STUDY PROTOCOL. . NCT (Uni.Liverpool reference): 4612WP1B2b

Study title: Socioeconomic status and the effect of information-based versus structural interventions on food choices at US restaurants: an online randomized experiment

Short title: US Restaurant Study

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1. BACKGROUND AND RATIONALE

A substantial contributor to social inequalities in health is diet [1], [2]. The dietary quality of people of lower socioeconomic status (SES) is poorer than that of people of higher SES [3], [4] and particularly rich in energy [5], [6] which likely contributes to the development of obesity and of a larger disease burden among people of lower SES [7].

Eating out of home has been associated to higher energy intake, weight gain and obesity [8], [9]. Yet, the popularity and availability of ready-to-eat meals have risen considerably over the last few decades [10], [11]. In this context, there is an increasing interest in interventions that aim at reducing the energy intake from food prepared out-of-home [12]–[14].

Information-based nutrition interventions (e.g., energy labelling on food menus) are one of the most common approaches to influence food choices [15], [16]. However, information-based interventions have been suggested to be less effective among people of lower compared to higher SES [17], [18] and therefore they may inadvertently widen inequalities in diet. Structural interventions that target core features of the food environment (e.g., increasing the availability of lower energy foods) are an alternative intervention approach do not depend on a sustained 'agentic' individual response [15], [19].

Information-based interventions typically rely on people understanding health consequences of what they eat and being motivated by health in their food choices [19]. Yet, health may be a less influential motive for food choice among people of lower SES [20]. Thus, SES based differences in food choice motives and health literacy may explain why information-based interventions would be less effective among people of lower vs. higher SES.

Moreover, the overall effect of energy labelling is small or unclear, as depicted in recent systematic reviews [21]–[23]. A possibility that has not been tested to date is that the effect of kcal labelling on purchasing behaviour is dependent on peoples' existing knowledge about the energy content of menu items, whereby energy labelling is most effective when people are making food choices from unfamiliar menus and therefore are less able to distinguish from the lower and high energy menu items.

2. OBJECTIVES, OUTCOMES MEASURES AND HYPOTHESES

OBJECTIVES	OUTCOME MEASURES	HYPOTHESES
Primary objective To examine the effect that an information-based intervention (energy labelling)	Energy (kcal) of the ordered meal.	An increased availability of lower energy menu options will result in a decrease in total

and a structural intervention (increased availability of lower kcals options) have on kcals ordered in a hypothetical meal ordering task among participants of lower and higher SES.		energy ordered among both participants of lower and higher SES. However, energy labelling may exert a stronger effect on energy ordered among participants of higher vs. lower SES.
Secondary objectives To examine the reasons why the effects that energy labelling have on kcals ordered may vary based on a participants' SES.	Health motivation in food choices (questionnaire score).	The participants of higher SES will be more motivated by health in their food choices than participants of lower SES, which will mediate the relationship between SES and the effect of energy labelling on the total energy ordered.
To examine the effect of labelling on familiar and unfamiliar cuisines menus.	Energy (kcal) of the ordered meals for familiar and unfamiliar cuisines.	Energy labelling will have a greater effect for unfamiliar compared to familiar cuisines.

3. EXPERIMENTAL DESIGN

Participants will be enrolled in an online survey and make hypothetical menu choices. Participants will be randomized into a mixed-design experiment with 2x2 between-subjects conditions with factors of kcal labelling (absent vs. present) and availability (baseline availability of main dishes with ≤600kcals vs. higher availability of main dishes with ≤600kcals) and 6 repeated measures (3 familiar and 3 unfamiliar menus).

4. PARTICIPANTS AND RECRUITMENT

4.1. Recruitment

Participants will be recruited through an online recruitment panel (Prolific) in which participants are compensated proportionate to the time it takes to complete the online study (≈ $6/hour reward participants). Participants' recruitment will be stratified by gender (50% male, 50% female), student status (8% yes and 92% no) [24] and highest achieved education level (10% less than high school, 30% high school completion, 30% some college or associate's degree, 20% bachelor's degree, 10% advanced degree) to be representative of US adults [25].

4.2. Inclusion criteria

- US 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.)

5. METHODS

5.1. Meal choice task

Procedure

Participants will be asked to select the meal options they would be most likely to choose from six different dining out scenarios. Participants will be randomly allocated to one of the following group:

- baseline availability & no energy labelling (C: *control*);
- baseline availability & energy labelling (CL: *kcal labelling*);
- increased availability of lower energy options & no energy labelling (A: *availability*);
- increased availability of lower energy options & energy labelling (AL: *availability and kcal labelling*).

For each dining out scenario participants will be asked to imagine that they are eating out with friends for dinner at a […] style restaurant. They will first be shown an image of the restaurant from the outside, before being shown an image of the inside of the restaurant and then the menu. Participants will be asked to make their main dish selection from a menu including 10 main dishes options.

In order to examine whether participants are more likely to order 'additional' food as a result of ordering a lower energy option, after selecting their main dish option participants will be shown a 'sides' section of the menu displaying 5 sides dependent on dining out scenario. Participants will be asked whether they would order an additional side with their meal and if they select 'yes', they will select their side. The same options will be shown in all conditions, although in the no energy labelling conditions (C and A) there will be no kcal information next to menu options and in the energy labelling conditions (CL and AL) there will be kcal information next to each menu options. On the next page, this will be repeated for the dessert menu. The dessert menu will display 5 dessert options dependent on dining out scenario. As described for the 'sides' section, the same dessert options will be shown in all conditions and kcal information will be displayed in the energy labelling conditions (CL and AL).

The six dining out scenarios will be randomised in order. Additionally, the order of the dishes in each main menu was counterbalanced as explained in **Appendix A**. For the sides and desserts menus, two variants with different random order of the items will be created for each condition.

Menus

The design of the restaurant menus will be based on menus from existing US restaurants. In a recent study, 1,184 American adults were asked which of 34 national cuisines they had tried and whether

they liked or disliked them [26]; results are summarised in **Appendix B**. Based on these results we selected three familiar (tried by at least 90% of US people: American, Mexican and Italian cuisines) and three unfamiliar cuisines (never tried by approximately 50% of US people: Lebanese, Peruvian, Moroccan cuisines) for American people. Using the online menus of US restaurants offering the selected cuisines, we will then create sample menus for the six distinct restaurant cuisines, each consisting of 10 main dishes and a selection of between 5 sides and 5 desserts (including actual food names, description and prices).

For familiar cuisines, the menu-model restaurants will be US popular chain restaurants (>800 outlets across the country); for unfamiliar cuisines, they will be US restaurants offering these specific types of cuisines that will be chosen by searching for restaurants in large US cities: New-York, Los Angeles, Chicago, Houston (using Yelp, Tripadvisor). All the food items (and their description) included in the experimental menus will be based on existing US restaurants. Because kcal labelling is only mandatory for restaurant chains in the US, we will use external sources to calculate the energy content per 100g of the menu options available for unfamiliar cuisines (e.g., online recipes, national food composition databases). All the six menus will offer a similar range of main options in terms of energy content (i.e., similar min, median and max).

Interventions

LE options are main dishes ≤600 kcal because meals ≤600 kcal comply with the dietary recommendation for US adults (i.e., on average 2,000 kcal per day) assuming an energy repartition pattern of three main meal occasions, each accounting for 20–35 % of daily energy intake, and 1–2 snacking occasions, each accounting for 5–10 % of daily energy intake [27].

In the baseline availability conditions (C and CL) 1/10 main dishes on the menus will be 600 kcal or less and 9/10 will exceed 600 kcal. In the increased availability of lower energy options conditions (A and AL), the proportion of main dishes ≤ 600 kcal will be increased to 5/10 by replacing four of the > 600 kcal main dishes from the baseline availability conditions with lower energy main dishes, whilst holding the price of replaced menu items the same. The menu items with the highest and the lowest energy content will remain the same in order to ensure the range of energy is consistent across conditions. The difference in the mean energy content of the menus items between C/CL and A/AL conditions will be approx. the same for familiar and unfamiliar menus.

In the energy labelling conditions (L and AL) energy in kcal will be added next to each menu option and reference information on energy requirements will be displayed. The energy labelling format will be in line with the mandatory menu labelling policy published by the US Food and Drug Administration [28], which requires restaurants to:

- Disclose calories for standard menu items listed on menus and menu boards:
    - Calorie labelling is placed on the menu adjacent to the name or the price of the menu item in a manner in close proximity and clearly associated with the menu item;
- Include on menus a succinct statement concerning suggested caloric intake and a statement that additional nutrition information is available upon request:
    - The succinct statement ‘2,000 calories a day is used for general nutrition advice, but calorie needs vary’ must appear on the bottom of menu boards and at the bottom of each page of multi-page menus;

- The statement of availability 'Additional nutrition information available upon request' must appear on the bottom of the first page of a menu that lists standard menu items and at the bottom of the menu board
- They may be on the individual sign adjacent to the food itself, or on a separate, larger sign in close proximity to the food. The customer must be able to easily read the sign when making a selection.

In the no energy labelling conditions (C and A) there will be no kcal information next to menu options.

5.2. Measures of socioeconomic status

The socioeconomic status is a multi-faceted concept. Four 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 and main job title;
- their household income and their household composition;
- a subjective measure of their socioeconomic status using the MacArthur Scale of Subjective Social Status (SSS) [29].

5.3. Measure of health motivation

The ***Food Choice Questionnaire***, developed by Steptoe et al. 1995 [30], measures the motives related to food choice, including health. We will use a short version of this questionnaire, the ***single-item Food Choice Questionnaire*** recently developed by Onwezen et al. 2019 [31].

6. STUDY FLOW

RECRUITMENT *(Prolific)*	▪ Predefined screening questions of Prolific website will be used to target the sample **(Appendix C)** ▪ Participants who meet the inclusion/exclusion criteria will be e-mailed by Prolific and/or offered to complete our study on their Prolific account **(Appendix D)** ▪ Eligible participants who want to take part on the study will click on the start button and be redirected to our study website (Qualtrics)
INFORMED CONSENT	▪ Participants will read the information sheet **(Appendix E)** ▪ Participants who want to proceed will tick a consent box **(Appendix F)**
RANDOMISATION	▪ When starting the study, participants will be equally randomized to the four experimental conditions
BASELINE ASSESSMENTS	▪ Participants will complete a baseline questionnaire on demographics **(Appendix G)**
MEAL CHOICE TASK	▪ Instructions will be displayed **(Appendix H)** ▪ Dining-out scenarios will be displayed in randomised order ▪ For each dining out scenario, participants will be asked to choose their main meal and whether they would like to order a side and a dessert.

	Control condition	Energy labelling condition	Low energy increased availability condition	Low energy increased availability and energy labelling condition
HEALTH MOTIVATION	▪ Single-item Food Choice Questionnaire **(Appendix I)**			
DEBRIEFING	▪ Aim guessing in an open-ended response format ▪ Insight on the participants' perception of the meal ordering task (**Appendix J**) ▪ Text to tell the participants what the study was about (**Appendix K**)			
DATA MANAGEMENT	▪ The result files will contain: o Participant unique ID o Experimental condition participant is directed to o Food choices o Answers to questionnaires			

7. STATISTICAL ANALYSIS

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 $p < 0.05$. Linear mixed models will be fitted with PROC MIXED.

7.1. Participant's characteristics

A table will present the baseline characteristics by condition group and overall. The table will include gender, age, ethnic group, proportion of students, highest educational qualification, years in higher education, household income, subjective socioeconomic status, BMI, dieting status, dining-out frequency. Continuous variables will be summarised using means and standard deviations. Categorical variables will be summarised using counts and percentages.

7.2. Variables description

Primary outcome

The main outcome variable is the **energy of the main** selected in each dining out scenario in kcal.

Secondary outcome

From the meal choice task:

We will also calculate the **total energy** of the selected meal. It will be calculated by summing the kcal of the selected main, side and dessert.

From the debriefing questionnaire:

- ***Validity of menu design*** (item 2)
- ***Validity of food offer*** (items 4 and 5)
- ***Kcal influence*** (item 3)

Answers to all the items will be coded as: 1 = Strongly disagree; 2 = Disagree; 3 = Slightly disagree; 4 = Neither agree or disagree; 5 = Slightly agree; 6 = Agree; 7 = Strongly agree.

Internal dimension consistency of the items measuring *validity of food offer (for each cuisine)* will be assessed by calculating McDonald's ω for each, which is an alternative to Cronbach's α when the total test scores are normally distributed (i.e., all items are normally distributed) [32]. If adequate consistency is reached (ω ≥ 0.7), *validity of food offer (for each cuisine)* score will be calculated as the mean of the two items constituting the dimension. In the case where internal consistency is not acceptable, we will run analyses separately on individual items.

Independent variables

SES

Level of education

- **Highest educational qualification** will be coded from 1 = less than high school; 2 = high school completion; 3 = some college or associate degree; 4 = bachelor's degree; 5 = master's degree; 6 = doctoral or professional degree [33], [34] and as a binary variable as *lower* (values: 1 and 2) or *higher* (values: 3, 4, 5 and 6).
- **Years in higher education,** as a continuous variable.

Assuming that the two education variables are significantly correlated (tested using Pearson's *r*) we will *z-score* the two variables and create an average of the two to form a composite score called '*level of education'*.

Health motivation

The health motivation score will be coded from 1 to 7 and correspond to the responses at the first and ninth items of the Single-item Food choice Questionnaire: "It is important to me that the food I eat on a typical day is healthy" and "It is important to me that the food I eat on a typical day helps me control my weight": 1 = Not at all important; 2 = Not important; 3 = Not very important; 4 = Neutral; 5 = Slightly important; 6 = Important; 7 = Very important.

Cuisine familiarity

- Familiarity condition: Binary variable based on the experimental design: 0 for unfamiliar cuisines and 1 for familiar cuisines
- Familiarity score: Ordinal variable based participants answer for each cuisine to the question "Have you ever tried [6 cuisines]?" coded as 1: Never tried; 2: Not in the last year; 3:Less than once per month; 4: 1-3 times per month; 5: 1-2 times per week; 6: 3 times per week or more

Other variables

Household income: To be consistent with US census data [35], participants will report their annual household income before tax to the nearest $1000.

Subjective SES: The measure of the Subjective Social Status using the MacArthur Scale will be coded from 1 to 10.

BMI will be calculated as weight (kg) / Height (m^2). BMI data only will be trimmed for implausible values: BMI>10 or BMI<60 [36].

Aim guessing: Participants who identify the aim of the study as being to examine the influence of energy labelling or increased availability of lower energy food items on food choices 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.

7.3. 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).

7.4. Main analyses

The measure of SES used in our primary analysis will be the *highest educational qualification* (categorical variable: *lower vs. higher*) because previous research showed that people with college education were more likely to use kcal labels at restaurants [37]. The measure of health motivation will be the response to the first item from the Single-item Food choice Questionnaire: "It is important to me that the food I eat on a typical day is healthy", i.e., importance of healthiness.

First, we will examine whether our manipulation of familiarity is valid by examining the proportion of participants that are familiar / unfamiliar with each cuisine menu type (i.e. we expect >75% of participants to be familiar with our chosen 'familiar' cuisines and <25% of participants to be familiar with our 'unfamiliar' cuisines). We will also report the mean and SD of the *familiarity score* for each cuisine.

A linear mixed model will be used to test the effect of *labelling* (categorical, between-subject), *availability* (categorical, between-subject), *highest educational qualification* (categorical, between-subject), *familiarity* (categorical, within-subject) and *labelling*highest educational qualification*, *availability*highest educational qualification, labelling*familiarity*, *availability*familiarity,* interactions on *energy of the main* for the six dining out scenario. A random effect of participant will be added by using an unstructured covariance structure to account for correlation between repeated ordering by the same participant.

If any interactions with *familiarity* are significant, analysis will be stratified by *familiarity* and two linear mixed models will be fitted to examine the effect of *labelling*, *availability, highest educational qualification* and *labelling*highest educational qualification*, *availability* highest educational qualification* interactions on *energy of the main* for familiar and unfamiliar cuisines with participant effect as random to account for correlation between repeated ordering by the same participant for familiar and unfamiliar cuisines.

If the above analyses reveals a significant interaction between *labelling* or *availability* condition and *highest educational qualification* on *energy of the main*, analysis will be stratified by *highest educational qualification (lower vs. higher)* and two linear mixed models will be fitted to examine the effect of *labelling* and *availability* on *energy of the main* for lower and higher educational qualifications.

<u>Sensitivity analyses</u>

Sensitivity analyses will be conducted to examine whether the pattern of results from the main analyses differ after excluding participants guessing the aims of the study.

We will also repeat the main analysis substituting the categorical variable *highest educational qualification* by the composite variable *level of education* as a continuous covariate.

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).

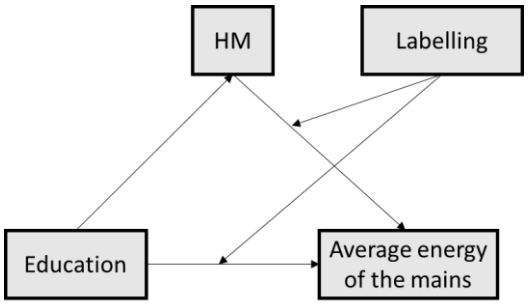
7.5. Secondary analyses

Moderated mediation analysis of health motivation

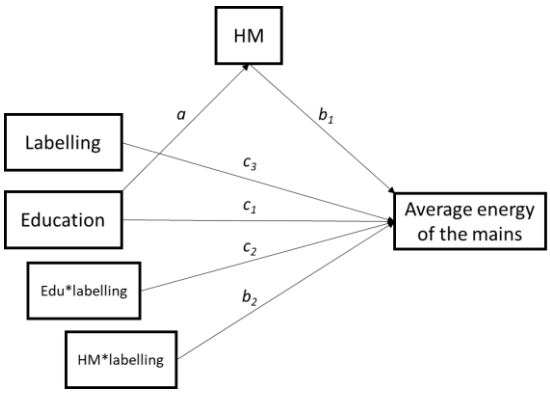
If the main analyses suggest that *highest educational qualification* moderates the effect of *labelling* or *availability* on *energy of the main* (i.e., the *labelling* highest educational qualification* or *availability* highest educational qualification* interaction is significant), moderated mediation analyses will be performed in order to examine the extent to which health motivation (HM) (healthiness motivation and weight control motivation) mediates the effect of *highest educational qualification* on *energy of the main* with and without labelling.

If the main analysis reveals any significant interactions between *labelling* or a*vailability* and *familiarity*, then repeated ordering will be aggregated at participant level by calculating the average energy of the mains for familiar and unfamiliar cuisines separately. If the main analysis reveals no interaction between *labelling* or *availability* and *familiarity*, then repeated ordering will be aggregated at participant level by calculating the average energy of the mains for all cuisines.

Conceptual diagram example (labelling):



Statistical diagram example (labelling):



Conditional indirect effect of *highest educational qualification* on the *average energy of the mains* through *HM* = $a(b_1 + b_2 labelling)$.

The moderated mediation will be tested by estimating the conditional indirect effect of *level of education* on the *energy of the main* through *HM* for *labelling* and *no labelling* conditions (resp. the *increased* and *baseline availability* 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 [38]. Moderated mediation will be tested by determining whether or not the confidence intervals contain zero.

Debriefing questionnaire

We will finally explore whether the restaurants menus are valid and the extent to which participants reported using kcal information when making food choices. Responses to the debriefing questionnaire will be analysed:

- We will describe the responses to each item (mean, SD, % agree [5, 6, 7], % disagree [1, 2, 3]) in the overall sample to characterise *validity of menu design, validity of food offer, kcal influence*.
- Three linear mixed models will be used to test the effect of *labelling*, *availability, familiarity* and *highest educational level* on the three dimensions of the debriefing questionnaire (a) *validity of menu design*, (b) *validity of food offer*, and (c) *kcal influence* to investigate whether the responses differ across experimental conditions and SES.

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

7.6. Sample size

The best available evidence of the effect of kcal labelling on kcal ordered at restaurants is the meta-analysis of Crockett et al. 2018. The authors analysed the effects of 3 RCTs testing energy labelling in restaurants [21]. They demonstrated a statistically significant reduction of 47 kcal in energy purchased when menus were labelled. The weighted average kcal ordered in the no label condition was 706 kcal[1]. These results suggest that we could expect a 7% energy reduction in the labelling condition compare to the control condition. Previous studies examining the effect of an increased availability of lower-energy products on food selection tend to produce similar or larger effects than kcal labelling tends to [39], [40]. In a previous trial we ran at virtual fast food restaurants (osf.io/ajcr6), we found a between-subject variance of 47,224 for kcal ordered (SD = 217.3).

In a two-level mixed model, including 6 observations per participant at level 1 and estimating a level 1 and level 2 variance of 47,244 for energy of the main, a sample size of 1,000 participants with α = 0.05 allows to detect 2% energy reduction and above at power = 0.93 due to labelling and/or availability, an additional 2% energy reduction (or above) in participants of higher educational qualification at power = 0.81 due to an interaction between labelling and highest educational qualification and/or an interaction between availability and highest educational qualification, an additional 2% energy reduction (or above) for unfamiliar menus at power = 0.86 due to an interaction between labelling and familiarity and/or an interaction between availability and familiarity (MLPowSim) [41].

<u>To observe a mediated effect of SES through health motivation</u>

Based on existing literature we hypothesise that the relationship between SES and food choice motives will be small-to-medium in size [42]. Moreover, in a previous trial we ran at virtual fast food restaurants (osf.io/ajcr6), 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). 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 [43]. Thus, a sample of 1,000 participants (i.e., 580 per *labelling* or *availability* condition) allow for adequate power in our planned moderated mediation analysis.

We will recruit a sample of 1,200 participants (who start the study) to account for potential data loss due to drop outs and failed quality controls (approx. 20%) resulting in a minimum sample of 1,000

[1] Ellison 2013 [44]; no label: 765 (368) kcal; n=138
Ellison 2014 [45]; no label: 746 (368) kcal; n=1532
VanEpps 2016 [46]; no label: 605 (223) kcal; n=207

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 1,000 participants.

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9. APPENDIX A: PROCESS OF ORDERING MAINS ITEMS ON THE MENUS

For the all conditions, the lowest calorie and highest calorie item were identified. Meanwhile, the remaining eight items were categorised as either 'higher' or 'lower' calorie items, making sure that there were four items in each of these categories. Below is the example of this for the American C/CL condition.

Classic Broccoli Blackened Shrimp Alfredo	1360 kcal	Highest
Riblet Platter	1290 kcal	Higher
Brunch Burger	1220 kcal	Higher
Double Crunch Shrimp	1170 kcal	Higher
Clubhouse Grillle	1040 kcal	Higher
Grilled Chicken Caesar Salad	970 kcal	Lower
Classic Bacon Cheeseburger	870 kcal	Lower
Chicken Wonton Stir Fry	790 kcal	Lower
Signature Bourbon Street Steak	650 kcal	Lower
Cedar Salmon with Maple Mustard Glaze	370 kcal	Lowest

It was agreed that it is important that the lowest and highest calorie option are featured in certain positions on the menu. For example, it is important that the highest calorie option is featured at the 'top' of the menu as well as the 'bottom' and also being featured in the 'middle' of the menu. It is also important that the lowest calorie option is also featured on the menu in the same positions. Below is a table outlining what we mean by 'top' 'middle' and 'bottom' of the menu.

Position 1	Top
Position 2	Top
Position 3	Middle
Position 4	Middle
Position 5	Middle
Position 6	Middle
Position 7	Middle
Position 8	Middle
Position 9	Bottom
Position 10	Bottom

Below are six menu scenarios where you can see how these categories have formed different menu listings.

	1	2	3	4	5	6
Top	Highest Lower	Lower Highest	Lowest Higher	Higher Lowest	Lower Higher	Higher Lower

Middle	Higher Lower Higher Lowest Higher Lower	Lower Higher Lower Higher Lower Higher	Lower Higher Lower Highest Lower Higher	Higher Lower Higher Lower Higher Lower	Lower Higher Lowest Higher Lower Higher	Higher Lower Highest Lower Higher Lower
Bottom	Higher Lower	Lowest Higher	Lower Higher	Highest Lower	Lower Highest	Higher Lowest

It was also agreed that when 'highest' or 'lowest' items were featured in either the 'top' or 'bottom' positions, they should be counterbalanced by the opposite pair. For example, when the 'highest' item is at the top, this should be matched with a 'lower' item also being featured in the top section. Similarly, if the 'lowest' item was at the top, this should be matched with a 'higher' item also at the top.

In order to decide in what order the 'lower' and 'higher' options would feature in the menu, a random number generator was used. For example, using Excel the lower and higher items were assigned random values spanning from 1-10,000 and then coded from 1 to 8 in ascending order. Items with number 1 were listed first, either in the top segment (either higher or lower – explained above) or bottom segment. For the remaining 'higher' and 'lower' category items these were listed alternately according to their random number value, i.e. item number 2 was followed by 3 etc.

10. APPENDIX B: GLOBAL CUISINE SURVEY SUMMARY

Cuisine	I have never eaten this cuisine (%)*
American	8
Mexican	8
Italian	9
Chinese	13
Spanish	17
Japanese	22
Greek	24
French	25
German	27
Thai	29
British	31
Indian	31
Caribbean	35
Korean	38
Vietnamese	40
Swedish	42
Brazilian	47
Filipino	48
Moroccan	49
Hong Kong	49
Danish	50
Taiwanese	50
Norwegian	51
Lebanese	51
Argentinian	52
Turkish	53
Indonesian	53
Australian	53
Peruvian	53
Finnish	54
Malaysian	54
Singaporean	56
Saudi Arabian	59
Emirati	60

*1,184 US respondents

11. APPENDIX C: AUDIENCE (PROLIFIC WEBSITE)

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

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

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

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

5. ***Gender***

    50% of participants
    - Male

    50% of participants
    - Female

6. ***Students***

    92% of participants
    - No

    8% of participants
    - Yes

7. ***Highest education level***

    70% of participants
    - No formal qualifications
    - Secondary school / GCSE
    - College / A level

    30% of participants
    - Undergraduate degree (BA, BS, other)
    - Graduate degree (MA, MSc, MPhil, other)
    - Doctoral degree (PhD, MD, other)

12. APPENDIX D: RECRUITMENT TEXT

"This is a study examining food choices at restaurants. You will choose between different foods in various restaurants, and fill some questionnaires in about yourself. Overall the study will take about 15 minutes.

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

- You have 15 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.

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 E: INFORMATION PAGE

Fast Food Study

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 how different people make food choices at restaurants

Why have I been chosen to take part?

We are recruiting volunteers who fulfil the following criteria:

1. Aged ≥ 25 years
2. Fluent English speaker
3. Reside in the US
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 meal choice task based on different restaurants menus. 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 15 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 in the table 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 F: CONSENT PAGE

Fast Food Study

I confirm that I have read and have understood the information sheet for the above 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 G: BASELINE QUESTIONNAIRE

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

2. ***Age***
   - _ _ (free text; range of 25-99)

3. ***Ethnicity***
   - White, non-Hispanic
   - Black
   - Asian
   - Hispanic
   - Other

4. ***What is your current employment status?***
   - Full or part-time
     What is the full title of your main job?
     _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ (free text)
     For business owners, your business is valued at:
     $_ _ _ _ _ _ _ _ _ (free text)
   - 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.***
   - Less than high-school
   - High-school completion
   - Some college or associate degree
   - Bachelor's degree
   - Master's degree
   - Doctoral or professional degree

6. **After leaving middle school (i.e. after 8th grade), how many further years of higher education did you study for?**
   Examples:
   If you left middle school and did not go on to high school, your answer would be 0.
   If you left middle school and then studied for two years in high school, your answer would be 2.
   If you completed high school over four years and then also went to college for two years, your answer would be 6.
   - _ _ (free text)

7. ***What is your annual household income (before tax), including all earners in your household, in dollars (to the nearest $1000)?***
   $_ _ _ _ _ _ (free text; range 0-999,999)

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

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

10. ***Think of a ladder (see image) 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:
_ _ (free text: range 1-10)

11. ***How often, on average over the past year, have you had diner at restaurants?***
   - Not in the last year
   - Less than once per month
   - 1-3 times per month

- 1-2 times per week
- 3 times per week or more

12. Are you currently dieting?

- Yes
- No

13. Weight

_ _ . _ kg

14. Height

_ _ _ cm

15. How hungry do you feel?

---

0 100

Not at all hungry As hungry as I've ever felt

16. APPENDIX H: MEAL CHOICE TASK INSTRUCTION

Before the task begins:

> *"For this task, we would like you to imagine that you are going to eat out with friends for dinner. You will be asked to choose your meal from the menus of six different restaurants."*

For each dining out scenario:

> *"We would like you to imagine that you are eating out with friends for dinner at a **[…]** style restaurant. On the next page you will be at the door of the restaurant, then taken inside the restaurant. Then, you will be asked to choose your meal from the menu. When making your meal choice, try to imagine you actually are in the restaurant and choose food items that you would eat."*

On top of mains menus:

"Please choose you main meal"

On top of sides menus:

"Would you like to order any sides?"

On top of desserts menus:

"Would you like to order any desserts?"

17. APPENDIX I: SINGLE ITEM FOOD CHOICE QUESTIONNAIRE

Instruction: *"Several different factors influence our choice of food. Listed below are a series of factors that may be relevant to your choice of foods. 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	*Not important* 2	*Not very important* 3	*Neutral* 4	*Slightly important* 5	*Important* 6	*Very important* 7
1.	*is healthy*	○	○	○	○	○	○	○
2.	*is a way of monitoring my mood (e.g., a good feeling or coping with stress')*	○	○	○	○	○	○	○
3.	*is convenient (in buying and preparing)*	○	○	○	○	○	○	○
4.	*provides me with pleasurable sensations (e.g., texture. appearance. smell and taste)*	○	○	○	○	○	○	○
5.	*is natural*	○	○	○	○	○	○	○
6.	*is affordable*	○	○	○	○	○	○	○
7.	*This is an attention check. Please choose the answer 2 'Not important'*	○	○	○	○	○	○	○
8.	*is familiar*	○	○	○	○	○	○	○
9.	*helps me control my weight*	○	○	○	○	○	○	○
10.	*is environmentally friendly*	○	○	○	○	○	○	○
11.	*is animal friendly*	○	○	○	○	○	○	○
12.	*is fairly traded*	○	○	○	○	○	○	○

18. APPENDIX J: DEBRIEFING

Aim guessing:

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

[Free text]

Questionnaire:

1. There was an acceptable number of food items on the menus.

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

2. The food choices I made for each dining out scenario were influenced by how many calories I thought were in the food options available.

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

3. The food items available in the menus are common in […] style restaurants.

	Strongly disagree	*Disagree*	*Slightly disagree*	*Neither agree or disagree*	*Slightly agree*	*Agree*	*Strongly agree*
American	○	○	○	○	○	○	○
Mexican	○	○	○	○	○	○	○
Italian	○	○	○	○	○	○	○
Lebanese	○	○	○	○	○	○	○
Peruvian	○	○	○	○	○	○	○
Moroccan	○	○	○	○	○	○	○

4. The food items I picked for my meal in the […] style restaurant would be something that I would normally order in the real world.

	Strongly disagree	*Disagree*	*Slightly disagree*	*Neither agree or disagree*	*Slightly agree*	*Agree*	*Strongly agree*
American	○	○	○	○	○	○	○
Mexican	○	○	○	○	○	○	○
Italian	○	○	○	○	○	○	○
Lebanese	○	○	○	○	○	○	○
Peruvian	○	○	○	○	○	○	○
Moroccan	○	○	○	○	○	○	○

5. *Have you ever tried?*

- ☐ American cuisine

- ☐ Mexican cuisine
- ☐ Italian cuisine
- ☐ Lebanese cuisine
- ☐ Peruvian cuisine
- ☐ Moroccan cuisine

For each cuisines, if ticked:

How often, on average over the past year, have you ate food from […] style restaurant?

- ○ Not in the last year
- ○ Less than once per month
- ○ 1-3 times per month
- ○ 1-2 times per week
- ○ 3 times per week or more

19. APPENDIX K: DEBRIEFING TEXT

"In this study we were interested in the effect of nutrition interventions on food choices at restaurants.

All the participants saw the same six dining out scenario but in four different conditions. In the first condition, the menus reflected the food offer that can be found in restaurants in the US – for the six specific cuisines; in the second one energy labels for each food item were added on the menus; in the third one the proportion of healthy food items (low energy) was increased; in the fourth one energy labels were added and the proportion of healthy food items was increased. We will compare the total energy of the food items selected by the participants from the four conditions. The results will help to identify the most promising intervention to reduce the overall energy when dining out. You saw familiar and unfamiliar restaurants menus because we will test whether the effect of the interventions is influenced by how familiar the menu options are.

You also answered questionnaire about your food choices motivations and nutrition knowledge. We will test if the ones who are the most motivated by health in their food choices and who have better nutrition knowledge were more likely to use energy information when making food choices.

Thank you very much for your participation in our study!"