.xlsx.

Participants will be requested 1/ not to consume any additional food apart from the items provided as part of the study, and 2/ drink only tea, coffee, and no calorie drinks (water) as they usually would.

Note for each self-service breakfast meal we will also vary the size of the dishware (smaller vs larger), the results of which will be reported in detail elsewhere. Given evidence to date (e.g. [47,48]), we expect this to have no impact on energy intake at breakfast, and this will be tested in analyses (see analysis plan). Manipulation of dishware size (smaller followed by larger dishware size

vs larger followed by smaller dishware size) will be fully counterbalanced with the order of portion size presentation (smaller followed by larger portions vs larger followed by smaller portions).

5.2. Measures

5.2.1. Energy intake during test meals (breakfast, lunch, dinner and dessert)

All the foods served in the lab will be weighed before and after breakfast/lunch/dinner/dessert in order to determine how much of each food has been consumed by the participants. Energy intake will be calculated by multiplying the consumed weight of each food by the energy density (kcal/g) provided by the food manufacturer.

5.2.2. Energy intake from the snack box

Participants will be asked to take a photo of their snack box before bed and send it to the research team via email or WhatsApp. They will be told that all items must be photographed (e.g. if they have eaten a chocolate bar, the empty wrapper must be photographed). Participants will be asked to return the snack box including all food and wrappers the following day during the washout session. Returned items will be checked against the photo in case any items are missing on return, which can then be clarified with the participant. Energy intake from the snack box will be calculated by multiplying the consumed weight of each food by the energy density (kcal/g) provided by the food manufacturer.

5.2.3. Additional energy intake

Participants will be asked not to eat any food apart from the meals and snacks provided during each testing period. To assess compliance and to more accurately measure total energy intake, participants will be asked to provide details of any extra food and drink (excluding water) they consumed outside of the study, during the washout and final sessions. Participants will be reassured that they will not be penalised for eating additional food, only that we need to keep detailed records of it. To calculate additional energy intake, a researcher will enter the recorded additional food items into intake24, an online dietary assessment tool [26], [27].

5.2.4. Hunger and fullness

Participants will rate their current level of hunger and fullness on visual analog scales ranging from 0 to 100 before and after eating each meal in the lab.

5.2.5. Physical activity

Participants will be asked not to perform any vigorous physical activity during the study days and to keep their level of physical activity identical across all the testing days. To encourage compliance with the protocol and to control for potential variation in physical activity level, participants will wear an activity monitor (Fitbit Zip) continuously during each study day (except while bathing) to assess moderate-vigorous physical activity. Fitbit device estimates of active minutes have been validated against gold standard research-grade physical activity monitoring devices, and Fitbit devices have been demonstrated to have high reliability.

5.2.6. Impulsivity

We will use the 30-item Barratt Impulsiveness Scale to measure self-reported trait impulsivity [28] (APPENDIX B).

5.2.7. Inhibition

A Stroop task will be used to measure inhibition ($\approx 2\text{min.}30\text{sec.}$). In this task, participants are given colour words (e.g. “red”) 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. 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) \times 3 colour-stimuli congruency (congruent, incongruent, control) \times 7 repetitions = 84 trials randomly sampled.

5.2.8. Portion size appropriateness

Participants will complete a computerised task in which they will be asked to select the portion size they consider appropriate to consume for the test foods (portion-manipulated main dishes: lunch and dinner). Food pictures start at 40 kcal and increase in 40 kcal increments up to 1000 kcal.

5.2.9. Satiety responsiveness

We will use the *satiety responsiveness* subscale of the Adult Eating Behaviour Questionnaire (AEBQ) [29] (**APPENDIX C**).

5.2.10. Plate clearing tendencies

We will use the 5-item plate clearing tendencies measure developed by Robinson and colleagues [49]. Participants rate questions (e.g. “I always tend to clear my plate when eating”) from 1 (Strongly disagree) to 5 (Strongly agree) (**APPENDIX D**).

5.2.11. Perceived food insecurity

Food insecurity is defined as “limited or uncertain ability to acquire nutritionally adequate and safe food in socially acceptable ways” [30], [31]. We will use USDA 12-month Food Security Scale Questionnaire, one of the most widely use self-report questionnaires to measure food insecurity [19]. Given the high volume of questionnaire measures in this study, we opt to use the 6-item short-form version as this has been found to have reasonable sensitivity and specificity as compared to the full 18-item [32] with less burden to the participant (**APPENDIX E**).

5.2.12. Resource availability in childhood

Participants will complete a 3-item measure of perceived resource availability during childhood developed in 2011 by Griskevicius et al. [33] and used in previous studies investigating the relationship with obesity or eating behaviour [20], [21] (**APPENDIX F**).

5.2.13. Food choice motives

To assess food choice motives we will use the ‘Health’ (6 items, e.g. “Keeps me healthy”) and ‘Weight control’ (3 items, e.g. “Is low in calories”) subscales from the Food Choice Questionnaire [50]. These questions are rated from 1 (Not at all important) to 4 (Very important) (**APPENDIX G**).

5.2.14. Compensatory health beliefs

We will use two measures of compensatory health beliefs, forming a 7-item questionnaire (adapted from [51,52]). We will use the 3-item weight-regulation subscale developed by Knäuper and colleagues [51]. Participants rate from 1 (not at all) to 5 (very much) how much the compensatory health belief matches their own belief around weight regulation (e.g. “Eating dessert can be made

up for by skipping the main dish"). We will also use the 4-item portion size subscale developed by Poelman and colleagues [52]. Participants rate from 1 (not at all) to 5 (very much) how much the compensatory health belief matches their own belief around portion size (e.g. "If I eat a small meal, it's fine to have a larger portion during the next meal") (**APPENDIX H**).

5.2.15. Other questionnaire measures

We plan to collect some questionnaire items for the purpose of other research that will not be used in the present study (**APPENDIX I**).

5.2.16. Demographic and socioeconomic status measures

Participants will be asked to report their gender, age and ethnic group, employment status, and to report four measures of socioeconomic status:

- their highest educational qualification;
- their number of years in higher education;
- their household income and their household composition;
- a subjective measure of their socioeconomic status using the MacArthur Scale of Subjective Social Status (SSS) [34].

5.2.17. Study experience questionnaire

Aims guessing. Participants will be asked to report what they thought the aims of the study were in an open-ended response format.

Manipulation awareness. To assess awareness of the difference in portion sizes between the two study days, participants will be asked a series of questions with a yes/no response format about their experience of the study. The questions will consist of several filler questions to distract from the focus on portion size, and a single item to assess awareness of the portion size manipulation ("I noticed a difference in the size of the lunch and dinner portions between the two study days"). All the participants will also be asked to order the portion sizes (smallest and largest lunch and dinner portions) according to the study day (1 and 2) in which they were served.

Food liking. Participants will be asked to report how much they liked (from 1 [*not at all*], to 7 [*very much*]), each of the specific foods presented in the study.

Familiarity ratings. Participants will also be asked to indicate their agreement with the following statement, indicating familiarity with the foods served in the study: "I would normally eat this type of food" (rated from 1 [*strongly disagree*], to 7 [*strongly agree*]).

Normality ratings. Participants will be shown a picture of each portion size of the portion-manipulated lunch and dinner dishes and asked: "In your opinion, how normal is this portion? By 'normal' we mean whether the portion contains a normal amount of food to eat for a single meal." Responses will be collected on 7-point Likert scales ranging from 1 (not normal, it is far too small), to 7 (not normal, it is far too big), with a midpoint of 4 (normal).

5.2.18. Filler measures

Participants will complete mood ratings before and after eating each meal (on visual analog scales ranging from 0 – 100 with embedded 'hunger and fullness' ratings) and computerised tasks assessing categorisation of positive versus neutral words during the lunch session each day as part of the cover story. Participants will also complete a daily sleep quality questionnaire to distract from the focus on food intake.

Computerised mood task. The computerised mood filler task consists of a 1-minute lexical decision task. The task will be introduced as “A new way to assess mood by measuring speed of responding to positive versus neutral words”. Five positive words, 5 neutral words, and 5 ‘non-words’ will be presented on the computer screen one by one in a random order. Participants will be asked to respond to each word/non-word by pressing the left or right key marked on the keyboard to indicate whether the task displays a word or non-word (according to the key assignment specified in the task instructions). There will be two different versions of the task, each consisting of different word sets – one for each study day.

6. STUDY PROCEDURE

To disguise the true purpose of the study, participants will be told that the study aims to investigate daily fluctuations in mood after accounting for lifestyle factors such as diet and sleep. To bolster the cover story, participants will complete mood ratings before and after eating each meal and computerised tasks assessing categorisation of positive versus neutral words at lunchtime during each study day. Participants will also complete a sleep quality questionnaire on each study day to distract from the focus on food intake. Data from mood and sleep measures will not be analysed.

Figure 1 presents the sequence of steps in the study that are described **Table 2**. Occasionally, exceptions to the general rule will be made in order to fit within a participant’s schedule.

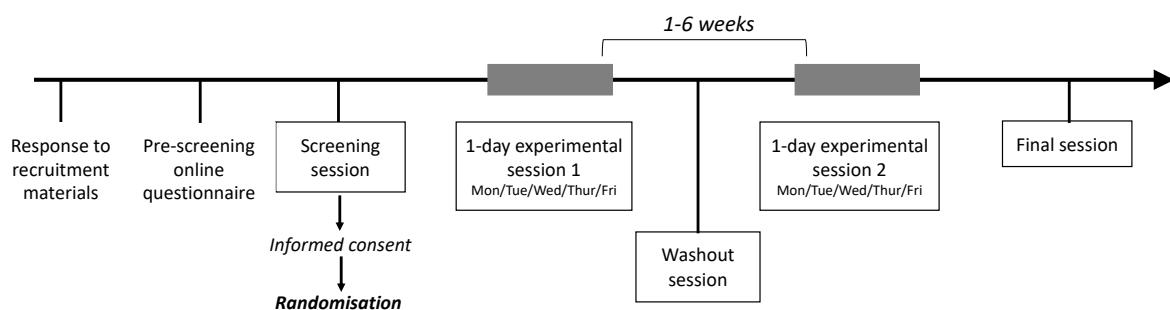


Figure 1. Participants’ schedule

Table 2. Description of the study procedure

RECRUITMENT	<ul style="list-style-type: none"> ▪ Participants respond to recruitment materials via email/phone ▪ Information sheet sent over email with link to online pre-screening questionnaire (Qualtrics) ▪ Eligible participants are invited to a screening session in person to formally check that they meet the eligibility criteria
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SCREENING SESSION <i>Informed consent</i>	<ul style="list-style-type: none"> ○ Ensure participants have read information sheet and explain the study in more details ○ Measure height and weight ○ Confirm eligibility ○ Participants sign the consent form and keep a copy ○ Organise the study with the participants: <ul style="list-style-type: none"> ○ Record contact information and preferred communication (text, call or email) ○ Organise individual schedule ○ Explain FitBit use and physical activity restriction ○ Discuss allowed food / drink ○ Participants complete the baseline questionnaire: <ul style="list-style-type: none"> ○ Demographic questions ○ Portion size appropriateness ○ Stroop task
RANDOMISATION	<ul style="list-style-type: none"> ▪ Participants will be randomly assigned to receive the larger portion sizes at the first experimental session and the smaller portion sizes at the second experimental session or vice versa. ▪ A randomisation sequence will be created using Random Allocation Software [35] with a 1:1 allocation stratified by highest educational qualification (Group 1: low ≤ A level, 18-25 years; Group 2: low ≤ A level, 26+ years, Group 3: ≥ degree, 18-25 years, Group 4: ≥ degree, 26+ years). ▪ The allocations will be placed inside envelopes for each group; the envelopes will be sequentially opened each time a participant from one group consent to take part in the study. ▪ Participants' two experimental sessions should take place on the same day of the week
STUDY DAY 1	<ul style="list-style-type: none"> ▪ Remind allowed food / drink, physical activity restriction and install the FitBit ▪ Sleep, mood, and hunger ratings ▪ <u>Breakfast 30 minute session between 7 am and 10:30 am</u> ▪ <u>Snack box</u> <ul style="list-style-type: none"> ○ Provide the snack box after breakfast ▪ <u>Lunch 30 minute session (between 12pm and 2pm)</u> ▪ <u>Dinner 30 minute session (between 5pm and 7pm – at least 4 hours after lunch)</u> ▪ Organise the following steps: <ul style="list-style-type: none"> ○ Remind the date of the next session (washout)
WASHOUT SESSION	<ul style="list-style-type: none"> ▪ Participants return FitBit device and snack box ▪ Check if any additional foods/drinks consumed ▪ Remind participants about date of next session (Study Day 2)

STUDY DAY 2	<ul style="list-style-type: none"> ▪ Remind allowed food / drink, physical activity restriction and install the FitBit ▪ Sleep, mood, and hunger ratings ▪ <u>Breakfast 30 minute session between 7 am and 10:30 am</u> ▪ <u>Snack box</u> <ul style="list-style-type: none"> ○ Provide the snack box after breakfast ▪ <u>Lunch 30 minute session (between 12pm and 2pm)</u> ▪ <u>Dinner 30 minute session (between 5pm and 7pm – at least 4 hours after lunch)</u> ▪ Organise the following steps: <ul style="list-style-type: none"> ○ Remind the date of the next session (final session)
FINAL SESSION	<ul style="list-style-type: none"> ▪ Participants return FitBit device and snack box ▪ Check if any additional foods/drinks consumed ▪ Battery of measures <ul style="list-style-type: none"> ○ Barratt Impulsiveness Scale ○ Satiety responsiveness ○ Plate clearing tendencies ○ Perceived food insecurity ○ Resource availability in childhood ○ Food choice motives ○ Compensatory health beliefs ▪ Study experience questionnaire ▪ Debriefing: explain the purpose of the study, the cover story and provide opportunity to ask questions ▪ Financial compensation (£70)

7. STATISTICAL ANALYSIS

All statistical analyses will be performed using SPSS (Version 26.0). The level of significance will be set at $p < 0.05$ for primary analyses and $p < 0.01$ for secondary analyses to account for multiple testing.

7.1. Participant's characteristics

A table will present the baseline characteristics. The table will include gender, age, ethnic group, employment status, highest educational qualification, years in higher education, household income, subjective socioeconomic status and BMI for all the participants and for lower and higher education groups. Continuous variables will be summarised using means and standard deviations. Categorical variables will be summarised using counts and percentages. We will test for baseline differences between SEP groups (higher vs lower) on demographic variables using t-tests (or if data does not meet parametric assumptions – i.e. not normally distributed – Wilcoxon Mann-Whitney tests will be used) and chi-square tests.

7.2. Variables description

7.2.1. Primary outcome

Daily energy intake i.e., energy (kcal) from breakfast, lunch and dinner (main and dessert) in the lab, from the snack box and any self-reported additional foods consumed, summed to provide daily energy intake.

Secondary outcomes

Hunger and fullness. Each participant will have 12 measures of hunger and fullness: [breakfast, lunch, dinner] x [pre meal, post meal] x [larger portion size, smaller portion size]. Daily hunger and fullness ratings across time will be summarised by calculating the area under the curve (AUC) using the trapezoid function [36].

Physical activity will be operationalised as ‘active minutes’ per day which are logged for activities with a metabolic equivalent (MET) of ≥ 3 .

7.2.2. Independent variables

Socioeconomic position (SEP) will be derived from highest educational qualification, coded as lower (1 = No formal qualifications; 2 = 1–3 GCSEs; 3 = 4+ GCSEs; 4 = A level) or higher (5 = Certificate of higher education (CertHE); 6 = Diploma of higher education (DipHE); 7 = Bachelor; 8 = Master’s degree; 9 = Doctorate).

Impulsivity. Items from the Barratt Impulsiveness Scale will be coded from 1 to 4. The higher the summed score for all items, the higher the level of impulsiveness (min. = 30, max. = 120). McDonald’s Omega will be calculated as an indicator of internal consistency.

Inhibition. For correct responses, the median reaction times (RTs) in incongruent and congruent trials will be calculated [53,54]. The difference in median RTs between incongruent vs congruent trials will be calculated [incongruent RT – congruent RT] = *The Stroop interference effect*. Higher scores indicate poorer response inhibition.

Portion size appropriateness. For each participant the average selected portion size will be calculated in kcal.

Satiety responsiveness. Items will be coded from 1: *strongly disagree*, to 5: *strongly agree* and their mean will be calculated. A higher score indicates a higher satiety responsiveness. McDonald’s Omega will be calculated as an indicator of internal consistency.

Plate clearing tendencies. Response options range from 1 to 5: 1 = strongly disagree, to 5 = strongly agree. Responses will be averaged. Higher scores indicate higher plate clearing tendencies. McDonald’s Omega will be calculated as an indicator of internal consistency.

Perceived food insecurity. Based on the recommendations of the authors of the questionnaire [55] responses to the 6 questions about food insecurity will be coded as affirmatives (i.e. “yes”, “often true”, “sometimes true”, “almost every month”, “some months but not every month”) and negatives (i.e. “no”, “never true”, “only 1 or 2 months”). Coding of food security is based on the number of affirmatives as follows: 0-1 = “food secure”, 2-4 = “food insecure without hunger”, 5-6 = “food insecure with hunger”. The responses “don’t know” and blank responses reflect missing data, which will be imputed following best practice guidance [55].

Resource availability in childhood. Each item will be coded from 1 = strongly disagree, to 7 = strongly agree and an index of resource availability in childhood will be calculated as the mean of the three items. McDonald’s Omega will be calculated as an indicator of internal consistency.

Food choice motives. Both health and weight control scores will be computed by averaging ratings for individual items of each dimension (health motivation: 6 items; weight control motivation: 3 items). Response options range from 1 to 4: 1 = Not at all important; 2 = A little important; 3 = Moderately important; 4 = Very important. Higher scores indicate stronger motives around health and weight control respectively. McDonald’s Omega will be calculated as an indicator of internal consistency for both scores.

Compensatory health beliefs. Response options range from 1 to 5: 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, 5 = very much. Higher scores indicate stronger compensatory health beliefs. McDonald's Omega will be calculated as an indicator of internal consistency and if this is consistent across the two measures (weight regulation and portion size) scores will be averaged.

7.2.3. Other variables

BMI. Calculated as weight (kg) / Height (m²)

Aim guessing. Participants who identify the aim of the study as being to examine the influence of portion/meal size on food intake/appetite 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.

Manipulation awareness. Two binary variables: self-reported awareness (0: unaware, 1: aware) and observed awareness (0: wrong answer to ordering task, 1: right answer to the ordering task).

Liking, familiarity, and normality ratings. Scores range: 1 to 7.

7.3. Missing data

We do not anticipate missing data on energy intake due to participant non-attendance (if a participant misses a meal and it is not possible to reschedule for a later time that day, they will be required to begin that study day again). Every effort will be made to keep the number of missing data due to researchers' error to the lowest. The extent of the missing data will be reported. We plan to analyse complete cases only.

Missing data on other variables will not be allowed by the experimental procedure because the record for each participant will be checked after each study day and the participants will be asked to provide their answers again if case of any missing data.

7.4. Primary analyses

7.4.1. Confirmatory analyses

To be consistent with previous studies we ran investigating the effect of SEP on intended energy consumption (e.g [45]), the primary measure of SEP used in our primary analysis will be highest educational qualification (binary – lower vs higher).

A mixed ANOVA will be used to test the effect of portion size (categorical: larger, smaller; within-subject), SEP (categorical: lower (\leq A level), higher ($>$ A level), between-subjects), the interaction portion size*SEP on daily energy intake. If the interaction between portion size*SEP is significant the analysis will be stratified by SEP (\leq A level, $>$ A level) and two repeated-measures t-tests will be used to examine the effect of portion size (larger vs smaller) on daily energy intake in the two groups of participants separately. We will not correct for multiple comparisons as we specified a priori hypotheses.

7.4.2. Sensitivity analyses

Sensitivity analyses will be conducted to examine whether the pattern of results from the main analyses differ after 1/ excluding participants guessing the aims of the study, 2/ excluding outliers on main outcome variables (identified as those with a value $>$ 3SD from condition mean) and influential cases (identified as those with a Cook's distance $>$ 1, indicating a multivariate outlier [37], 3/

substituting SEP measure (highest educational qualification, \leq A level, $>$ A level) with alternative measures of SEP (level of education – composite score, subjective socioeconomic status (1-10), and household income).

The main analyses will also be repeated controlling for any non-SEP based demographic variables (e.g. BMI, age) that significantly differ between the higher vs. lower SEP groups in order to examine if results remain consistent. To examine whether the order that portions are presented impacts the findings, the main analyses will be repeated with an additional 2-level between-subjects factor (portion size order: smaller, larger vs larger, smaller). Finally, the main analyses will be repeated with dishware size as an additional 2-level within-subjects factor (dishware size: smaller vs larger).

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).

Note if $>30\%$ participants guess the study aim we will include aim guessing as a between-subjects factor in ANOVA rather than use listwise removal.

7.5. Secondary analyses

7.5.1. Mediation analyses

For each participant, we will compute the average daily energy intake in the larger portion condition minus average daily energy intake in the smaller portion size condition, referred below as the portion size effect (PSE).

We will first report and compare the individual measures of impulsivity, inhibition, portion size appropriateness, satiety responsiveness, plate clearing tendencies, perceived food insecurity, resource availability in childhood, food choice motives, and compensatory health beliefs for lower and higher SEP groups using means, standard deviations and T-tests. If we find individual differences for any of these measures between participants of lower and higher SEP, mediation analyses will be performed in order to examine the extent to which it mediates the effect of SEP on the PSE (**Figure 2**).

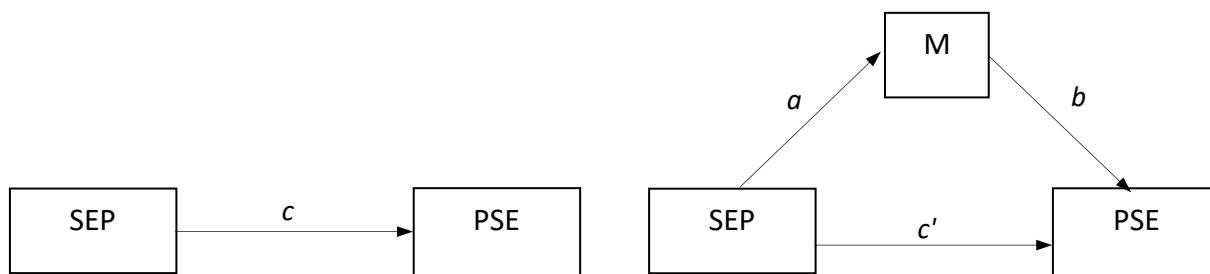


Figure 2. Mediation diagrams for the PSE. Indirect effect of SEP on the PSE through a mediator M = $c - c' = ab$.

The mediation will be tested by estimating the indirect effects of SEP on the PSE through all the potential mediators and testing their indirect effect using bias-corrected bootstrap. We will use the PROCESS macro (Model 4 – one mediator at a time and all together) in SPSS that provides asymmetric bias-corrected bootstrap confidence intervals for inference about the indirect effects using 5,000 bootstrap samples [38]. Mediation will be tested by determining whether or not the confidence intervals of the indirect effects estimates contain zero.

If we do not find evidence that the PSE is moderated by SEP or that our individual difference measures do not explain moderation by SEP, we will repeat the primary analysis replacing SEP with the individual measures, to examine whether any of the individual difference measures moderates the main effect of portion size on daily energy intake.

7.5.2. Hunger and fullness

To investigate whether portion size reduction is associated with increased hunger/decreased fullness repeated-measures t-tests will be used to test the effect of portion size (categorical: larger, smaller; within-subject), on AUC for hunger and fullness.

7.5.3. Physical activity

To check whether the participants followed the instructions properly, we will investigate whether portion size reduction is associated with compensatory reductions in physical activity. A repeated-measures t-test will be used to test the effect of portion size (categorical: larger, smaller; within-subject) on the number of active minutes per day.

7.5.4. Study experience

We will report liking, familiarity, and normality ratings for each portion-size manipulated dish. We will also report the number of participants (total and in each group) who declared being aware of the portion-size manipulation and compare their observed awareness to chance expectation and to observed awareness of participants who declared not to be aware of the portion size manipulation (Chi-square test).

7.6. Sample size

In a previous study that used the same basic methodology but investigated the PSE over a 5-day period [39], the main effect of portion size on daily energy intake was partial $\eta^2 = 0.41$ – considered a statistically large effect size. From other studies examining shorter time frames, the effect of portion size on energy intake is medium-sized [7, 57]. To be conservative we will power the present study to be able to detect a small to medium size main effect of portion size on daily energy intake ($f=0.175$, $p < .05$, 85% power, within-subject correlation of 0.7 conservatively estimated from [39]), resulting in a minimum sample size of 46 participants. As there is limited evidence on the size of moderating effect of SEP on portion size, this sample size also provides adequate power to detect the same small to medium sized portion size and SEP interaction (within-between-subject interaction) on energy intake. Due to on-going COVID restrictions there is uncertainty over recruitment rates and it may be plausible to recruit more participants into the study. If it is feasible in the time frame of the project, we will aim to recruit up to a further 14 participants, resulting in a final $N=60$. This decision will be made prior to conducting any data analyses. Increasing sample size by approximately 30% would address uncertainty for power analysis parameters (e.g. a smaller than

anticipated sized effect being observed in the study) by increasing power. Furthermore, empirical estimates of sample sizes needed for reasonable power (e.g. 80%) in mediation analyses indicate that a sample of ≈ 60 would be sufficient to detect mediation through pathways that are medium and above in statistical size using bias-corrected bootstrap tests [40].

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9. Appendices

9.1. APPENDIX A: SUMMARY OF PILOT STUDIES

Based on two previous pilot studies, we selected foods that are palatable for the study population and portion sizes that are perceived as 'normal' in order to limit potential compensatory eating after consuming a meal perceived as being 'smaller than normal'.

In a first pilot study, a selection of seven candidate main meal dishes (3 pasta lunchtime dishes: penne with pesto, spaghetti carbonara, spaghetti Bolognese; 4 dinner dishes: beef curry, chicken korma curry, chilli con carne, sweet and sour chicken [all served with rice]) were photographed on standard-sized (28.5cm diameter) dinner plates at portion sizes ranging from 40 to 300% of a reference portion (equal to the manufacturer's recommended serving for commercially available foods, or equivalent to similar commercially available foods for recipes prepared from ingredients). Participants ($N = 30$, 50% female) completed a computer-based rating task in which they viewed each portion size in a randomised order, and indicated whether they perceived that portion as a 'normal' or 'not normal' amount to eat. The proportion of the sample that perceived each portion size as 'normal' in size to determine the 'norm range' for each dish (i.e., the range of portions perceived as 'normal' by at least 60% of the sample) was calculated. The reduced portion size for each food was selected from the lower end of the norm range, the large portion size from the mid-high end of the norm range.

In a second pilot study, 10 participants (50% female) viewed each main meal dish in the two portion sizes in person. Participants rated the perceived normality of each portion for each dish (grouped by dish, such that they rated the normality of each portion for the first dish, followed by each portion size for the second dish, and so on) on a Likert scale ranging from 1 ("not normal – too small") to 7 ("not normal – too large"), with a midpoint of 4 ("normal"). Participants subsequently tasted each dish and rated how much they liked the taste on a 7-point Likert scale ranging from 1 ("dislike very much") to 7 ("like very much"). All dishes were at least moderately liked by all participants, such that only a small number of participants rated their liking of the meals below the midpoint of the scale ($n = 0$ participants for chilli, $n = 2$ participants for Bolognese, carbonara, pesto, beef curry), and the mean liking rating was above the midpoint of the scale for all dishes (mean ratings for each rice dish was significantly larger than 4, while the mean ratings for each pasta dish was at least 4.5, but did not significantly differ from 4). For most dishes, the mean ratings of the reduced portion sizes did not significantly differ from the midpoint of the scale, and the majority (at least 60%) of participants provided a normality rating of '4' for most dishes indicating that participants perceived these portions as 'normal'. There were two exceptions: the mean normality rating for the reduced portion of pasta with pesto was significantly higher than 4 (indicating perceived 'larger than normal'), and the mean normality rating for the reduced portion of chicken with sweet and sour sauce was significantly lower than 4 (indicating perceived 'smaller than normal'). To ensure that the portions were perceived as *at least* normal in size, sweet and sour chicken with rice was omitted from the menu.

Finally, given logistical considerations (in part relating to running experiments during COVID-19), we decided that each experimental session would last 1 day, meaning only one lunch option and one dinner option would be required. We decided on a final menu based on these pilot studies and logistical considerations, giving 1 lunchtime pasta dish (3-cheese pasta) and 1 dinner dish (chili-con-carne with rice).

9.2. APPENDIX B: BARRATT IMPULSIVENESS SCALE

Instruction: “Read each statement and select the appropriate response. Do not spend too much time on any statement. Answer quickly and honestly.”

		Rarely/Never	Occasionally	Often	Almost always/Always
		1	2	3	4
1.	<i>I “squirm” at plays or lectures.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<i>I am restless at the theatre or lectures.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<i>I don’t “pay attention.”</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<i>I concentrate easily.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<i>I am a steady thinker.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<i>I act “on impulse.”</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<i>I act on the spur of the moment.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8.	<i>I buy things on impulse.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	<i>I make-up my mind quickly.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<i>I do things without thinking.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	<i>I spend or charge more than I earn.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<i>I am happy-go-lucky.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<i>I am a careful thinker.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<i>I plan tasks carefully.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<i>I am self-controlled.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	<i>I plan trips well ahead of time.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	<i>I plan for job security.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	<i>I say things without thinking.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	<i>I like to think about complex problems.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.	<i>I like puzzles.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.	<i>I save regularly.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.	<i>I am more interested in the present than the future.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23.	<i>I get easily bored when solving thought problems.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.	<i>I change residences.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.	<i>I change jobs.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26.	<i>I am future oriented.*</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27.	<i>I can only think about one problem at a time.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28.	<i>I often have extraneous thoughts when thinking.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29.	<i>I have “racing” thoughts.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30.	<i>I change hobbies.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*reverse scoring

9.3. APPENDIX C: SATIETY RESPONSIVENESS

		Strongly disagree 1	Disagree 2	Neither agree nor disagree 3	Agree 4	Strongly agree 5
1.	<i>I often leave food on my plate at the end of a meal.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<i>I often get full before my meal is finished.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<i>I get full up easily.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<i>I cannot eat a meal if I have had a snack just before.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9.4. APPENDIX D: PLATE CLEARING TENDENCIES

		<i>Strongly disagree</i> 1	<i>Disagree</i> 2	<i>Neither agree nor disagree</i> 3	<i>Agree</i> 4	<i>Strongly agree</i> 5
1.	<i>I always tend to clear my plate when eating.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<i>I normally finish eating when my plate is empty.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<i>Before I start eating, I normally plan to finish the serving I am about to eat</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<i>I rarely leave food on my plate</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<i>It is normal for me to have very little food left or an empty plate at the end of a meal</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9.5. APPENDIX E: PERCEIVED FOOD INSECURITY

Instructions: These next questions are about the food eaten in your household in the last 12 months and whether you were able to afford the food you need.

Here are two statements that people have made about their food situation. Please tell me whether the statement was OFTEN, SOMETIMES, or NEVER true for (you/you and the other members of your household) in the last 12 months.

		<i>Often true</i> 1	<i>Sometimes true</i> 2	<i>Never true</i> 3	<i>Don't know</i> DK
Q3	<i>The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more</i>				
Q4	<i>(I/we) couldn't afford to eat balanced meals</i>				

		<i>Yes</i> 1	<i>No</i> 2	<i>Don't know</i> DK
Q8	<i>In the last 12 months, since (date 12 months ago) did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		<i>Almost every month</i> 1	<i>Some months but not every month</i> 2	<i>Only 1 or 2 months</i> 3	<i>Don't know</i> DK
Q8a	<i>How often did this happen?</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		<i>Yes</i> 1	<i>No</i> 2	<i>Don't know</i> DK
Q9	<i>In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q10	<i>In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

NOTES.

If any of the first 3 questions are answered affirmatively (i.e., if either Q3 or Q4 are "often true [1]" or "sometimes true [2]" or Q8 is "yes" [1]), the participant will proceed to Q8a. Otherwise, they will skip to Q9.

All questions are optional (meaning there can be missing data).

9.6. APPENDIX F: PERCEIVED RESOURCE AVAILABILITY IN CHILDHOOD

Instructions: Think about your childhood before age 12 and rate your agreement or disagreement with the following statements.

	Strongly disagree 1						Strongly agree 7
<i>My family had enough money for things growing up.</i>	<input type="radio"/>						<input type="radio"/>
<i>I grew up in a relatively wealthy neighbourhood.</i>	<input type="radio"/>						<input type="radio"/>
<i>I felt relatively wealthy compared to others my age.</i>	<input type="radio"/>						<input type="radio"/>

9.7. APPENDIX G: 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...

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

9.8. APPENDIX H: COMPENSATORY HEALTH BELIEFS

Instruction: "Different people believe different things regarding their health. Below is a list of beliefs that everyone may hold to some degree. Please read each sentence carefully and rate how closely the idea matches your own belief. Since we all believe different things, there are no correct or incorrect choices. As well, most of these beliefs have not been scientifically tested. How closely does each of the following ideas match your own belief?"

	<i>Not at all</i> 1	<i>A little</i> 2	<i>Somewhat</i> 3	<i>Quite a bit</i> 4	<i>Very much</i> 5
<i>Eating dessert can be made up for by skipping the main dish</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Using artificial sweeteners compensates for extra calories</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Breaking a diet today may be compensated for by starting a new diet tomorrow</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<i>If I eat a small meal, it's fine to have a larger portion during the next meal</i>	<input type="radio"/>				
<i>To maintain your weight, it is fine to eat a large meal, if you eat a small portion during the next meal</i>	<input type="radio"/>				
<i>To maintain your weight, it is fine to eat a high caloric snack in between meals, if you compensate for this by eating a smaller portion later in the day</i>	<input type="radio"/>				
<i>If I eat a small meal, there is no harm in eating more cookies and candies</i>	<input type="radio"/>				

9.9. APPENDIX I: INTEROCEPTIVE ACCURACY SCALE

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	Disagree	Neither agree nor disagree	Agree	Strongly agree
	1	2	3	4	5
1. I can always accurately perceive when my heart is beating fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I can always accurately perceive when I am hungry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I can always accurately perceive when I am breathing fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I can always accurately perceive when I am thirsty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I can always accurately perceive when I need to urinate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I can always accurately perceive when I need to defecate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I can always accurately perceive when I encounter different tastes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I can always accurately perceive when I am going to vomit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I can always accurately perceive when I am going to sneeze	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I can always accurately perceive when I am going to cough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I can always accurately perceive when I am hot/cold	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I can always accurately perceive when I am sexually aroused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I can always accurately perceive when I am going to pass wind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I can always accurately perceive when I am going to burp	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I can always accurately perceive when my muscles are tired/sore	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I can always accurately perceive when I am going to get a bruise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I can always accurately perceive when I am in pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I can always accurately perceive when my blood sugar is low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I can always accurately perceive when someone is touching me affectionately rather than non-affectionately	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. I can always accurately perceive when something is going to be ticklish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. I can always accurately perceive when something is going to be itchy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>