Testing the effect of availability and ecolabels on the environmental impact of food purchases in worksite cafeterias: A randomised controlled trial

Study protocol

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BACKGROUND AND RATIONALE

Meeting global climate targets will require a rapid reduction in environmental impacts caused by dietary patterns [1].

A recent systematic review found that ecolabels (including a broad range of designs) are effective at promoting the selection, purchase, and consumption of food and drink [2]. A subsequent series of studies using an experimental online supermarket platform tested six different ecolabel versions [3, 4]. Across these studies, results indicated that providing a single environmental impact score (A-E) was effective at decreasing the environmental impact of participants' food purchases. However, these studies were conducted in an online experimental supermarket, where participants did not receive the food they selected for purchase, and there remains a need to examine the effectiveness of such labels in real-world settings. Only one field study to our knowledge has tested ecolabels, finding no evidence of an effect on the environmental impact of purchases, but this was limited by a narrow range of main meal options being available, with the majority rated 'E' in both control and intervention sites [5].

Another promising intervention is to alter the availability of meat vs. meat-free meals. A recent Cochrane review found that altering the availability of a particular set of food options changes their selection [6], albeit with low overall certainty. However, no evidence was identified in this review targeting the availability of meat-free options. Similarly, a systematic review of the impact of interventions that aim to restructure physical micro-environments on selection of meat products did not identify any studies relating to increasing the availability of vegetarian food to reduce meat consumption [7]. Since then, an experimental field study in one student cafeteria has suggested that increasing the percentage of vegetarian meals from 25% to 50% leads to an approximately 40% rise in vegetarian meal sales [8]. Observational data from both university and worksite cafeterias also suggest increased meat-free meal availability is associated with increased meat-free purchasing [8, 9]. No field studies have experimentally manipulated availability of meat-free options in worksite, rather than university, cafeterias (to our knowledge).

Here, we propose to run a randomised controlled trial in worksite cafeterias to identify the effect of (a) ecolabels, and (b) increased meat-free availability, on weekly sales of meat and meat-free menu options. The secondary aim is to explore whether the effects of ecolabels and meat-free availability are greater when implemented together.

STUDY DESIGN

This will be a randomised controlled trial, with worksite cafeterias allocated according to stratified randomisation (based on mean transactions per day) to one of three conditions initially: Control (no increased meat-free availability or ecolabels); Ecolabels only; Increased Availability Only for a period of 4 weeks.

As the catering provider is planning to introduce both increased meat-free availability and ecolabels across all sites, these interventions will then be introduced in the sites in which they were absent during the 4-week RCT, in a stepwise manner. Following this initial 4 week period, meat-free availability will be increased across all sites, and then ecolabels will be introduced in the remaining sites after 8 weeks, so that all sites will have both ecolabels and increased meat-free availability in the final 4 week period (see Table 1). Other sites run by the catering provider will implement both ecolabels and increased meat-free availability from Week 1.

Table 1. Study Design

Time	Group 1	Group 2	Group 3
Wks 1-4	- No ecolabels - No increased meat-free availability	+ Ecolabels - No increased meat-free availability	- No ecolabels + Increased meat-free availability
Wks 5-8	- No ecolabels + Increased meat-free availability	+ Ecolabels + Increased meat-free availability	- No ecolabels + Increased meat-free availability
Wks 9-12	+ Ecolabels + Increased meat-free availability	+ Ecolabels + Increased meat-free availability	+ Ecolabels + Increased meat-free availability

INTERVENTIONS

Availability

The proportion of plant-based options was due to be increased across all options on daily menus on 10th January 2022 across all sites catered for by our catering provider partner. For sites participating in this trial, instead only sites where meat-free availability will increase will introduce this new menu. Other sites will introduce an alternative version of this new menu, where the proportion of meat-free options will instead correspond to that in the previous menu cycle. Plant-based menu options will also have names designed to make these more appealing, but these will be introduced across all sites.

Ecolabels

The ecolabels will be printed on the menus at each of the intervention sites and site managers will be sent colour stickers to place over the black-and-white printed versions. They show environmental impacts as one of 5 letters (A-E), each with its own colour (from dark green to dark red):

The ecolabels will be generated by the Oxford team (see Appendix A), based on ingredient-level data obtained from the catering provider for each hot menu item sold.

SITE IDENTIFICATION AND RECRUITMENT

Inclusion Criteria

The study will include UK-based worksite cafeterias that:

- Have electronic point-of-sale tills operated by our foodservice partner,
- Are able to provide data at a detailed enough level to identify specific meals sold
- Have a minimum of 50 transactions/day at baseline
- Offer main meal options (in line with the base menu for the catering provider)

Recruitment

Recruitment will be conducted at the worksite-level by the catering provider. The sample size will be based on pragmatic factors, primarily including the number of eligible sites identified that are likely to continue operating (at least partially) in the event of a Covid-19 lockdown. The catering provider will obtain verbal consent from site managers. Cafeteria users will not be made aware of the research during the trial period. We do not anticipate unintended or adverse effects due to the intervention.

STUDY PROCEDURE

For ecolabels, the catering provider will send the Oxford team menus and ingredient lists for each site for the trial period. The Oxford research team will generate environmental impact scores (see Appendix A) for each menu item in the hot meal categories (including jacket potatoes, noodle bar, hot snacks and sandwiches, and soup). The catering provider will upload the ecolabel scores to its recipe software system and arrange for the printing and distribution of labels to intervention sites. Ecolabels will appear as coloured stickers which cafeteria staff will add each day next to meal options on hard copy menus. The catering provider will print and display information sheets near the menus and elsewhere in the cafeteria giving some background to the ecolabels.

For availability, the catering provider was planning to roll out new menus with increased proportions of plant-based options across all sites. Instead, they will send out alternative new menus to sites that are not implementing the availability component, which sites will be asked to use for the first 4 weeks of the trial. After this period, sites will revert to their usual menu system, which will then include the increased proportion of plant-based options already rolled out in other sites.

The trial will run for 12 weeks. The catering provider will provide Oxford with sales data for each site. Baseline data for the 12 weeks prior to the trial will also be obtained from the catering provider, and included in multilevel models. All study data will be anonymised and stored on a University of Oxford secured server. There will be no individual level sales data collected for this study, nor any data with customer identifiable information.

Randomisation

Randomisation will be performed by a statistician allocating a list of site names using random numbers. Sites will be evenly allocated to the three study groups, within stratification groups determined by mean daily transactions during the baseline period. Cafeterias (n=96) initially identified as eligible will be randomised to the three study groups. The research team will approach sites to obtain contact details to

allow fidelity checks and communication throughout the trial. Sites with which contact has not been established prior to the start of the study will be assumed to have dropped out.

Fidelity to protocol

Given restrictions due to the Covid-19 pandemic, it may not be possible for researchers to visit sites in person. Site managers will send weekly photos to the research team to enable us to gauge fidelity. We will also have a fortnightly phone call with each site to check the study is running smoothly. If possible, researchers may additionally carry out visits to each cafeteria to monitor implementation of the ecolabels and availability.

Data analysis / statistical plan

Primary outcome measures

Environmental impact of purchases: Measured by the mean environmental impact score (taken across standardised values for the four environmental indicators listed below) for purchased products from hot meal categories in each worksite cafeteria for the period of interest. The outcome will be calculated from sales data, recorded via electronic point-of-sale tills throughout the trial, combined with data on the environmental impact of each food option.

We will also examine the impacts on each of the four indicators (greenhouse gas emissions, land use, water use, and eutrophication) separately. Environmental indicators will be the sum of the absolute values for that indicator from items purchased in each site for the period of interest.

Secondary outcome measures

Health impact:

1. Total energy (kcal) purchased from hot meal categories in each worksite cafeteria, calculated from sales data recorded via electronic point-of-sale tills throughout the 12 weeks of the trial, combined with data on the energy content of each food option.

Nutrient content

2. Nutrient content (total fat (% energy purchased), saturated fat (% energy purchased), protein (% energy purchased), and fibre (g/100g)) of purchases from hot meal categories in each worksite cafeteria – if possible to obtain nutrient data.

Impact on revenue: Measured by the total weekly revenue (£GBP) from each cafeteria, based on sales data recorded via electronic point-of-sale tills throughout the 12 weeks of the trial.

Impact on transactions: Measured by the total number of transactions per week in each cafeteria, based on sales data recorded via electronic point-of-sale tills throughout the 12 weeks of the trial.

Analyses

Model assumptions - Assumptions of normality and constant variance in linear regression models will be assessed using residual and other diagnostic plots, and if violated, an appropriate transformation will be investigated. If none are found then non-parametric methods will be investigated.

Primary analyses:

These will be intention-to-treat analyses.

Weeks 1-4: Linear regression models will be used over the first 4 weeks of the study period only, examining mean environmental impact score/individual indicator score for hot meal options sold in each cafeteria across the 4-week period. Predictors will include the dummy variables for group (i.e. control vs. ecolabel vs. availability), the mean number of transactions and the mean baseline environmental impact score for hot meal options.

Weeks 5-8: Linear regression models will be used on data from Weeks 5-8 of the study period only, to compare the effect when only availability is implemented to when availability is implemented alongside ecolabels. Predictors will include the dummy variables for group (i.e. availability only vs. availability plus ecolabels), the mean number of transactions, the mean baseline environmental impact score for hot meal options, and a dummy variable indicating whether availability of plant-based options had increased in Week 5.

Significance will be compared with an alpha of 0.05 for the primary analyses.

If issues are observed with fidelity to protocol, sensitivity analyses will be conducted, namely (a) per protocol analyses where intervention implementation variables are coded to instead represent only the periods when these were actually implemented and (b) excluding sites known to have low fidelity.

Secondary analyses:

Full dataset: Mixed effects modelling will be used over the full 12 weeks of the study period. Predictors will include the primary predictors outlined above, the number of weekly transactions, study week and whether there was a bank holiday that week. Given the heterogeneous nature of the trial sites, the sites will be controlled for as a random effect.

Significance will be compared with an alpha of 0.016 for secondary analyses (Bonferroni adjustment).

Secondary outcomes:

Analyses for health impact and nutrient content of purchases will be carried out using linear regressions, separately for (a) Weeks 1-4, and (b) Weeks 5-8, with covariates as described for the primary outcomes. Significance will be compared with an alpha of 0.01 for these analyses (Bonferroni adjustment).

Analyses for revenue and transactions will be carried out using mixed effects modelling across the full dataset, adjusting for weekly transactions (revenue only), study week and whether there was a bank holiday that week, with site as a random effect. Significance will be compared with an alpha of 0.025 for these analyses (Bonferroni adjustment).

Exploratory analyses:
Descriptive statistics will explore: (1) the percentage of meat vs. meat-free sales over time by site grouping; (2) the percentage of meat vs. meat-free available over time by site grouping; (3) the percentage of hot meals (a) on offer and (b) purchased, by ecolabel rating (i.e. A,B,C,D or E) over time by site grouping.

Data exclusions and missing data
Data from bank holidays and weekends will be removed for all analyses, as not all sites are open.

Complete case analysis is planned. No missing data will be imputed.

Sites will be excluded from the analysis for specific time periods due to missing data, for example, till malfunctions or temporary site closure. Data may be removed if considered to be "outlying" (e.g., outside 3 standard deviations of the mean) without sufficient reason upon investigation and discussion with site managers.

Research governance

Ethics approval was obtained from the Central University Research Ethics Committee, University of Oxford on 5/1/22 (ref R72710/RE004).

References

1. Willett, W., et al., *Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems.* The Lancet, 2019. **393**(10170): p. 447-492.
2. Potter, C., et al., *The effectiveness of environmental sustainability labels on the selection, purchase, or consumption of food and drink products: a systematic review.* Environment and Behavior, 2021.
3. Potter, C., et al., *Effects of environmental impact labels on the sustainability of food purchases: Two randomised controlled trials in an experimental online supermarket.* in submission.
4. Potter, C., et al., *Effects of environmental impact and nutriion labelling on food purchasing: An experimental online supermarket study.* in submission.
5. Bateman, P.A., et al., *Testing the effect of ecolabels on the environmental impact of food purchases in worksite cafeterias: A randomised controlled trial* in preparation.
6. Hollands, G.J., et al., *Altering the availability or proximity of food, alcohol, and tobacco products to change their selection and consumption.* Cochrane Database of Systematic Reviews, 2019(9).
7. Bianchi, F., et al., *Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis.* The Lancet Planetary Health, 2018. **2**(9): p. e384-e397.
8. Garnett, E.E., et al., *Impact of increasing vegetarian availability on meal selection and sales in cafeterias.* PNAS, 2019. **201907207**.
9. Pechey, R., et al., *Impact of increasing the relative availability of meat-free options on food selection: Two natural field experiments and an online randomised trial.* in submission.