Nutri-score labelling in a UK restaurant setting: a randomised control trial

Clinical Trials Protocol

02/04/2025

Description: An experiment exploring the perceived effectiveness of Nutri-score food labels with calorie labelling compared to calorie labelling only on food choice and consumption in a real-world setting

Contributors: Amy Finlay, Andrew Jones, Rebecca Evans, Zoé Colombet, James Garbutt, Martin O'Flaherty, Zoi Toumpakari, Nick Townsend & Eric Robinson

Category: Project

Affiliated institutions: University of Liverpool, John Moores University, University of Bristol

License: CC-By Attribution 4.0 International

Subjects: Psychology, Life Sciences, Health Psychology

Background:

Data from the Food & You 2 survey conducted in 2022-2023 showed that between 60% and 72% of adults (according to age group) reported eating food out of home in the last four weeks while between 22% and 80% of adults reported ordering a takeaway in the last four weeks(1). Additionally, survey findings from 2024 suggest that 60% of UK adults eat food prepared outside of the home weekly(2). Individuals who eat out-of-home (OOH) food more frequently typically have poorer dietary quality due to a higher intake of energy and nutrients of concern (saturated fat, salt and sugar) and lower intake of fibre, dairy, fruit and vegetables(3). There is a need to improve the nutritional quality of meals selected by individuals in OOH settings.

Interventions to improve eating OOH typically fall into three categories: structural (e.g. changing the presentation or availability of food items)(4), fiscal (e.g. changing the price of food items)(5) or informational (e.g. labelling food items)(6). Labelling is seen by consumers as the most acceptable type of policy for unhealthy commodities(7), and has been shown previously to prompt healthier food choices by consumers(8), and result in healthier offerings from outlets(9).

Front of package (FOP) labels have been used in grocery store settings for some time. For example, in the UK multiple traffic light (MTL) labelling on packaged foods was introduced as a voluntary policy in 2013(10) while Nutri-score (NS) labels were implemented as a voluntary policy in France in 2017(11) and warning labels were mandated in Chile in 2016(12). A scoping review of FOP labelling strategies concluded that MTL, NS and warning labels were likely to be the most effective label types for informing consumers of the healthiness of food products(13), as opposed to informing consumers of guideline daily amounts. Warning labels highlight when a product is high in one specific nutrient (for example high in salt/high in sugar)(14), while MTL and NS use colour coded systems to summarise the healthiness of the product(15). Specifically, MTL labels report how various nutrients in a product (fat, saturated fat, sugar, sodium) compare to guideline daily amounts. Each nutrient is highlighted in red (signalling high content), amber (medium content) or green (low content)(16). In comparison, NS labels summarise the healthiness of a product as a whole and consider both positive and negative nutrients within the product (e.g., salt, saturated fat, fibre, protein). All items are categorised from A (Dark green - healthiest) to E (Red - least healthy) and highlighted in the corresponding colour(11). All three of these label types have been evaluated as high in Perceived Message Effectiveness (PME)(6), which is considered an early indicator of long-term behaviour change(17), but NS labels were perceived as more credible by consumers than warning labels(6).

NS labels, while first implemented in France (11), have since been adopted by a number of European countries(18). Evidence from online studies suggest that when NS labels are present, the nutritional quality of participant food choices is improved(19, 20), likely through decreasing the probability of choosing less healthy options while increasing the probability of choosing healthier options (6). A study in an experimental supermarket found similarly that NS labels improved the nutritional quality of a shopping cart when applied to three categories (breakfast cereals, sweet biscuits and appetizers)(21). When compared to pricing strategies, NS labelling was found to perform more effectively, through improving nutritional quality of selected foods(22).

Research conducted in supermarkets in France found that the introduction of NS labels was associated with significantly improved nutritional quality of food shops (mean UK Nutrient Profiling Model (NPM) score lowered by -0.27, an improvement of 4.45%)(23). Effects were found to be greater for people making the least expensive purchases, the majority of whom were those with the lowest incomes. This suggests that such a policy could help to reduce social inequalities, a vital consideration for food policy(24). Comprehension of NS was high, with 92% of consumers able to rank items in order of healthiness correctly(23), demonstrating that such labels can be considered informative. A limitation of the existing research is that it typically fails to explore compensation. For example, whether there is a possibility of later compensation, e.g. through subsequent purchase or consumption of less healthy products.

As NS has generally been considered a FOP label, to date there has been limited consideration of how this could be applied to the OOH food sector. A meta-analysis(25) of field studies of food labelling in a range of settings including cafeterias, supermarkets and a restaurant found that descriptive labels (e.g. calorie or other nutritional information) led to a directional overall reduction in unhealthy eating behaviour (selection/consumption of energy-dense, nutrient-poor foods), however this was not statistically significant. Conversely, evaluative labelling comprised of nutritional information alongside information to aid interpretation, such as colour coding (e.g. traffic light labels) or special symbols (e.g. warning labels/labels signifying healthier options) led to a significant reduction in unhealthy eating behaviour (effect size d=0.17). Greater effects are likely a result of increased drawing of attention and improved understanding of labels(6).

Only one study has explored how NS impacted food choices in a work cafeteria(26). This study used a non-randomised design with no control group and found introduction of NS was associated with improved nutritional quality of food choices (UK NPM score -0.22; 11.5%), and lower selected energy content. However, due to data being gathered through receipts, this study did not collect information on consumption or demographic characteristics, so individual differences in impact of NS could not be explored. The impact of NS labels in a full-service restaurant setting has not yet been tested. Recent research has considered the role of expectations in determining the potential impact of NS labels(27). This study found that due to underlying expectations of healthiness, effectiveness of NS may be reduced. For example, if a product was anticipated to be the least unhealthy category ('E') but was rated healthier (e.g. 'D'), there may be increased selection of the product marked 'D' due to reduced guilt around eating the product. Therefore, labelling combined with expectations may result in less healthy food selection. Due to this uncertainty surrounding NS labelling, it is important we test the effectiveness of NS in the OOH food sector.

There have been a small number of cross-country studies assessing various food labels on consumer understanding and choice that have included UK participants(28, 29), and one online study of UK participants exploring the impact of labelling types on the ability of participants to rank packaged food items in order of healthiness(30). However, there is no research we are aware of that has tested NS labels on food choice in a UK OOH context.

The present study will be conducted in multiple independent outlets in the UK OOH food sector and examine the impact of NS menu labelling. Participants will visit an outlet and be randomized to order from the restaurant's menu with calorie information or a menu with calorie information and NS labelling. The main objective of this study is to assess differences in PME according to labelling condition. Secondary objectives are to measure the effect of NS labels on the nutritional quality of food selected (UK NPM scores), energy content of the meal (both ordered and consumed) and likelihood of selecting a healthier and a less healthy option. Whether impacts of NS labelling differ based on participant characteristics will be explored (Socioeconomic Position (SEP), food choice motives) and we will also examine later food intake to assess whether there is any evidence of between condition differences (e.g., compensating for healthier meal choice in the NS condition by consuming less healthy food later in the day).

Study Information

Hypotheses:

Participants in the NS with calorie labelling condition will score higher on PME relating to the menu compared to participants in the calorie labelling only condition.

Participants in the NS with calorie labelling condition will order a meal with greater nutritional quality compared to participants in the calorie labelling only condition.

Participants in the NS with calorie labelling condition will order fewer calories from food overall compared to participants in the calorie labelling only condition.

Participants in the NS with calorie labelling condition will be more likely to choose healthier items (categorised as A/B) from the menu, and less likely to choose less healthy items (categorised as D/E) from the menu compared to participants in the calorie labelling only condition.

Design Plan

Study type: Experiment - A researcher randomly assigns treatments to study subjects; this includes field or lab experiments. This is also known as an intervention experiment and includes randomised controlled trials.

Blinding: Participants will not know the treatment group to which they have been assigned.

Is there any additional blinding in this study? To attempt to reduce the likelihood of aim guessing, participants will be recruited to a study described as 'A study of consumer behaviour in different restaurants'.

Study design: Businesses are being actively recruited for this study. We aim to have a minimum of two outlets available for participants to visit. This study is a randomised controlled trial using a between-subjects design. Participants will be asked to visit a restaurant to eat lunch and complete some questionnaires. Participants will select one of the available restaurants to visit and will be randomly assigned to one of two conditions: Calorie labelling only or NS with calorie labelling. Later intake (over the rest of the day, after the lunch time study session) will be self-reported by participants. If one outlet is more popular than the other outlet(s), and we are not obtaining a similar number of participants for the outlets on offer, then we will actively recruit participants to each of the outlets to ensure a similar number of participants are recruited to each outlet tested.

Randomisation: Participants will be randomised to one of the two conditions. Data collection days at each of the outlets will be randomised as either NS with calorie labelling or calorie labelling only. Data collection days will be randomly assigned to condition using the RANDBETWEEN function in excel.

Sampling Plan

Existing Data: Registration prior to creation of data

Explanation of existing data: N/A

Sample

Data collection procedures: We will use an existing participant database consisting of local volunteer participants recruited through social media advertising. Only participants who have not taken part in previous similar research conducted by the appetite group at the University of Liverpool will be contacted. If required, more participants will be recruited from the local community (e.g. adverts on social media/posters in the university). Participants who sign up to the study can bring up to 4 guests with them to also take part. Tables of 5 participants were determined as the upper limit as it was deemed a manageable size for researchers to effectively monitor individual orders. Over the course of the study, we will attempt to ensure our sample is representative of the UK population in terms of gender (50% male, 50% female), age (36% aged 18-39; 64% aged 40+(31)), and SEP - education level (50% level 3 and above (2+ A-levels or equivalent, not including apprenticeships(32)).

 Inclusion criteria**:**

- Can visit a restaurant in Liverpool city centre
- Regularly eat food prepared out of the home (from restaurants, cafes, fast food etc., at least once a month)
- Over the age of 18 years
- Fluent English speaker

Exclusion criteria:

- Pregnant/breastfeeding
- You have been diagnosed with a current or historic eating disorder

We will check whether participants have any food allergies prior to taking part in the study and ensure that if there are allergies this information is communicated to the food outlet by a researcher. All participants will be aware of the nature of the study (i.e. consuming food/drink in a food outlet) - this will be explicitly stated in the Information Sheet. The information sheet will also draw attention to the potential risks of taking part if a participant has a food allergy and that they should consider this before deciding whether to visit the food outlet.

Procedure:

Participants will be contacted via email and asked to complete a short online screening questionnaire. Screening will ensure participants meet the inclusion criteria.

Participants that pass the screening questionnaire will be contacted to book the date and time of their meal at one of the food outlets in Liverpool city centre. There will be 6 time slots available over lunch time (between 12 and 2.30). Participants will be able to bring up to four guests with them to take part in the study. All guests must meet the inclusion criteria.

Each **study day** will be randomised to one of the two conditions:

- *Calorie labelling only condition*
- *NS with calorie labelling condition*

Upon arrival, all participants will be asked to provide verbal consent to take part in the study. The menu randomised according to day using the RANDBETWEEN function in excel (Calorie labelling only or NS with calorie labelling) will be provided to all participants, and they will order their meals and drinks with the wait staff when they are ready.

Participants will be provided with their lunch. Before serving foods, away from the view of participants, researchers will take a picture of each plate of food. Each picture will be uploaded to a personal folder labelled with each participant ID.

When they have finished each food course, plates will be cleared by wait staff and taken to another part of the restaurant, away from view of the participants. Researchers will take photographs of the plates to document any food left over, and images will be uploaded to participant personal folders. Participants will each pay for their meal once they have finished.

Participants will be asked to complete a questionnaire on an iPad to collect demographic information, assess health food choice motives, PME relating to the menu labels and to guess the aim of the study. Participants will also be asked to confirm the food items they ordered, whether they had any additional components such as condiments, and to report whether they shared any items with others at the table and if so, how much was shared. Participants will be given clear examples of how to report this. Upon completion of the study session, participants will complete a payment form to receive monetary reimbursement. This reimbursement will compensate participants for travel and time.

The next morning, participants will be emailed with a link to Intake 24, an online programme for dietary recall. They will be asked to report anything that had been eaten after the lunch time meal the previous day. Following this, all participants will be fully debriefed.

The restaurants in which this study will take place will be independent restaurants in Liverpool city centre. As they are small, independent businesses, they are not required to report any nutritional information. Researchers liaised with restaurant owners, chefs and front of house staff to gather the required menu information (ingredients, cooking method) to calculate the nutritional content of meals using Nutritics(33), a platform which can be used to estimate the nutritional content of meals using validated methods. The NS values for all items on the food menus of the outlets were calculated using the NS spreadsheet available online (34). There are currently three outlets where data collection is planned to take place. These are all in Liverpool city centre and are 1) a plant-based café, 2) a café in the university campus and 3) a street-food inspired café.

Variables

Manipulated variables: Whether participants are provided with a calorie labelled menu or a menu where each item is also labelled with a NS classification from A (healthiest) to E (least healthy).

Adapted NS: The NS classification was created in France to apply to packaged food products, and the calculations are made based on energy, nutrients (saturated fat, sugar, salt, fibre, protein) and fruit, vegetable and nut content per 100g of the food product. Fruit, vegetable and nut content for each menu item was estimated by two researchers individually. Any disagreements were resolved by

discussion. In order to accurately categorise food products in an OOH venue, some adaptations were made to account for the serving size of items. Cut off values for energy content (kcal) based on UK nutrition guidance were used according to menu category. If the kcal content of items was below the lower cut off value, items were upgraded a NS value (e.g. from C to B). If the kcal content of items was above the higher cut off value, items were downgraded a NS value (e.g. from C to D)

- Starters and sides 280kcal/600kcal
- Mains 600kcal/860kcal

These cut-off values were informed by UK Public Health guidance, where available. 280kcal was deemed a suitable size for a small dish to accompany a main meal, based on NHS guidance for snacks(35). 600 kcal was selected as the recommended energy content for main meals(36), therefore was deemed suitable for main meals but excessive for starters and side dishes. Above 860 kcal was deemed excessive for main meals, as it would exceed the average calorie guideline for a main meal set out in the calorie reduction technical report(37).

As an additional measure to accurately represent the healthiness of items, if any items contained ≥100% of the average guideline daily allowance of energy, saturated fat, salt, or sugar, it was not possible for the item to score higher than an E.

On the NS labelled menus, there will also be a short description of how the labels are calculated:

"Nutri-score represents the overall healthiness of menu items on a scale of A (healthiest) to E (least healthy). This score is calculated according to the content of energy and key dietary nutrients (e.g. saturated fat, sugar, salt, protein, fibre).

This does not differentiate between fructose (i.e. sugar found in fruit) and refined sugar or directly account for vitamin/mineral contents or level of processing."

Measured variables:

Perceived Message Effectiveness

An adapted version of the University of North Carolina PME scale(38) will be used to measure health concern, product attitude, and discouragement of item consumption in response to the food menu. Participants will be given the menu they ordered from to look at. All participants will answer 3 questions using a Likert scale ranging from 1 – 5 anchored by "not at all" and "a great deal". The mean response to the three items will be calculated. PME is used as an early indicator of a health message's potential to change behaviour (e.g., reduce selection of less healthy items)(17). The scale has been used previously to identify the potential impact of food labels and is predictive of long-term behaviour (39-45).

NS label of each item selected (A,B,C,D,E).

A NS category value will be recorded for each item selected by participants.

Nutritional quality of each item and for the full meal

Nutritional quality for meal choices will be calculated using the UK NPM scoring system(46). This calculates a score (continuous variable) for a product by deducting a total score for positive nutrients from a total score for negative nutrients. A lower score represents greater nutritional quality and a higher score represents poorer nutritional quality.

We will calculate the mean NPM score weighted by energy content of items for each participant. This will ensure that the NPM score of main dishes will be weighted higher than that of starters or sides (assuming energy content of selected main is higher than any starters or sides), leading to a more representative overall NPM score for food orders. This will be done using the weighted.mean function in R(47). This function multiplies each value (i.e. NPM scores for individual items) by its corresponding weight (kcal content of individual items), sums all items and then divides this by the sum of the weights.

Energy content of all food ordered

The sum of energy (kcal) across all foods ordered for the meal will be calculated

Energy and nutrients consumed

Researchers will take pictures of plates before and after each item is given to participants. Researchers will estimate the percentage of each dish consumed, by estimating the percentage of individual meal components that have been eaten. Estimations will be guided by the information available from the nutritional analysis of items, which details the proportion of the meal that is made up by individual components. For example:

Fish and chips: Total energy comes from 41% fish, 41% chips, 12% mushy peas, 5% tartare sauce, 1% watercress.

- *If 50% of chips are left (20.5% total) and 1/3 mushy peas left (4% total), then 24.5% of the meal was not eaten and 75.5% of the meal was eaten.*

Participants will also be asked whether they shared any of their meal with someone else and this will be taken into account when making percentage estimates. A random 10% of percentage estimates will be performed by a second researcher to measure reliability.

Energy and nutrient consumption will be calculated by multiplying the total energy/nutritional content of food items selected/consumed by the estimated proportion of the item consumed. Nutrients explored will be salt, sugar, fat, saturated fat, protein and fibre.

Later intake

The morning after participants take part in the study, they will be emailed with a link to complete a dietary recall survey (via intake 24, https://intake24.co.uk/). Participants will report everything they ate after the study session up until they went to bed. They will be asked to provide as much detail as possible on what they had for dinner, snacks, and drinks after the study session. We will estimate based on data from Intake 24, later consumption (kcal, salt, fat, saturated fat, sugar, protein, fibre).

Participant characteristics

To characterise the sample and present outcomes by individual participant variables, participants will be asked to report their gender, age and ethnicity. Height and weight data will also be collected to calculate body mass index (BMI), so participants can be classified into underweight, healthy weight, overweight or obesity.

Highest educational qualification: measure of socioeconomic position (SEP)

Participants will be asked to report their highest educational qualification. If they are still studying, they should report the diploma they are currently studying for. The categories provided will be:

- Less than high school
- High school completion
- College or foundation degree
- Bachelor's degree
- Master's degree
- Doctoral or professional degree

Frequency of eating OOH

Participants will be asked to report how often they eat food prepared OOH. They will be provided with an explanation of what constitutes OOH (e.g., "How often over the past year on average have you eaten food prepared out of the home? This includes food from a restaurant, café, pub or similar venue"). The response options will be:

- 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

Measure of health food choice motives

The Food Choice Questionnaire(48) is comprised of nine factors (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity & ethical concern). We will include the health motive scale into our questionnaire to assess whether the value of health is associated with the impact of NS labelling on participant food choices.

Attention check

An attention check will be placed in the questionnaire: "This question is an attention check, so please answer truthfully. How many times have you visited the planet Mars? Several times / Just once / Never".

Correct answer: Never

Aim guessing

Participants will be asked what they believe the aims of the study to be. Anyone that guesses the study aims to be investigating the influence of food labels on food choice or consumption will be coded as being aware of study aims. Two researchers will independently code awareness of aims and any discrepancies will be judged by a third researcher.

Label awareness/understanding

Participants will be asked the following questions using a funneled approach whereby questions will be presented one by one:

1) Did you notice any labels or additional information on your food menu? (Yes/No)
   [If no, skip to Q5]

2) Which labels/information did you see on the food menu? (select one of the following)
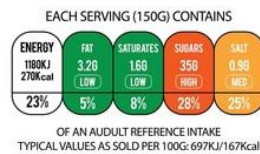
Calorie information

None of the above labels/information

[If incorrect, skip to Q5]
3) Did the labels/information influence your food selection? (Yes/No)
   [If no, skip to Q5]
4) How did the labels/information influence your food selection? (I chose a meal with a healthier classification/I avoided a meal with a less healthy classification/Other)

5) Nutri-score is a labelling strategy used in several European countries on food packaging. Nutri-score represents the healthiness of menu items on a scale of A (healthiest) to E (least healthy). This score is calculated according to the amount of healthy and unhealthy nutrients.

If the UK government introduced a policy requiring the use of a 'Nutri-score' system on food menus, how would you feel? (Likert scale ranging from 1 – 5 anchored by "strongly oppose" and "strongly support")

Study flow

Recruitment	• Participants will be identified via an existing database of individuals who expressed interest in taking part in research or through social media advertisement.
	• Prospective participants will be emailed with a brief study overview (consumer behaviour at different restaurants) and a link to complete the screening questionnaire (Appendix A).
	• Throughout the study (e.g. after 25%, 50% and 75% completion achieved), we will examine the characteristics of participants to ensure the sample is broadly representative of the UK population. If this is not the case (e.g. there are 70% female participants) then recruitment will be altered to source the participants needed (i.e. to recruit an equal number of male participants). This will be done through targeted advertising.
Information sheet and informed consent	• Eligible participants will be e-mailed an information sheet (Appendix B) and consent form (Appendix C). Participants will be told they can ask any questions about the study via e-mail.

	• The researcher will schedule a study visit day. For each of the restaurants, there will be 6 available lunch time study slots scheduled every 30 minutes between 12pm and 2.30pm. Participants may bring a maximum of four guests aged 18 years or older to the restaurant, and must confirm the final number of participants, and that all guests meet inclusion criteria. • As the additional guests would not have received an online information sheet and consent form, upon arrival at the restaurant all participants will be provided with information by the researcher and will give verbal consent. The researcher will answer any questions prior to the study. • Study days will be randomised as calorie labelling only or NS with calorie labelling condition.
Meal choice task	• Participants will be given a participant number which must be entered in the follow-up questionnaire they complete.

Control condition	Experimental condition
Participants will receive a calorie labelled menu without NS labels. The menu will include a statement that 'Adults need on average 2000 kcal per day'.	**Experimental condition** Participants will receive a menu with each item labelled with calorie content and a NS value (A to E, where A is the healthiest in dark green and E is the least healthy, in red). The menu will include a statement that 'Adults need on average 2000 kcal per day'. Text at the bottom of the menu will show the full Nutri-score diagram and read: " Nutri-score represents the overall healthiness of menu items on a scale of A (healthiest) to E (least healthy). This score is calculated according to the content of energy and key dietary nutrients (e.g. saturated fat, sugar, salt, protein, fibre). This does not differentiate between fructose (i.e. sugar found in fruit) and refined sugar or directly account for vitamin/mineral contents or level of processing"

	• The participants will be asked to order lunch from the menu. The procedure of placing orders will be finalised with the restaurant staff. • When meals are ready, researchers will take a picture of each plate of food and serve to participants. A second photo of each plate will be taken when meals are finished, and plates are cleared.
Post-meal assessments (Qualtrics)	• After finishing their meal, participants will be provided with an iPad to complete a follow-up questionnaire (Appendix D), which will ask them to guess the aim of the study, collect information on perceived message effectiveness, health food choice motives,

	demographic characteristics, and label awareness and understanding.
Reimbursement	• Participants will pay for their meals individually before being asked to complete a payment form. • Participants will receive reimbursement for their time and travel and serve as an incentive for people from different SEP strata to participate.
Later intake	• After the restaurant visit (the next morning), participants will receive a link to Intake 24, an online programme used for dietary recall. This will be used to estimate intake for the remainder of the day after the study session.
Debrief	• Participants will be sent a debrief sheet which will detail the full aims of the study. (Appendix E)

Analysis Plan

Participant characteristics:

Only participants who completed the restaurant visit (consumed a meal and completed the questionnaire) will be included in analysis. We will report analyses with any participants who guess the aims of the study included and excluded. We will identify any cases where the height and weight data provided has resulted in an implausible BMI value (<12kg/m^2 and >100kg/m^2(49)) and exclude these subjects from analysis involving BMI.

Participant characteristics will be presented in a table. Data will include age, gender, ethnicity, BMI and highest education level. Continuous variables will be summarised by means and standard deviations, categorical variables will be summarised by counts and percentages. The descriptives table will report variables overall and split by condition and outlet.

Descriptive analyses:

We will report quantitative questionnaire findings and main outcomes by condition in a table. This will consist of: frequency of eating OOH food, health food choice motive scores, label awareness/understanding, PME, UK NPM score, kcal selected and consumed and the proportion of participants selecting food with each label (A-E). As above, these variables will be reported overall and split by condition and restaurant.

Anticipated primary analyses:

Shortly after starting data collection and prior to any interim analyses, we will finalise the full analysis plan and publish this alongside the protocol on the Open Science Framework. The anticipated analysis approach is briefly stated below.

PME

A linear mixed model will be used to assess the impact of labelling condition (calorie labelling only/NS with calorie labelling) on PME relating to the food menu (a mean score).

Nutritional quality of ordered meal (UK NPM score)

A further Linear mixed model will be conducted to explore the impact of labelling condition (calorie labelling only/NS with calorie labelling) on the nutritional quality of the participant's full meal (mean weighted UK NPM score: linear outcome variable).

Secondary analyses:

Likelihood of selecting a healthier option (A/B)

Any participants who have selected a healthier item (A/B) as part of their meal will be coded as 1 and participants who have only selected options with a C/D/E value will be coded as 0. We will conduct a logistic regression to test whether NS labelling (Y/N) is associated with the likelihood of selecting a healthier item.

Likelihood of selecting a less healthy option (D/E)

Similar to the above, any participants who select a less healthy item (D/E) as part of their meal will be coded as 1, and participants who have only selected options with a A/B/C value will be coded as 0. We will conduct a logistic regression to test whether NS labelling (Y/N) is associated with the likelihood of selecting a less healthy item.

Energy and nutrient content consumed at lunch

Similar to primary analyses, we will explore the impact of NS labelling on total energy and nutrient content of food consumed (linear outcome variables) through n=8 linear mixed models. The nutrients explored will be salt, sugar, fat, saturated fat, protein, fibre and fruit vegetable and nut content.

Transformations: N/A

Inference criteria: Results for primary analyses will be considered significant at p<0.05, and to account for multiple comparisons, secondary analyses will be considered significant at p<0.01.

Data exclusion: If participants leave the restaurant study session without ordering food their data will be excluded from analyses.

Missing data: If participants do not complete the dietary recall survey, and therefore do not provide data of later intake, then we will impute the missing data for this variable. Any missing data for other outcomes (e.g., PME) will also be imputed. We will complete multiple imputation with 5 imputed datasets(50) in R using the 'mice' package. Imputation will be reported in line with published guidance(51).

Exploratory analysis:

Other:

Sample size:

We conducted a simulation to estimate sample size required for two primary outcomes: PME and NPM scores. Our simulation was based on previous research and knowledge of the outlets confirmed for data collection.

We simulated running the study with 20 participants a day for 20 days (400 total data points). For PME, we estimated from previous research that we may have an intercept PME value of 1.85 (SD: 1.08), with an intervention effect of 1 (the intervention group will have PME values 1 unit greater than the control group on average, based on previous research(52)), and minimal difference in PME

scores between the two outlets (0.2). We also assumed ICC of approximately 0.200, and a standard deviation of the random intercept of eating group in a mixed model of 1. Across 200 simulations using a regression model clustered by day, we would have 94% power (95% CI 89.75, 96.86) to detect differences in PME between the two conditions.

For NPM scores, we calculated using the two confirmed outlet menus, that we may have an intercept NPM score of -0.27 (SD: 3.29) with an intervention effect of 0.22 (the intervention group will select meals with with greater nutritional quality, shown by a 0.22 higher NPM score) based on previous research(26) and a mean difference between the two outlets of 1.4 (the difference in mean NPM scores for the two outlets). We also assumed ICC of approximately 0.819, and a standard deviation of the random intercept of eating group in a mixed model of 1. Across 200 simulations using a regression model clustered by day we would have 88.5% power (95% CI 83.25, 92.57) to detect differences in NPM scores between the two conditions.

Due to uncertainty over size of anticipated effects and available resources, we will increase the above desired maximum sample size (400) by 12.5% to 450 participants.

Stopping rule

Prior to the study we do not know with certainty what the rate of participant recruitment will be, and effect size estimates have a degree of uncertainty. To balance the trade-off between costs (e.g., in research time, participant burden) and likelihood of the study providing convincing evidence, we will conduct interim analyses to assess whether the results are convincing enough to conclude that effects on PME and nutritional quality of food order are present(53). The interim analyses will examine the effect sizes of these two primary outcomes and observed statistical significance. We will also calculate Bayes Factors to assess the strength of evidence for the experimental vs null hypotheses.

We will conduct the interim analysis when we have obtained approximately 50% of the full sample (224 participants, ~112 completers in each condition). If at this point, the data suggests that it is extremely unlikely that either of the predicted effects would be observed up to maximum sample size capacity (described above), and if Bayes Factors suggest there is evidence for the null hypothesis (BF10 < 0.3) then we will cease data collection and conduct full planned analyses.

However, if the observed effect size suggests that an effect size statistically detectable at N=450 is present but is not statistically significant at interim, or Bayes Factors do not provide support for either the null or alternative hypothesis (BF10 > 0.3 and < 3), we will continue data collection to recruit the largest possible sample size and adjust p values (dividing by 2 for outcomes examined at interim to account for multiple analyses) to account for error rate inflation for final full sample analyses.

Due to the sample size required and potential difficulties in recruiting sufficient numbers for each stratum (e.g., lower SEP individuals, males) we may need to adjust plans during data collection. If we experience recruitment difficulty during the first month of data collection, we will prioritise stratifying by SEP ahead of age and sex, as individuals with a higher education level are more motivated by health when making food choices (16).

Appendix A: Recruitment text

This is a study exploring eating out at restaurants. If you wish to take part, you will need to complete a short screening questionnaire to ensure you are eligible to take part.

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

- You currently reside in Liverpool and can visit a restaurant in the city centre for lunch on a weekday.
- You regularly eat food prepared out of the home (from restaurants, cafes, fast food, etc.)
- You are over the age of 18 years
- You are a fluent English speaker
- You are **not** pregnant/breastfeeding
- You have **no** current or historic eating disorder

If you are eligible, you will be asked to come to a restaurant in Liverpool city centre for lunch at a pre-specified time between 12 and 2:30pm on a weekday. You can bring up to 4 friends with you to take part. All participants must meet the above criteria.

You will be able to choose a meal from a full restaurant menu and asked to complete a couple of short questionnaires. You will each pay for the meal yourself and receive monetary reimbursement of £20 for your time once the study is complete. This reimbursement should cover meal and travel costs associated with taking part in the study.

The following morning you will be sent a link to follow to report what you ate for the rest of the day following the meal.

To complete the screening questionnaire, please follow the link below:

[insert link]

UNIVERSITY OF
LIVERPOOL

A study on consumer behaviour in different restaurants

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 consumer habits in different types of restaurants.

Why have I been chosen to take part?
We are recruiting volunteers who fulfil the following criteria:
- You can visit a restaurant in Liverpool city centre for lunch on a weekday.
- You regularly eat food prepared out of the home (from restaurants, cafes, etc.)
- You are over the age of 18 years
- You are a fluent English speaker
- You are not pregnant/breastfeeding

Please be aware of the potential risks of taking part if you have a food allergy. These risks are no higher than if you were to eat food at a restaurant generally, however, please consider this before deciding whether to take part in the study. If you do have a food allergy and still wish to take part in the study, please inform the researcher of your allergy so they can ensure the restaurant are aware.

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?

Following a short online screening questionnaire, you will be required to come to a restaurant in Liverpool city centre for your lunch on a weekday. You can come alone or with up to four friends. You will be asked to order your meal and then provide some information about yourself (e.g., age, gender). You will then be served your lunch. When you have finished your food you will be asked to complete another short questionnaire and pay for your meal. The following morning you will be sent a link to follow where you will be able to report what you ate for the rest of the day following the lunch time meal. So that your awareness of the study hypotheses does not affect your behaviour in the study we will 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. The study should take approximately 60-90 minutes, depending on how long you take to eat your lunch. You will be reimbursed for your time, the reimbursement provided should cover meal costs plus travel expenses incurred.

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 Amy Finlay (**amy.finlay@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. Further information on how your data will be used can be found in the table below.

How will my data be collected?	Through measurement of in-person tasks, questionnaires and food ordered.
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 monetary reimbursement.

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. We cannot guarantee payment if you do not complete all three visits.

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 Amy Finlay or Eric Robinson (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: Amy Finlay (amy.finlay@liverpool.ac.uk)
2.80, Eleanor Rathbone Building
University of Liverpool,
L69 7ZA,

or the senior researcher: Prof. Eric Robinson (robinsoe@liverpool.ac.uk)

I confirm I have read the information sheet
o   Yes

Appendix C: Consent form

UNIVERSITY OF LIVERPOOL

A study of consumer behaviour in different restaurants

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 questionnaires and ordering and eating lunch in a restaurant.

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

- o   Yes

Appendix D: Follow up questionnaire

1. How comfortable did you feel in this restaurant?

- ☐ Very uncomfortable
- ☐ Slightly uncomfortable
- ☐ Neutral
- ☐ Comfortable
- ☐ Very comfortable

2. Was this restaurant representative of restaurants you normally eat in?

- ☐ Yes
- ☐ No

3. Would you eat in this restaurant again?

- ☐ Yes
- ☐ No
- ☐ Maybe

3a. Please elaborate on the reasons behind your answer to the previous question.

_____
_____
_____

4. What do you think the aim of this study was?

_____
_____
_____

5. Did you share any of the food or drink items?

- ☐ Yes
- ☐ No

5a. [if yes] What items were shared? Please give an estimation in % of how much of each item was shared and specify what was (i) given to others and (ii) received from others.

Example response: Potato bites, 20% given to others. Greek salad, 10% received from others.

_____
_____
_____

6. Did you add any condiments (e.g., sauce, salt, pepper) to your food?

- ☐ Yes
- ☐ No

6a. [if yes] What condiments did you add? Please give an estimation in teaspoons of how much of each condiment was added.

Example response: ½ teaspoon of salt

_____
_____
_____

7. *[Health food choice motives measure]* 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
1	*Is high in fibre and roughage*	○	○	○	○
2	*Is nutritious*	○	○	○	○
	This is an attention check. *Please select the answer (2) 'A little important'*	○	○	○	○
3	*Contains a lot of vitamins and minerals*	○	○	○	○
4	*Is high in protein*	○	○	○	○
5	*Keeps me healthy*	○	○	○	○
6	*Is good for my skin/teeth/hair/nails etc.*	○	○	○	○

8. This is an attention check. How many times have you visited the planet Mars?

- ○ Several times
- ○ Just once
- ○ Never

9. What is your age (in years):

10. What is your sex? A question about gender identity will follow

- ☐ Male
- ☐ Female

11. Which of the following best describes your gender?

- ☐ Man

- ☐ Woman
- ☐ Non-binary
- ☐ Other
- ☐ Prefer not to say

12. What is your highest educational qualification? If you are a student please select the qualification being studied for.

- ☐ Less than high school
- ☐ High school completion
- ☐ College or foundation degree
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Doctoral or professional degree

13. Please select your ethnicity:

- ☐ White English/Welsh/Scottish/Northern Irish/British
- ☐ White Irish
- ☐ Any other White background
- ☐ White and Black Caribbean
- ☐ White and Black African
- ☐ Any other mixed/multiple ethnic background please describe
- ☐ Indian
- ☐ Pakistani
- ☐ Bangladeshi
- ☐ Chinese
- ☐ Other Asian
- ☐ African
- ☐ Caribbean
- ☐ Arab
- ☐ Any other ethnic group

14. What is your weight

- ☐ In KG _____
- ☐ In Stone and pounds _____
- ☐ Prefer not to say

15. What is your height

- ☐ In centimetres_____
- ☐ In feet and inches _____
- ☐ Prefer not to say

16. How often, on average, over the past year have you eaten out (e.g., at a restaurant, café)?

☐ 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

17. Did you notice a label on the food menu? *[If no, skip to Q21]*

☐ Yes
☐ No

18. Which labels/information did you see on the food menu? (select one of the following) *[If incorrect, skip to Q21]*

☐   ☐   ☐   ☐   ☐

Calorie information

☐

19. Did the label/information influence your food selection? (Yes/No) *[If no, skip to Q21]*

☐ Yes
☐ No

20. How did the label/information influence your food selection?

a. I chose a meal with a healthier classification
b. I avoided a meal with a less healthy classification
c. Other

21. Nutri-score is a labelling strategy used in several European countries on food packaging. Nutri-score represents the healthiness of menu items on a scale of A (healthiest) to E (least healthy). This score is calculated according to the amount of healthy and unhealthy nutrients.

If the UK government introduced a policy requiring the use of a 'Nutri-score' system on food menus, how would you feel? (Likert scale ranging from 1 – 5 anchored by "strongly oppose" and "strongly support")

Strongly Oppose	Oppose	Neutral	Support	Strongly Support
☐	☐	☐	☐	☐

22. *[PME measure - participants in both conditions (calorie labels/NS with calorie labels) will be given the menu they ordered from].*

Please look at the menu you were given, and think about the menu.

"The menu made me concerned about the health effects of consuming less healthy menu items"

- ☐ Strongly disagree
- ☐ Slightly disagree
- ☐ Neither agree nor disagree
- ☐ Slightly agree
- ☐ Strongly agree

"The menu made consuming less healthy items seem unpleasant"

- ☐ Strongly disagree
- ☐ Slightly disagree
- ☐ Neither agree nor disagree
- ☐ Slightly agree
- ☐ Strongly agree

"The menu discouraged me from wanting to consume less healthy items".

- ☐ Strongly disagree
- ☐ Slightly disagree
- ☐ Neither agree nor disagree
- ☐ Slightly agree
- ☐ Strongly agree

Appendix E: Debriefing text

In this study we were interested in the effect Nutri-score labels on perceived effectiveness of labels, food choice and consumption. Nutri-score labels are used on food packaging in a number of European countries.

 In order to categorise items, scores are calculated by considering the healthy aspects of an item (e.g. fibre, protein, fruit, vegetable and nut content) and the less healthy aspects (e.g. salt, sugar, fat and saturated fat). Scores correspond to a letter where A (dark green) represents the healthiest items and E (red) represents the least healthy items.

Participants were presented with a regular menu, or a menu where all items were given a Nutri-score categorisation.

We wanted to investigate whether being shown a menu with Nutri-score would make people rate the menu as more effective in terms of communicating the healthiness of items. We also wanted to see if being shown the menu made participants more likely to select a healthier option and order fewer calories.

Finally, we wanted to see if being provided with Nutri-score labels was associated with later intake. Specifically, if healthier choices are made at lunch time, are these compensated for later in the day (e.g. by eating unhealthy food or more food later on).

The questionnaire about food choice motives and compensatory health beliefs will be used to test any characteristics and motivations that may impact the amount of food eaten.

If this study has raised any issues regarding your weight or eating behaviours, we recommend contacting your doctor.

The following NHS page provides information and guidance on eating a healthy, balanced diet: https://www.nhs.uk/live-well/eat-well/

Thank you very much for your participation in our study.

References

1.   Beth Armstrong LK, Robin Clifford, Mark Jitlal, Katie Mears, Charlotte Parnell & Daniel Mensah. F&Y2 Wave 6. UK: Food Standards Agency; 2023.
2.   Mariani E, Chacko A, Stewart I, Hadley M, Sleeman C, Bowes Byatt L, et al. How eating out contributes to our diets. UK: Nesta; 2024.
3.   Gesteiro E, García-Carro A, Aparicio-Ugarriza R, González-Gross M. Eating out of Home: Influence on Nutrition, Health, and Policies: A Scoping Review. Nutrients. 2022;14(6):1265.
4.   Marty L, Reed SM, Jones AJ, Robinson E. Increasing availability of lower energy meals vs. energy labelling in virtual full-service restaurants: two randomized controlled trials in participants of higher and lower socioeconomic position. BMC Public Health. 2021;21(1):1-11.
5.   Dogbe W, Akaichi F, Rungapamestry V, Revoredo-Giha C. Effectiveness of implemented global dietary interventions: a scoping review of fiscal policies. BMC Public Health. 2024;24(1):2552.
6.   Song J, Brown MK, Tan M, MacGregor GA, Webster J, Campbell NRC, et al. Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis. PLOS Medicine. 2021;18(10):e1003765.
7.   Reynolds JP, Archer S, Pilling M, Kenny M, Hollands GJ, Marteau TM. Public acceptability of nudging and taxing to reduce consumption of alcohol, tobacco, and food: A population-based survey experiment. Social Science & Medicine. 2019;236:112395.
8.   Cecchini M, Warin L. Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies. Obesity Reviews. 2016;17(3):201-10.
9.   Essman M, Burgoine T, Huang Y, Jones A, Polden M, Robinson E, et al. Changes in energy content of menu items at out-of-home food outlets in England after calorie labelling policy implementation: a pre-post analysis (2021-2022). medRxiv. 2024:2024.08.09.24311741.
10.   Department of Health and Social Care. Front of Pack nutrition labelling guidance. UK: GOV.UK; 2013.
11.   Sante Publique France. Nutri-Score France: Sante Publique France; 2024 [Available from: https://www.santepubliquefrance.fr/en/nutri-score.
12.   Taillie LS, Bercholz M, Popkin B, Reyes M, Colchero MA, Corvalán C. Changes in food purchases after the Chilean policies on food labelling, marketing, and sales in schools: a before and after study. The Lancet Planetary Health. 2021;5(8):e526-e33.
13.   Temple NJ. Front-of-package food labels: A narrative review. Appetite. 2020;144:104485.
14.   Clarke N, Pechey E, Kosīte D, König LM, Mantzari E, Blackwell AK, et al. Impact of health warning labels on selection and consumption of food and alcohol products: systematic review with meta-analysis. Health Psychology Review. 2021;15(3):430-53.
15.   Finkelstein EA, Ang FJL, Doble B, Wong WHM, van Dam RM. A Randomized Controlled Trial Evaluating the Relative Effectiveness of the Multiple Traffic Light and Nutri-Score Front of Package Nutrition Labels. Nutrients. 2019;11(9):2236.
16.   Food Standards Agency. Check the Label UK: Food Standards Agency; 2020 [Available from: https://www.food.gov.uk/safety-hygiene/check-the-label#:~:text=The%20traffic%20light%20label%20is%20colour%20coded%20and%20shows%20that,Amber%20means%20medium.
17.   Noar SM, Bell T, Kelley D, Barker J, Yzer M. Perceived message effectiveness measures in tobacco education campaigns: A systematic review. Communication methods and measures. 2018;12(4):295-313.
18.   Dréano-Trécant L, Egnell M, Hercberg S, Galan P, Soudon J, Fialon M, et al. Performance of the Front-of-Pack Nutrition Label Nutri-Score to Discriminate the Nutritional Quality of Foods Products: A Comparative Study across 8 European Countries. Nutrients. 2020;12(5):1303.
19.   Egnell M, Talati Z, Galan P, Andreeva VA, Vandevijvere S, Gombaud M, et al. Objective understanding of the Nutri-score front-of-pack label by European consumers and its effect on food

choices: an online experimental study. International Journal of Behavioral Nutrition and Physical Activity. 2020;17(1):146.

20.	Egnell M, Galan P, Farpour-Lambert NJ, Talati Z, Pettigrew S, Hercberg S, et al. Compared to other front-of-pack nutrition labels, the Nutri-Score emerged as the most efficient to inform Swiss consumers on the nutritional quality of food products. PLOS ONE. 2020;15(2):e0228179.

21.	Julia C, Blanchet O, Méjean C, Péneau S, Ducrot P, Allès B, et al. Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: an experimental study. International Journal of Behavioral Nutrition and Physical Activity. 2016;13(1):101.

22.	Crosetto P, Muller L, Ruffieux B. Label or taxes: Why not both? Testing nutritional mixed policies in the lab. Journal of Economic Behavior & Organization. 2025;229:106825.

23.	Ministére des affaires sociales et de la santé. Simplified nutrition labelling: Implementation of the law on modernising our health system. France; 2017. Contract No.: Article 14-11.

24.	Løvhaug AL, Granheim SI, Djojosoeparto SK, Harrington JM, Kamphuis CBM, Poelman MP, et al. The potential of food environment policies to reduce socioeconomic inequalities in diets and to improve healthy diets among lower socioeconomic groups: an umbrella review. BMC Public Health. 2022;22(1):433.

25.	Cadario R, Chandon P. Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments. Marketing Science. 2020;39(3):465-86.

26.	Julia C, Arnault N, Agaësse C, Fialon M, Deschasaux-Tanguy M, Andreeva VA, et al. Impact of the Front-of-Pack Label Nutri-Score on the Nutritional Quality of Food Choices in a Quasi-Experimental Trial in Catering. Nutrients. 2021;13(12):4530.

27.	Yamim AP, Werle COC. Nutri-score label influence on food purchase intention depends on consumers' expectations of healthiness. Appetite. 2025;207:107870.

28.	Egnell M, Talati Z, Hercberg S, Pettigrew S, Julia C. Objective Understanding of Front-of-Package Nutrition Labels: An International Comparative Experimental Study across 12 Countries. Nutrients. 2018;10(10):1542.

29.	Talati Z, Egnell M, Hercberg S, Julia C, Pettigrew S. Food Choice Under Five Front-of-Package Nutrition Label Conditions: An Experimental Study Across 12 Countries. Am J Public Health. 2019;109(12):1770-5.

30.	Packer J, Russell SJ, Ridout D, Hope S, Conolly A, Jessop C, et al. Assessing the Effectiveness of Front of Pack Labels: Findings from an Online Randomised-Controlled Experiment in a Representative British Sample. Nutrients [Internet]. 2021; 13(3).

31.	Office for National Statistics. Age groups UK: GOV.UK; 2023 [Available from: https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/age-groups.

32.	Census 2021. Education, England and Wales: Census 2021. UK: Office for National Statistics; 2023.

33.	Nutritics. *Research Edition, v6.00. Dublin: Nutritics; 2024.

34.	Nutri-score. Nutri-score 2022 [Available from: https://nutriscore.blog/2022/12/25/spreadsheet-to-calculate-the-updated-version-of-the-nutri-score/.

35.	Better Health. Calorie counting UK: NHS; n.d. [Available from: https://www.nhs.uk/better-health/lose-weight/calorie-counting/.

36.	Public Health England. Behind the headlines: calorie guidelines remain unchanged. UK; 2017.

37.	Public Health England. Calorie reduction: Technical report: guidelines for industry, 2017 baseline calorie levels and the next steps. UK: GOV.UK; 2020.

38.	Baig SA, Noar SM, Gottfredson NC, Boynton MH, Ribisl KM, Brewer NT. UNC Perceived Message Effectiveness: Validation of a Brief Scale. Annals of Behavioral Medicine. 2018;53(8):732-42.

39.	Baig SA, Noar SM, Gottfredson NC, Boynton MH, Ribisl KM, Brewer NT. UNC perceived message effectiveness: validation of a brief scale. Annals of Behavioral Medicine. 2019;53(8):732-42.

40.   Grummon AH, Hall MG, Taillie LS, Brewer NT. How should sugar-sweetened beverage health warnings be designed? A randomized experiment. Preventive Medicine. 2019;121:158-66.

41.   Hall MG, Grummon AH, Lazard AJ, Maynard OM, Taillie LS. Reactions to graphic and text health warnings for cigarettes, sugar-sweetened beverages, and alcohol: An online randomized experiment of US adults. Preventive medicine. 2020;137:106120.

42.   Hall MG, Lazard AJ, Grummon AH, Higgins IC, Bercholz M, Richter APC, et al. Designing warnings for sugary drinks: A randomized experiment with Latino parents and non-Latino parents. Preventive medicine. 2021;148:106562.

43.   Taillie LS, Chauvenet C, Grummon AH, Hall MG, Waterlander W, Prestemon CE, et al. Testing front-of-package warnings to discourage red meat consumption: a randomized experiment with US meat consumers. International Journal of Behavioral Nutrition and Physical Activity. 2021;18:1-13.

44.   Taillie LS, Hall MG, Gómez LF, Higgins I, Bercholz M, Murukutla N, et al. Designing an effective front-of-package warning label for food and drinks high in added sugar, sodium, or saturated fat in Colombia: an online experiment. Nutrients. 2020;12(10):3124.

45.   Noar SM, Barker J, Bell T, Yzer M. Does perceived message effectiveness predict the actual effectiveness of tobacco education messages? A systematic review and meta-analysis. Health communication. 2020;35(2):148-57.

46.   Department of Health. Nutrient Profiling Technical Guidance.; 2011.

47.   R documentation. weighted.mean: Weighted Arithmetic Mean n.d. [Available from: https://www.rdocumentation.org/packages/stats/versions/3.6.2/topics/weighted.mean.

48.   Steptoe A, Pollard TM, Wardle J. Development of a measure of the motives underlying the selection of food: the food choice questionnaire. Appetite. 1995;25(3):267-84.

49.   US Centres for Disease Control and Prevention. Definitions n.d. [Available from: https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/help/npao_dtm/definitions.html.

50.   Carpenter JR, Kenward MG. Missing data in randomised controlled trials: a practical guide. Health Technology Assessment Methodology Programme; 2007.

51.   Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. Bmj. 2009;338.

52.   Evans R, Brealey J, Clarke N, Falbe J, Finlay A, Jones A, et al. Salt warning labels in the out-of-home food sector: online and real-world randomised controlled trials. medRxiv. 2025:2025.01.13.25320447.

53.   Lakens D. Performing high-powered studies efficiently with sequential analyses. European Journal of Social Psychology. 2014;44(7):701-10.