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Two online randomised controlled trials examining effects of alcohol calorie labelling on hypothetical ordering of calories from alcohol and food

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ABSTRACT

Background: Providing calorie information for alcoholic beverages is a potential public-health intervention which may serve to reduce alcohol use but also prevalence of overweight/obesity. Equivocal evidence has been found for the effectiveness of alcohol calorie information at reducing drinking intentions as well as purchasing and consumption. However, the extent at which calorie information 'on-trade' will impact consumer behaviour for both alcohol and food consumption has not been investigated.
Aims: (1) To examine the presence of alcohol calorie labelling for hypothetical purchasing of alcohol and food in typical UK restaurant scenarios. (2) To determine the characteristics of individuals who will be likely to choose to view alcohol calorie labels.
Methods: Two online randomised control trials using a hypothetical menu selection. In experiment one (N = 325) participants were randomised to the presence or absence of alcohol calorie labels. In experiment two (N = 1081) individuals were randomised to alcohol calorie labels absent or the choice to view alcohol calorie labels. The primary outcome for each study was calories ordered from alcoholic beverages.
Results: There was no evidence that the presence of alcohol calorie information on restaurant menus impacted the number of calories ordered from alcoholic beverages or from food and soft drinks. Younger individuals and individuals who exhibit greater motives for good health were more likely to choose to view alcohol calorie labels.
Conclusions: In two online, hypothetical experiments there is no evidence for alcohol calorie labelling impacting consumer decisions to order alcohol or food. Given the choice, a self-selecting group of individuals who are more motivated by health concerns will view alcohol calorie labels, and in turn may be less likely to order alcohol.

1. Introduction

Alcohol consumption is a considerable public health concern (Park & Kim, 2020), with excessive use linked to numerous alcohol-related harms in the individual, both short-term (e.g. hangovers, changes in mood: (Jones, Crawford, Rose, Christiansen, & Cooke, 2020) and long-term (contributing to disease burden and mortality (Rehm et al., 2017; Spillane et al., 2020):); as well as wider societal costs (e.g. loss of productivity (Mohapatra, Patra, Popova, Duhig, & Rehm, 2010)). Alcohol is calorie dense at ~7.1 calories/g whilst containing little nutritional value (Traversy & Chaput, 2015), and experimental studies demonstrate that calories from alcohol contribute additively to overall energy intake, as opposed to being compensated for (Kwok, Dordevic, Paton, Page, & Truby, 2019). This suggests alcohol may contribute to increased energy intake and overweight/obesity (Traversy & Chaput, 2015). As such, public health policies which target reductions in alcohol use may also help to reduce the prevalence of overweight /obesity.

In England, mandatory calorie labelling of foods served in out-of-home food sector businesses was implemented in April 2022, following similar policies implemented in parts of the USA, Canada, Mexico, and Australia (Essman et al., 2023). England's policy requires all large businesses to provide calorie information for all food and beverage items available for purchase. However, this does not cover alcoholic beverages, despite suggestions that alcohol labelling in the UK is 'woefully inadequate' (Gilmore & Griffiths, 2021). Nevertheless, the UK government recently announced an intention to consult on applying mandatory calorie labelling to alcoholic beverages, including on restaurant menus, as part of their ambition to reduce both obesity and alcohol use. This line of reasoning is in part motivated by the observation that individuals have limited knowledge of, and are poor at

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estimating, the number of calories in alcoholic beverages. For instance, a meta-analysis demonstrated that 74% of participants across 8 studies were inaccurate in their estimations of calories in alcoholic beverages (Robinson, Humphreys, & Jones, 2021). Furthermore, the contribution of alcohol to daily diet in many populations is not trivial (Brenes et al., 2021; Nielsen, Kit, Fakhouri, & al. e, 2012), with estimates suggesting alcohol contributes ~10% of energy intake in UK drinkers (Shelton & Knott, 2014), and providing a substantial source of sugar in adult diets (Petticrew et al., 2017).

A number of surveys have demonstrated that the general public are widely supportive of calorie labelling for alcoholic beverages, and rate calorie content as one of the most important components of any alcoholic beverage label (Moore, 2010). Overall, across 9 studies the pooled prevalence rate of support for alcohol calorie labelling policies is 64% (Robinson et al., 2021). However, there have been some concerns raised about providing calorie labelling as a public health policy, with arguments suggesting that a focus on calories may adversely impact individuals with eating disorders, that the policy interferes with or restricts personal choice ('nanny statism'), or that the information will simply be ignored by most (Jeacle and Carter, 2023; McGeown, 2019; Polden et al., 2023).

Empirical evidence examining the impact of alcohol calorie labelling is limited and somewhat equivocal. Robinson, Smith, and Jones (2022) demonstrated that the presence of alcohol calorie labels led to significantly lower *intentions* to drink alcohol ($d = 0.31$) compared to no labels. However, in a similar study, Clarke et al. (2023) examined alcohol calorie labels on beverages in an online supermarket setting. Participants were asked to purchase real beverages with the intent to consume. Here, there was no evidence that exposure to alcohol calorie information influenced the *purchasing* of alcohol, however among participants that purchased alcohol, approximately 20% fewer calories [95% CI: −35% to −2%] were purchased in the calorie labelling group vs the no labelling group. In a randomised controlled trial (Hobin et al., 2022), university students in Canada viewed a restaurant beverage menu with or without calories and were asked to hypothetically order beverages under the scenario that they were in a pub drinking with friends. There was no difference in the number of alcoholic beverages ordered or the total number of calories ordered. In a laboratory setting, a randomised controlled trial by Maynard et al. (2018) found that alcohol calorie information (vs no information) did not lead to any changes in *ad-libitum* alcohol consumed during a mock taste test.

A limitation of the available evidence is that studies to date have examined whether alcohol calorie labelling affects calories ordered or selected from alcohol only, but have not considered potential impacts on accompanying energy containing selections (food/soft drinks). Alcohol is commonly consumed alongside food and one potential pathway by which alcohol calorie labelling could impact on population levels of overweight and obesity is by causing consumers to alter their choice behaviours around food, to compensate for the calories from alcohol being consumed (Robinson, Boyland, Christiansen, et al., 2023). Across two experiments, the present study sought to investigate how the presence of alcohol calorie labelling can affect the choice of alcoholic beverages, as well as food and soft drinks in a hypothetical restaurant setting. Examining alcohol calorie labelling in a hypothetical restaurant setting allows us to examine whether individuals compensate for the calories in alcohol by altering the amount of food calories ordered, allowing us to overcome limitations of previous research which has only examined alcohol choice behaviour.

1.1. Experiment one

In experiment one, participants were randomised (using a random number generator) to one of two groups: a calorie label condition – in which calorie labelling was present on alcoholic drinks, and a no calorie labelling condition - in which no calorie information was provided for alcoholic drinks. The aim of experiment one was to examine whether alcohol calorie information would impact calories ordered from alcohol (and food/soft drinks) in a hypothetical online restaurant ('on-trade' alcohol purchasing). We hypothesised that, relative to when alcohol calorie labelling was absent, the presence of alcohol calorie labelling would (i) reduce the number of alcohol calories ordered (ii) reduce the likelihood of ordering an alcoholic drink (iii) reduce the number of non-alcohol calories (food and soft drinks) ordered. The study design and analysis were pre-registered [https://aspredicted.org/6xh6t.pdf] with data and analysis scripts here [https://osf.io/y2hbc/].

2. Methods

2.1. Participants

Participants were recruited using word-of-mouth, experiment recruitment participation schemes, and also via the crowdsourcing platform Prolific (Palan & Schitter, 2018). Our aim was to recruit a minimum of 278 participants to detect a between-group effect size of dz = 0.30, with 80% power and alpha = 0.05. This was based on an effect size of alcohol calorie labels on intentions to drink (Robinson, Smith, & Jones, 2022), but we were able to recruit above this. Three-hundred and eighty-six individuals accessed the link to the online experiment, but 61 participants did not progress to randomisation. We obtained complete data from 325 participants (170 female, 154 male, 1 non-binary: 160 in the alcohol calorie label group and 165 in the no alcohol calorie label group) with a mean age of 36.19 (SD = 15.55). Inclusion criteria required participants to consume alcohol on a regular basis, at least one UK unit per week, and were not currently following any diet (including vegetarianism or veganism) or restricting food intake in order to ensure there were a sufficient number of menu options for all participants (in line with previous studies examining online restaurant ordering tasks: Marty, Jones, & Robinson, 2020). All participants were required to be a UK resident.

3. Materials

3.1. Online restaurant task

Prior to the online restaurant task, participants were informed that they should order as if they were in the restaurant and only order for themselves (e.g. what they would like to consume). They could select items in any order (e.g. desserts, then starters), and multiple items from each category (e.g. more than one starter) if they wished. The menu options were taken from popular chain restaurants in the UK (including Italian/American food items, as well as more standard items, such as Steak and Chips), with descriptions, calories and prices changed to avoid familiarity. For more information see Supplementary Fig. 1.

Participants were presented with a menu selection page (Supplementary Fig. 2) which allowed them to click to view "starters", "mains", "desserts", and "drinks". Upon clicking, they were given a list of items they could order for each (see Supplementary Fig. 3). Each item had a picture of the dish, a short description, a price, and the number of calories in the dish (Supplementary Table 1). Price and calorie information were presented below the name and description of the dish, and no typical recommendation was provided (e.g. '*A typical adult needs about 2000 calories* per *day*'). Overall, there were 8 options for starters (calorie range 247–764), 8 for mains (calorie range 544–980) and 4 for desserts (calorie range 387–761).

When participants clicked "drinks" they were given the option to choose alcoholic or non-alcoholic beverages. If they chose non-alcoholic beverages, there were 13 options. If they chose alcoholic beverages, there were 17 options. Most options had multiple sizes to choose from (e.g. Wine options had; a small 175 ml glass, a medium 250 ml glass, a large 325 ml glass; a 750 ml bottle). For wine, we provided an additional serving size option of 325 ml, which is larger than what is permitted by UK licencing regulations. In error we also described 175 ml as a 'small

glass' which is typically the descriptor used for a 125 ml glass in the UK. We included the extra serving size (325 ml) to increase the number of options participants could choose from. However, this resulted in wine serving size options that were not representative of wine serving size options in the UK restaurants. Calorie content of alcoholic beverage options ranged from 70 to 634 calories and 0–423 calories for non-alcoholic beverage options. Drinks were chosen based on common availability across the UK restaurants.

Upon selecting an item from the menu, participants were asked to confirm their choice. Once their choice was confirmed they were returned to the menu selection page, and the home page was updated (e.g. '*You have ordered 1 starter*'). Irrespective of experimental group, all food and soft drink items had calorie information, in line with mandatory calorie labelling requirements in large out of home food outlets in England, UK.

3.2. Alcohol use disorders identification task-C (AUDIT-C (Bush, Kilvahan, McDonnell, & al, 1998):)

Participants were given the AUDIT-C to examine the quantity and frequency of their alcohol consumption. The AUDIT-C uses the first three items of the AUDIT (e.g. '*How often do you have a drink containing alcohol?*'), with 5 possible responses to each statement (e.g. 'Never', 'Monthly or less', '2 to 4 times per month', '2 to 3 times per week', '4 or more times per week') each scored from 0 to 4. The AUDIT-C demonstrated good internal reliability in this sample (Omega = 0.81).

3.3. Procedure

The experiment was hosted via Inquisit Web v.6 (Millisecond Software, Seattle). Upon clicking the link participants saw an information sheet, then provided informed consent. After providing consent, participants completed some demographic questions; including age, gender (male, female, non-binary), highest level of education completed (no formal education, GCSE/equivalent, A-Level/equivalent, Degree/equivalent, Higher Degree/equivalent). The online restaurant task was then completed. Following this, participants completed an explicit attention check questionnaire ['What planet are you from? [Earth, Saturn, Mars, Venus]), the AUDIT-C, and self-reported weight/height. Data collection took place January to May 2023.

3.4. Outcomes

The primary outcome in both experiments was the total number of calories ordered from alcoholic beverages from the online menus (e.g. if participants ordered a half pint of Stella Artois this would have been 114 calories). Secondary outcomes were whether participants ordered alcohol vs not, and the total number of calories ordered which were not from alcoholic beverages (e.g. combined calories from starters, main courses, desserts and soft drinks).

3.5. Data reduction and analysis

Data were analysed using R Studio with the 'tidyverse', 'ggstatsplot', 'epitools', and 'psych' packages. BMI values that were considered implausible (BMI <14 or BMI >70) were removed from the computation of descriptive statistics (Booth, Prevost, & Gulliford, 2013). Any income greater than what was deemed implausible by examination of the distributions and box plot was also removed (1 participant reporting income of £1,400,000). These participants were retained for the inferential analysis.

Three participants failed the explicit attention check item (2 from the calorie label group and 1 from the no calorie label group), which is typically lower than previous estimates in online alcohol research (Jones et al., 2022). These participants remained in inferential analyses to ensure generalisability (Jones, Gillespie, Pennington, Strickland, & Robinson, 2023), however their removal did not significantly influence any of the results reported below. The average time spent on the menu selections was 72 s (SD = 37 s), and there were no significant differences between the conditions on how long they spent ordering (t (302.02) = 0.14, p = 0.89, d = 0.02 [95% CI: −0.23 to 0.20]). No 'very fast orderers' (Mean – 3SD) could be identified as we pre-registered, therefore we conducted sensitivity analyses by removing the quickest 5% of participants. This did not significantly alter any results (see online supplementary materials).

As some participants did not order alcohol, this led to non-normal distributions of alcohol calories ordered. Therefore, we analysed the data by first conducting non-parametric analyses of the complete data set using Mann Whitney U tests, then removing data from participants who did not order any alcohol and then conducting Welch's t-tests (similar to the procedure by Clarke et al. (2023)). To examine whether alcohol calorie labels influenced the decision to order alcohol vs. not, we conducted Chi Square analyses and present the Odds Ratio for alcohol calorie labelling's impact on ordering of alcohol. To determine effects on total calories, we examined whether the presence of alcohol calorie labelling had an impact on the total number of non-alcohol calories ordered (from both food items and beverages, including soft drinks).

4. Results

4.1. Participants

The demographic information for participants split by group randomisation is shown in Table 1.

4.2. Will alcohol calorie labelling reduce calories of alcohol ordered (vs the absence of alcohol calorie labelling)?

A Mann Whitney *U* test demonstrated no significant differences between the experimental groups (U = 12588.00, p = 0.460, r = −0.05 [95% CI: −0.17 to 0.08]). The median number of alcohol calories ordered in the alcohol calorie labelling group was 182 calories and in the no calorie label group was 208 calories. A *t*-test conducted on individuals who ordered alcohol demonstrated no significant differences between the experimental groups (see Fig. 1). The Bayes factor was BF^{10} = 0.66, indicating evidence for the null hypothesis.

4.3. Will alcohol calorie labelling reduce the likelihood of ordering an alcoholic drink (vs the absence of calorie labelling)?

In the alcohol calorie labelling group 53 participants didn't order an alcohol beverage and 107 did. In the no alcohol calorie labelling group 57 participants didn't order an alcohol beverage and 108 did. The Odds Ratio was not statistically significant (OR = 0.93 [95% CI: 0.59 to 1.48], p = 0.815).

Table 1
Demographics of participants in experiment one, split by experimental condition.

	Alc Calorie Label	Alc No Calorie Label
Age	34.91 (15.42)	37.44 (15.62)
Income (£s)	55261.29 (44589.81)	48375.31 (58871.53)
BMI	25.56 (6.21)	26.13 (6.44)
AUDIT-C	5.34 (2.72)	4.90 (2.57)
	N	N
Education		
No formal education	1	0
GSCE/Equivalent	19	27
A-Level/Equivalent	65	68
Degree/Equivalent	58	52
Higher Degree/Equivalent	17	18

Legend: AUDIT = Alcohol Use Disorders Identification Test; BMI = Body Mass Index.

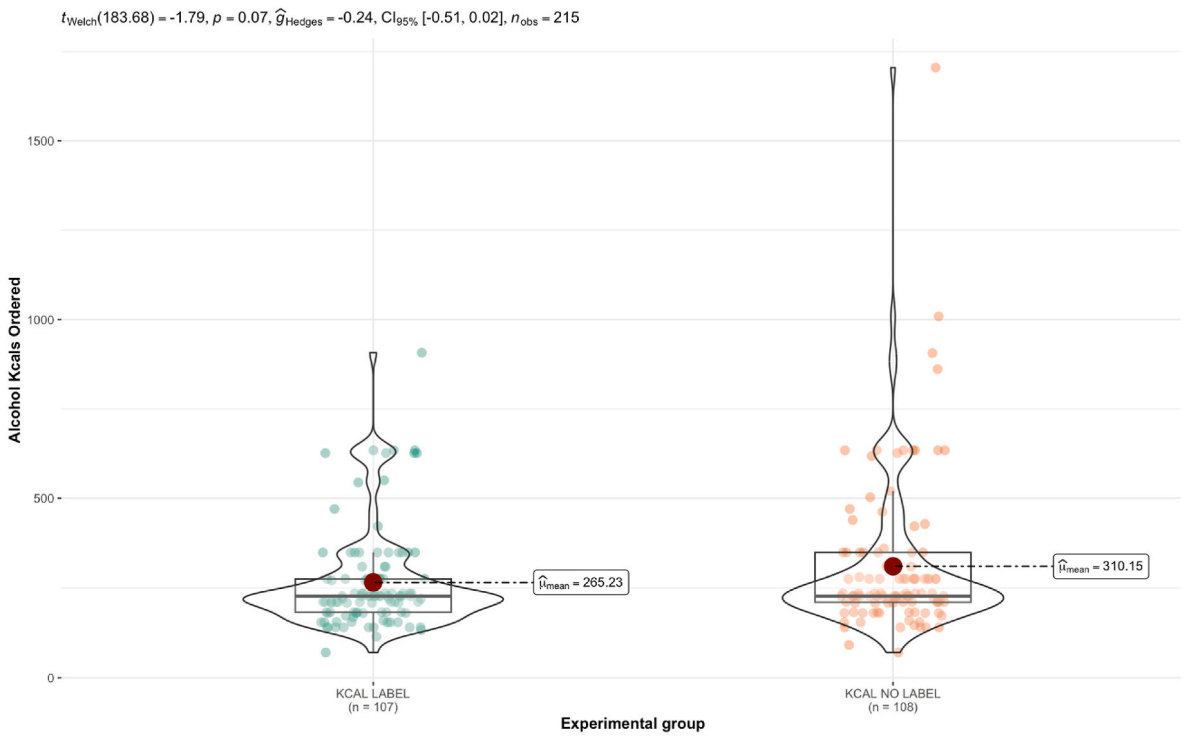

Fig. 1. Experimental group differences of the number of alcohol calories ordered, in individuals who ordered an alcoholic beverage, in experiment one.

4.4. Will alcohol calorie labelling impact calories ordered from food and soft drinks?

In individuals that ordered alcohol, the presence of alcohol calorie labelling (mean = 1949.61 calories) did not significantly impact the number of calories ordered from food and soft drinks, vs no alcohol calorie labelling (mean = 1966.84: t (206.9) = 0.19, p = 0.85, d = −0.03 [95% CI: −0.29 to 0.24]). The same pattern was observed in individuals who didn't order alcohol (mean alcohol calorie labelling = 2128.47; no alcohol calorie labelling = 1967.07: t (83.83) = 1.05, p = 0.30, d = 0.20 [95% CI: −0.18 to 0.57]).

4.5. Experiment two

In line with experiment one, the aim of experiment two was to examine whether alcohol calorie labels impacted ordering of alcohol and food. A secondary aim was to examine predictors of the choice to view alcohol calorie labels (vs not). To examine this, some participants were randomised to being given the decision to view alcohol calorie information on the menu (vs not). We hypothesised the presence of alcohol calorie labelling would (i) reduce the number of alcohol calories ordered (ii) reduce the likelihood of ordering an alcoholic drink. Our exploratory hypothesis was that demographic information, and health motivations would predict the decision to view alcohol kcal labels (vs not).

5. Method

5.1. Participants

A total of 1182 participants accessed the link. We randomised and obtained complete data from 1081 participants (493 female, 580 male, 7 non-binary, 1 missing) with a mean age of 40.78 (SD = 13.32). See Table 2 for demographic breakdown. The inclusion/exclusion criteria were the same as experiment one. Given the lack of effects in experiment 1, our a-priori power calculation was to detect a smaller effect (f = 0.10/d = 0.20) across three experimental groups, with 80% power, resulting in a minimum sample size of 969. All data were recruited via Prolific. The study was pre-registered [https://aspredicted.org/sm5b3.pdf] with data and analysis scripts here [https://osf.io/y2hbc/].

Table 2
Demographic information from experiment 2, split condition (self-selected for choice).

	Chose Alc Cal Label	Chose No Alc Cal Label	No Cal Label No Choice
Age	37.57 (11.79)	41.76 (13.52)	42.13 (13.83)
Income (£s)	46961.01 (32125.50)	41967.77 (29519.20)	46767.89 (31317.90)
BMI	26.07 (5.87)	26.93 (6.13)	27.68 (6.51)
AUDIT-C	3.66 (2.38)	3.37 (2.87)	3.36 (2.79)
Health Motivations	9.51 (2.48)	8.82 (2.41)	9.21 (2.37)
EDE-Q: Restraint	2.38 (1.57)	1.97 (1.31)	2.20 (1.51)
EDE-Q: Shape	3.39 (2.02)	2.99 (1.93)	3.47 (2.02)
EDE-Q: Body dis	3.76 (2.07)	3.46 (2.02)	3.90 (2.00)
	N	N	N
Education			
No formal education	0	1	2
GSCE/Equivalent	32	74	43
A-Level/Equivalent	67	100	90
Degree/Equivalent	122	203	150
Higher Degree/ Equivalent	64	62	70

Legend: AUDIT = Alcohol Use Disorders Identification Test; BMI = Body Mass Index; EDE-Q = Eating Disorders Examination Questionnaire.

6. Materials

The online restaurant ordering task was the same, with the addition of extra drink items (see online Supplementary Table 1). The AUDIT-C administered in this sample had good reliability (Omega = 0.83).

6.1. Brief eating disorder examination questionnaire (EDE-Q (Jenkins & Davey, 2020)

The EDE-Q is a 7-item questionnaire which measures three aspects of eating disorder symptomology; dietary restraint (‘*Have you attempted to avoid eating any foods which you like in order to influence your shape or weight?*‘), shape/weight overevaluation (‘*Has your weight influenced how you think about (judge) yourself as a person?*‘), and body dissatisfaction (‘*How dissatisfied have you felt about your shape*’). Statements are rated on a 1–7 Likert scale, with anchors depending on the statement (e.g. ‘Not at all’ to ‘Extremely’). It demonstrated good psychometric properties in this sample (Omega = 0.91).

6.2. Food choice health motivation (Robinson, Jones, & Marty, 2022)

The following two statements were included: ‘*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*”. These statements were rated from 1 (Not at all important) to 7 (Very important) and were combined to a total score. These items have been shown to be predictive of Body Mass Index in UK samples (Robinson, Jones, & Marty, 2022).

6.3. Procedure

In experiment two we made the following changes to the study design. First, we provided participants with the instructions ‘*Please imagine it is 7pm on a Saturday evening, and you are ordering to sit down and eat at this restaurant*’ to provide some control over day/time which might influence ordering behaviour, as evidence suggests more calories are purchased and consumed in the out-of-home food sector on evenings and weekends (Polden, Robinson, & Jones, 2023). Second, we increased the number of beverage options available (see Supplementary Table 1) to examine whether calorie labelling exerted effects under increased choices and variability in calories. Third, we had a control condition with no alcohol calorie labels (as in experiment one), but an experimental condition in which participants were given a choice to view calorie information for alcohol vs not. Prior to seeing the menu, participants were asked ‘*Would you prefer to see a menu with information on the calories of alcoholic beverages or not*’ and options ‘*Menu WITH alcohol calories", "Menu WITHOUT alcohol calories*’, which created two possible groups (participants who chose alcohol calorie labels and participants who chose no alcohol calorie labels). Qualitative research has suggested that consumers prefer having choice of calorie information on menus (Frances, O’Neill, & Newman, 2023), and current legislation in England allows menus without calorie information be requested by consumers [‘*a menu without calorie information can be provided at the request of the customer*’ (Care, 2021)]. We therefore reasoned that this adaptation to the experimental condition may better characterise how participants could be exposed to alcohol calorie information, if implemented as a public health policy in future. We also reasoned it would provide useful information on what proportion of people would choose to not have alcohol calorie labelling, if given this choice (the flow of participants in the different experimental groups is shown in Fig. 2). Finally, we included the brief eating disorder examination questionnaire (EDE-Q) and health motivation questionnaire, to examine whether these variables predicted the choice to view alcohol calorie labels, given previous evidence to suggest individuals with eating disorders may respond differently to calorie information (Frances et al., 2023; Haynos & Roberto, 2017).

Following demographic reporting, participants were randomised (using random number generation via the experimental software) to the no calorie information or calorie information choice condition (randomisation was unbalanced to ensure a greater number of participants were randomised to the choice condition). Upon completion of the ordering, participants completed the same attention check as experiment one, then the AUDIT-C, EDE-Q and health motivations questions. Finally, participants were asked what they thought the aims of the experiment were using a free-text box (not analysed).

6.4. Data reduction and analysis

As in experiment 1, implausible BMI (N = 1) and income values (N = 0) were removed when calculating group means. Two participants failed the explicit attention check (data were retained for inferential analyses below, but removal did not significantly impact findings). The average time taken to complete the menu order was 76 s (SD = 180 s), and this was not significantly different across experimental groups (F (2373.92) = 1.87, p = 0.160). Sensitivity analysis with removal of 5% of fastest individuals is reported in supplementary materials.

We first analysed whether any differences in alcohol ordering occurred as a result of randomisation using Mann Whitney U and t-tests (not pre-registered, and reported in online supplementary materials). Then we conducted Friedman tests and ANOVAs to account for three groups (no alcohol calorie labels vs. chose to view alcohol calorie labels

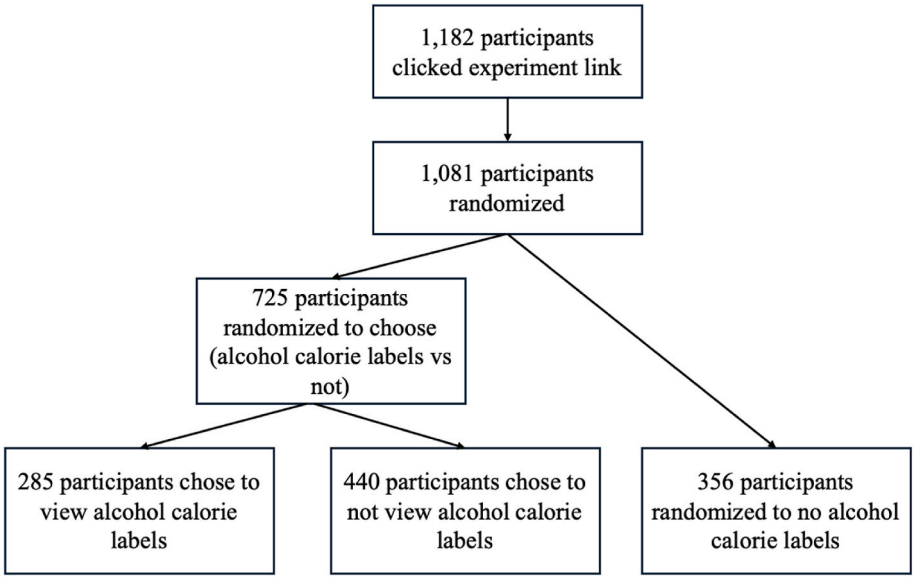

Fig. 2. The randomisation and flow of participants into different groups in experiment two.

vs. chose to not view alcohol calorie labels). To examine predictors of whether participants chose to view alcohol calorie labels (vs not), we conducted a binary logistic regression.

7. Results

7.1. Will alcohol calorie labelling reduce calories of alcohol ordered (vs the absence of alcohol calorie labelling)?

When provided with a choice, 60.7% of participants opted to not view alcohol calorie labels (comparison of choice vs no choice on alcohol ordering is provided in online supplementary materials). A Friedman's test demonstrated a significant difference in alcohol calories ordered between the three groups (no alcohol calorie labels vs. chose to view alcohol calorie labels vs. chose to not view alcohol calorie labels: X2 (2) = 13.35, p < 0.001). The median for the no alcohol calorie label group was 0, for the choice to view alcohol calorie labels was = 180, and for the choice to not view alcohol calorie labels was 140), with significant post hoc tests at p = 0.01). The unexpected median of 0 in the no alcohol calorie label group was due to more than half this group not choosing an alcoholic beverage.

When removing participants who did not order alcohol, a one-way ANOVA demonstrated no significant differences between the groups (see Fig. 3). The Bayes factor was $BF^{10} = 0.10$, indicative of strong evidence for the null hypothesis.

A planned contrast of alcohol calorie labelling vs no alcohol calorie labelling (both the choice not to view and no choice conditions) confirmed no evidence of labelling on alcohol calorie ordering (t (374.73) = 0.88, p = 0.38, d = −0.08 [95% CI: −0.25, 0.09]).

7.2. Will alcohol calorie labelling reduce the likelihood of ordering an alcohol drink (vs the absence of calorie labelling)?

In the group that chose to view alcohol calorie labels 97 participants didn't order an alcoholic beverage and 188 did. In the groups that did not view alcohol calorie labels (either by choice or randomisation) 385 participants didn't order an alcoholic beverage and 411 did. The Odds Ratio was statistically significant (OR = 0.55 [95% CI: 0.42 to 0.73], p < 0.001), suggesting decreased odds of ordering an alcoholic beverage if choosing to view calorie labels.

7.3. What predicts whether individuals choose to view alcohol calorie labels (vs not)?

The logistic regression on calorie information choice (1 = chose to view alcohol calorie labels, 0 = chose not to view alcohol calorie labels) demonstrated the only significant predictors were age and health motivations (see Table 3). Older individuals were less likely to view alcohol calorie labels and individuals who scored higher on health motivation were more likely to view calorie labels.

7.4. Will alcohol calorie labelling impact calories ordered from food and soft drinks?

In individuals that ordered alcohol, the presence of alcohol calorie labelling did not significantly impact the number of calories ordered from food and soft drinks (Mean for no labels no choice group = 1872.61; mean for chose not to view alcohol calorie labels group = 1876.50; mean for chose to view alcohol calorie labels group = 1879.05; F (2, 386.10) = 0.01, p = 0.99, $\eta p^2 = 0.00$). In individuals who didn't order alcohol the pattern of results was similar (mean for no labels no

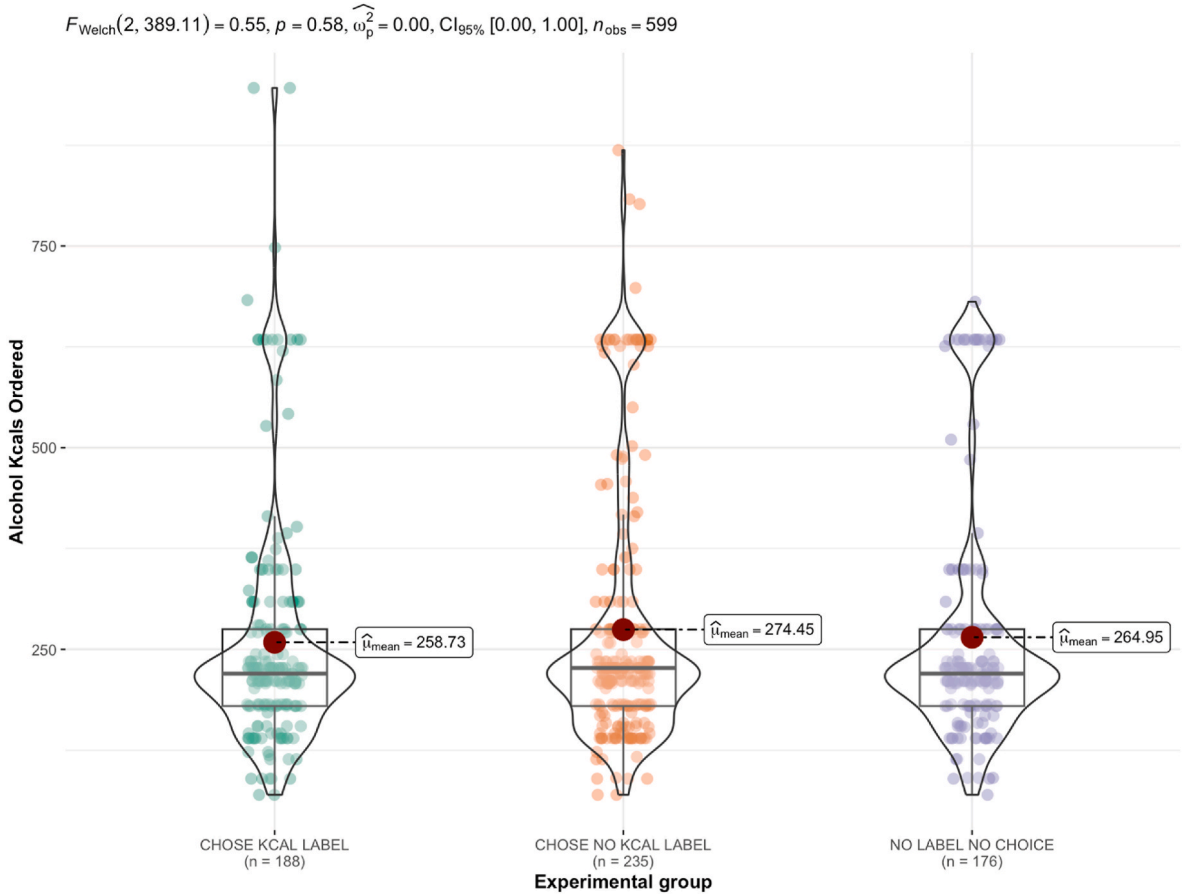

Fig. 3. Experimental group differences for the number of alcohol calories ordered, in individuals who ordered alcohol in experiment two.

Table 3
Binary logistic regression examining the predictors of individuals decision to view alcohol calorie labels (vs not).

Predictors	Choosing to view calorie labels		
	Odds Ratios	CI	p
Age	0.97	0.96–0.98	<0.001
Gender	1.34	0.94–1.92	0.108
High SES	0.77	0.54–1.10	0.149
BMI	0.99	0.96–1.02	0.393
EDE-Q: Dietary restraint	1.11	0.97–1.28	0.141
EDE-Q: Weight evaluation	1.06	0.91–1.25	0.462
EDE-Q: Body dissatisfaction	0.97	0.83–1.13	0.716
Health Motives	1.12	1.03–1.21	0.005
AUDIT-C	1.04	0.97–1.11	0.292
Observations	622		
Pseudo R^2	0.077		

Legend: AUDIT = Alcohol Use Disorders Identification Task; EDE = Eating Disorders Examination Questionnaire; Reference categories were female for Gender (vs male and non-binary) and low SES for SES (high SES was individuals educated to A-Level or greater in the UK).

choice group = 1888.03; mean for chose not to view alcohol calorie labels group = 1927.28; mean for chose to view alcohol calorie labels group = 1783.15; F (2, 248.70) = 0.09, p = 0.09, $\eta p^2 = 0.01$).

7.5. Supplementary analysis: combining data sets from experiment one and two

We combined datasets from experiment one and experiment two to examine predictors of whether a participant ordered alcohol (vs not), how many calories of alcohol were ordered by those that ordered alcohol, and also calories ordered from food and soft drinks. We included the predictors of alcohol calorie labelling (present vs absent), age, gender, SES and BMI.

When predicting the likelihood of ordering alcohol, age and AUDIT-C were positive predictors, BMI was a negative predictor, SES was a predictor as was Gender. The presence of calorie labels was also a predictor (reducing the odds of ordering alcohol). When predicting the number of alcohol calories ordered, only AUDIT-C was a significant positive predictor, and when predicting the number of non-alcohol calories ordered, only age was a significant (negative) predictor (see Table 4).

8. Discussion

Across two randomised controlled trials examining hypothetical restaurant ordering for food and beverages, we demonstrated no robust evidence that the presence of alcohol calorie labelling reduces the likelihood of ordering alcoholic beverages. Interestingly, if individuals chose to view calorie labels, they were less likely to purchase alcohol. However, this group were also self-selecting, and characterised by greater health/food-choice-related motives. There was no evidence that in individuals who ordered alcoholic beverages that alcohol calorie labelling reduces the calories ordered from alcohol, or from food and soft drinks.

These findings add to a growing body of evidence which have examined the impact of alcohol calorie labelling across different scenarios, including; online supermarket shopping (Clarke et al., 2023), intentions to purchase (Robinson, Smith, & Jones, 2022), acute-consumption of alcohol in the laboratory (Maynard et al., 2018), but find limited evidence that calorie information impacts consumer behaviour for alcohol, but also for food.

This study was the first (to our knowledge) to examine the predictors of individual's choices to view a menu which included calorie information or not. Our observation that individuals who demonstrate greater health motivations are more likely to choose calorie labelling is perhaps unsurprising given health motivations are linked to lower weight (Robinson, Jones, & Marty, 2022), and reduced alcohol consumption/abstinence (Davies et al., 2017; Delle et al., 2022). However, it is important to identify those individuals who are less likely to view calorie labelling when given a choice (Frances et al., 2023). Interestingly, 60.7% of individuals decided not to view alcohol calorie information, which suggests if given the option, the majority of the general public would not choose to view alcohol calorie information. It remains to be seen whether this is true also of food- and non-alcohol related calories.

These findings also support wider research to suggest informational approaches such as nutritional labelling are unlikely to have a meaningful (isolated) impact on consumer behaviour. Meta-analyses and empirical studies demonstrate that the effect of food calorie labelling is likely to be statistically small or close to zero (Bleich et al., 2017; Marty et al., 2020; Robinson, Boyland, Christiansen, et al., 2023), and evidence suggests that knowledge of calories isn't enough to promote behaviour change, in the face of competing motivations such as positive rewards, taste and habit (Guthrie, Mancino, & Lin, 2015).

The strengths of this study include it being one of the first to examine calorie labelling on potential alcohol ordering in 'on-trade' settings, which allowed us to examine whether alcohol calorie information would also impact calories ordered from food (via compensation). Unlike previous hypothetical ordering tasks (see (Marty, Reed, Jones, & Robinson, 2021)) we did not specify requirements on participant behaviour (e.g. having to order a starter, main and dessert), which would allow for more realistic ordering scenarios. However, there are also some limitations. First, our scenario and outcomes were hypothetical, which lack any direct consequences to the individual (Klein & Hilbig, 2019). Given the increased prevalence of ordering online for restaurants through food delivery services, our methodology may still be somewhat reflective of a realistic scenario (Keeble et al., 2020). Indeed, the calories ordered here are similar to those ordered when examining customer behaviour in the UK out-of-home-food sector (Polden et al., 2023). In experiment two, we specified a specific time when restaurant ordering is most likely (i.e., Saturday at 7pm), as such we cannot generalise beyond this (e.g. weekday ordering). Findings have demonstrated that weekend drinking is associated with alcohol-related social expectancies (Lau-Barraco et al.,

Table 4
Examination of binary decision to order an alcoholic beverage and number of alcohol calories ordered across both experiments.

	Decision to order alcohol		Number of Alcohol Calories ordered		Number of non-alcohol calories ordered	
	Odds Ratios	CI	Estimates	CI	Estimates	CI
Age	**1.02**	**1.01–1.03**	0.11	−0.69–0.91	**−4.90**	**−7.33 - - 2.48**
AUDIT	**1.70**	**1.59–1.83**	**14.69**	**10.33–19.06**	5.92	−6.39–18.23
BMI	**0.98**	**0.96–1.00**	1.59	−0.19–3.38	3.05	−2.17–8.26
SES	**0.56**	**0.42–0.74**	−20.14	−42.20–1.92	−13.31	−80.66–54.05
Gender	1.01	0.77–1.32	−18.04	−39.97–3.89	25.44	−42.01–90.90
Calorie Label	**0.69**	**0.51–0.92**	5.35	−17.23–27.92	40.17	−31.95–112.28
(pseudo) R2	0.298		0.056		0.010	

Legend: AUDIT = Alcohol Use Disorders Identification Task; Reference categories were female for Gender (vs male and non-binary), low SES for SES (high SES was individuals educated to A-Level or greater in the UK), Calorie labelling absent (vs present).

2016). Therefore, the motivations to consume alcohol within a weekend context may have led to participants perceiving calorie content to be less important than in a context where participants do not consume as much alcohol, or are not as motivated to do so. Relatedly, it may be the case that alcohol calorie labelling influences decisions outside of this specific context, such as choosing to eat more healthily later in the day or reducing the number of drinking days per week. Some self-reported survey data does suggest that consumers report changing alcohol consumption based on energy content considerations (Bowden et al., 2022), and therefore future research would benefit from examining whether labelling may affect behaviour outside of the context in which participants are directly exposed to labelling.

Future research should also continue to examine whether alcohol calorie labelling is likely to be an effective public health policy by examining real-world outcomes (e.g, consumption of on-trade and off-trade alcohol), whilst also examining any individual or situational predictors which might moderate any impact on calorie labelling. Similarly, examining different types of calorie information should be investigated, for example using images to increase the saliency of the information or providing food-calorie or physical activity calorie equivalents (Piper, Mileti, Prete, & Guido, 2021). Finally, given suggestions that calorie labelling might work by shifting consumers towards lower calorie alternatives (Bleich et al., 2017) future research should examine in more detail whether an increased presence of low calorie alcoholic beverages moderates any effect (Chrysochou, 2014; Robinson, Smith, & Jones, 2022).

To summarise, across two randomised controlled trials we found no consistent evidence to suggest that alcohol calorie information on restaurant menus may reduce the likelihood that individuals order an alcoholic beverage. However, we also demonstrated that the majority of people would choose not to view alcohol calorie information, and the information would not lead to a reduction in alcohol calories ordered in individuals who did choose to order alcohol.

Consent for publication

Not applicable.

Ethics statement

The research presented here was approved by the local research ethics committee (reference: 23/PSY/062). All participants provided informed consent.

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Contributions

All authors collaborated in designing the study protocol. AJ collected study data and performed the analyses. AJ drafted the manuscript and ER, TG provided critical revisions.

CRediT authorship contribution statement

Andrew Jones: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Methodology, Formal analysis, Data curation, Conceptualization. **Thomas Gough:** Writing – review & editing, Conceptualization. **Eric Robinson:** Writing – review & editing, Methodology, Conceptualization.

Declaration of competing interest

ER has previously been the recipient of research funding from Unilever and the American Beverage Association. However, he does not consider this to be a conflict of interest for the present research. AJ has received funding for projects unrelated to this from Camarus. TG declares no competing interests.

Data availability

Data available at https://osf.io/y2hbc

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2024.107548.

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