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Coffee shop menu calorie labelling: effects on beliefs, knowledge and behaviour and the role of food choice motives

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ABSTRACT

Calorie labelling has been implemented as a public health strategy to address obesity, but its mechanisms of action are not well understood. Drawing on expectancy-value models, this study explored whether calorie labelling influences the calorie content of items selected from a hypothetical coffee shop menu via changes in outcome expectancies and whether effects are moderated by food choice motives. Adults (n = 577) were randomly assigned to view a menu with (n = 290) or without (n = 287) calorie information and select their preferred items(s). The primary outcome was total calories selected. Secondary outcomes were change in weight control, health, taste, value for money and fullness expectations for each menu item and participants' motivation for weight control, health, price and sensory appeal. Exploratory outcomes included participants' calorie estimates for each menu item. Labelling did not significantly reduce calories selected ($p = 0.18$), though means were in the predicted direction (labelling $M = 371$, $SD = 261$; no labelling $M = 392$, $SD = 249$, 5% decrease). Labelling significantly increased health, weight control and value for money expectations of menu items but these changes did not influence calories selected. A sensitivity analysis suggested moderation by weight control motivation whereby labelling reduced calories selected among highly motivated participants, although this effect was not observed across other models. Labelling was associated with better calorie estimation accuracy. Findings suggest that while calorie labelling may influence beliefs and knowledge, its acute impact on population level behaviour may be minimal.

1. Introduction

The prevalence of obesity in the UK has been steadily increasing over the past few decades, with an estimated 64% of adults in England living with overweight or obesity in 2022 to 2023 (Health Survey for England, 2022). To address this, in 2022 the UK government introduced mandatory calorie labelling on menus and food labels for large food businesses such as restaurants and cafes (Department of Health & Social Care, 2021). This policy aimed to help individuals make healthier choices and reduce their calorie intake. However, research exploring the effects of calorie labelling of out-of-home foods and drinks on consumer choices has found mixed effects. Several systematic reviews and meta-analyses have reported a significant reduction in calories as a result of calorie labelling (Clarke et al., 2025; Crockett et al., 2018; Long et al., 2015; Robinson et al., 2023; Zlatevska et al., 2018). However, these reductions have consistently been modest across all reviews, ranging between 11 kcals and 50 kcals. Other studies have found no or only small effects of calorie labelling on calories selected or consumed (Bleich et al., 2017; Cantu-Jungles et al., 2017; Fernandes et al., 2016; Polden et al., 2025; Sinclair et al., 2014).

This mix of findings suggests that effects of calorie labelling may by influenced by different contexts and individual factors. For example, the evidence suggests that calorie labelling is more effective in restaurant settings (Bleich et al., 2017; Crockett et al., 2018; Zlatevska et al., 2018), and when additional nutrition information (such as healthy food symbols and traffic light labels) is provided (Fernandes et al., 2016; Sinclair et al., 2014). Calorie reduction also appears to be stronger in females and overweight individuals (Sinclair et al., 2014; Zlatevska et al., 2018). Additionally, one review suggests that significant effects of calorie labelling are more common in laboratory-based studies as opposed to studies carried out in real-world settings (Cantu-Jungles et al., 2017).

While these studies highlight several factors that may moderate the effects of calorie labelling, to date there have been no attempts to examine the mechanisms of action underlying these types of menu

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labelling interventions. This is important to better understand the different contexts in which these types of public health policy interventions are more or less likely to change behaviour. This aligns with the experimental medicine approach proposed by Sheeran et al. (2017), which provides a systematic process for developing effective behaviour change interventions. The process involves first identifying a potential mechanism of action (a target) and assessing its impact on the behavioural outcome. This is followed by assessing the impact of the proposed intervention on the target and finally investigating whether the intervention influences behaviour via its effect on the target. This approach helps discern how and why an intervention is effective, as opposed to traditional methods which solely focus on whether an intervention is effective.

Much of the research on calorie labelling has focused on food outlets such as cafes and restaurants. There is limited research exploring the effects of calorie labelling in coffee shop contexts, where consumers typically purchase hot drinks as opposed to food (Allan et al., 2015; Bollinger et al., 2011). This is an important context to explore as many of the hot drinks on offer have a considerable number of calories (Starbucks, 2021), and evidence suggests that liquid calories tend to be less satiating than calories consumed in food (Stribitcaia et al., 2020). This means that individuals may be regularly consuming excess calories at coffee shops. Tapper et al. (2022) explored this by testing the effects of calorie labelling in a hypothetical coffee shop setting. Their research also aimed to explore two potential moderators of the effects of calorie labelling: consumers' coffee shop purchasing habits and their reflective motivation (i.e., a deliberate, conscious motivation to limit calorie intake based on goals; Michie et al., 2011). In a series of two studies, Tapper et al. (2022) found no overall effect of calorie labelling on calories selected but did find a significant association between reflective motivation and calories selected, whereby individuals with higher reflective motivation selected lower calorie items. Additionally, there was some evidence for moderation by reflective motivation, with calorie labelling increasing calories selected in those with lower reflective motivation. These findings suggest that calorie labelling may not be helpful for individuals who are already motivated to limit their calorie intake, and that labelling may potentially have counterproductive effects among those with lower motivation.

The present study is an extension of the studies by Tapper et al. (2022), aiming to further examine the moderating effects of motivation in a larger sample, in addition to exploring potential mechanisms of action (mediators) underlying the effect of calorie labelling on calorie selection in coffee shop settings. We build on previous research by drawing on an expectancy-value framework typically used in social cognition models of behaviour, such as the Theory of Planned Behaviour (Ajzen, 1991) and Social Cognitive Theory (Bandura, 1986). Such theories state that behaviour change will occur when individuals' outcome expectancies (i.e., what they expect will occur as a result of their actions) are altered and if they value these outcomes. Prior research suggests that food labels, including calorie information, can shape beliefs and expectations regarding the properties of the food (Wegman et al., 2018). This can include beliefs about an item's healthiness and ability to support weight management, as well as perceived value for money, expected taste, and satiety potential (Choi, 2015; Ebneter et al., 2013; Gertner et al., 2016; Reale & Flint, 2016; Watson et al., 2022). Consistent with expectancy-value models, these expectations may influence food choice depending on the extent to which the relevant outcome is valued by the individual. For example, lower calorie items may be perceived as healthier, which may result in lower calorie selection in individuals with higher motivation to eat healthy. Accordingly, we examined whether change in outcome expectancies related to weight control, health, value for money, taste and fullness mediated the effects of calorie labelling on consumer choices, and whether these effects were moderated by corresponding food choice motivations of weight control, health, price, sensory appeal and hunger.

The primary outcome of interest was therefore total calories selected from the menu, and secondary outcomes were changes in outcome expectancies and food choice motivations. Based on previous research, we predicted that individuals exposed to calorie labelling would select items with lower calories and that this effect would be stronger in those with higher motivation for weight control. We also predicted that individuals who viewed calorie labels would report a greater change in expectations relating to weight control, health, taste, fullness and value for money of menu items. Based on research showing that people underestimate calories in high calorie items (Tapper et al., 2022), we anticipated that a greater change in weight control and health expectations about menu items would be associated with lower calorie selection. Similarly, based on research that people overestimate calories in low calorie items (Tapper et al., 2022), we anticipated that a greater change in taste, fullness and value for money expectations would be associated with higher calorie selection. Finally, we predicted that weight control, health, price, sensory appeal motivation and hunger would moderate both the effects of labelling on the relevant outcome expectancies (due to greater attention to, and processing of, calorie related information), and the effects of change in expectations on calorie selection (due to goal-behaviour alignment). See Fig. 1 for the full logic model showing predicted effects. The hypotheses, methods and analyses were pre-registered at https://osf.io/fkvz5. In additional exploratory analyses we also examined the effects of calorie labelling on the accuracy of participants' calorie estimates, i.e. their knowledge.

2. Methods

2.1. Sample size

Based on Tapper et al. (2022), the study was powered to detect small-to-moderate sized interaction effects between calorie labelling, motivation and menu choice using G*Power (f = 0.125, alpha = 0.05, 80% power), and a sample size of 505 was calculated. This was increased by approximately 20% due to uncertainty over the likely size of interactions and to allow for data exclusions, resulting in a target sample size of 600.

2.2. Participants

The study was advertised as a 'Coffee Shop Study' on Prolific, an online recruitment platform offering access to a large pool of diverse research participants. Recruitment was stratified using population-based quotas for age, sex and ethnicity to ensure that the sample was broadly representative of the UK population. A total of 602 participants (305 female, 292 male) aged 18 to 81 years ($M = 45.6$, $SD = 15.6$) took part in the study, and they received payment equivalent to approximately £8 per hour. The study received ethics approval from the City St Georges, University of London Psychology Department Research Ethics Committee.

2.3. Menu boards

All participants were presented with a menu board on a computer screen which listed 10 items from a coffee shop menu (see Supplementary Materials). These included seven drink options (three different coffees, tea, two hot chocolates, and water) and three food items (Belgian chocolate brownie, blueberry muffin and banana) with prices displayed to the right of each item. In the calorie labelling group, the calorie content of each item was displayed next to the price in italics. Calorie content values were based on a popular coffee shop franchise menu (Starbucks, 2021).

2.4. Measures

2.4.1. Outcome expectancies

For each item on the menu, participants were asked to rate to what

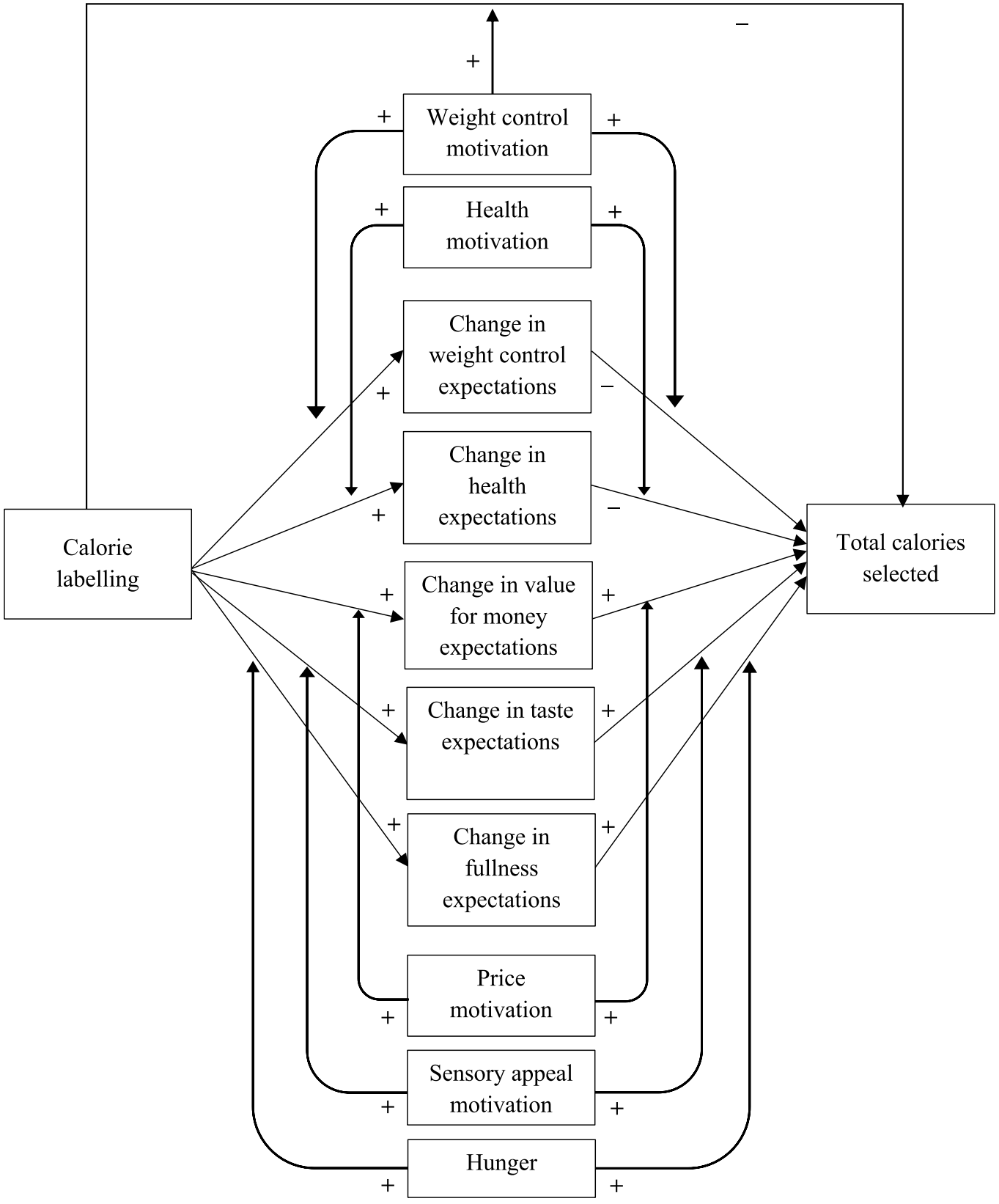

Fig. 1. Logic model showing predicted effects.

extent they thought the item would (a) taste good, (b) leave them feeling full, (c) be good value for money, (d) make them feel like they are eating healthily, and (e) help them avoid gaining weight. Ratings were provided on a visual analogue scale (VAS) ranging from 0 (strongly disagree) to 100 (strongly agree) at two timepoints; before viewing the menu board and after viewing the menu board. The two scores were then used to calculate change in outcome expectancies.

2.4.2. Hunger

Participants indicated their current hunger level on a VAS ranging from 0 (not at all hungry) to 100 (extremely hungry) before viewing the menu board.

2.4.3. Demographics

Participants reported their age, first language, and education level.

2.4.4. Item selection

Before they were presented with the menu board, participants were asked to imagine they had just walked into a coffee shop and to use the computer mouse to select their chosen item(s) by clicking on the price. Participants were instructed to only buy for themselves and not other people. Items were highlighted when selected and could also be deselected. The item(s) and the time it took to select each item were recorded. Participants were also asked to indicate what the first thing was that they clicked on *('the drink that I chose', 'a food item', 'something I changed my mind about and then unclicked'*, or *'I can't remember'*), and to describe the main reasons for their menu selection (open-text response).

2.4.5. Habits

Participants were asked how many times a week they buy a hot drink from a coffee shop. If they answered 0, they were then asked how many times a month they buy a hot drink from a coffee shop. Participants were also asked what type of drink they most often buy when visiting a coffee shop (open-text response).

2.4.6. Motivation

Twelve items from the Food Choice Questionnaire (FCQ; Steptoe, 1995) were used to assess motivation for eating healthy, motivation for weight control, importance of sensory appeal and importance of price. This consisted of three items each from the 'health', 'weight control', 'price' and 'sensory appeal' dimensions which asked participants to rate the importance of associated features of the food they eat on a typical day. All items were rated on a scale of 1 (not at all important) to 4 (very important).

2.4.7. Dieting status

Participants indicated whether or not they were currently dieting to lose weight.

2.4.8. Suspicion probe

To ascertain whether participants guessed the study aims, they were asked to indicate what they thought the study was expecting to find and whether they had learned anything about it from people who had already taken part (open-text response).

2.4.9. Calorie information recall

Whether participants noticed calorie labels on the menu was measured by asking them to indicate whether they viewed a menu with calorie information, without calorie information or if they were not sure whether there was calorie information.

2.4.10. Calorie estimates

Participants were asked to provide an estimate of the number of calories they thought each of the ten menu items contained. All items were presented on the same page and in the order they appeared on the menu. Drink sizes were provided in brackets next to each drink, in ounces for hot drinks and millilitres for water.

2.4.11. Attention and consistency checks

To ensure accuracy of responses to the survey, we included two attention checks and one consistency check. The first attention check item asked participants to indicate how many times they visited the planet Mars *('several times', 'just once',* or *'never'*). The second attention check item was incorporated into the motivations measure, where participants were specifically asked to select the rating 2. For the consistency check, participants were asked to indicate their education level twice (once towards the beginning and once towards the end of the survey), with the order of responses reversed the second time.

2.5. Procedure

Participants completed the study online on Qualtrics, which took approximately 20 minutes. Upon signing the consent form, participants completed the first round of outcome expectancy measures related to the ten menu items, followed by measures of hunger and demographics. They were then provided with the menu instructions and were randomised to view either the menu with calorie labels or the control menu. After selecting their choice of items from the menu, participants were immediately asked to indicate the first item they clicked on, followed by completion of the second round of outcome expectancy measures. Participants then indicated the reason for their menu selection and completed the habit, motivation and dieting status measures. Finally, participants completed the suspicion probe followed by the calorie information recall and calorie estimate measures. See Supplementary Materials for the full survey flow.

2.6. Primary data analysis

Data were analysed in the IBM SPSS statistical analysis package (Version 29). The primary pre-registered analyses consisted of a moderated parallel mediation model via the PROCESS macro (Hayes, 2017) to test the direct effect of labelling on calories selected as well as indirect effects via the 5 outcome expectancies. Indirect effects were subjected to follow-up bootstrap analyses with 5000 bootstrap samples and 95% bias corrected confidence intervals. As pre-registered, three different versions of the model were used to test the moderating effects of (1) weight control motivation and health motivation, (2) price motivation and sensory appeal motives, and (3) hunger. Pre-registered sensitivity analyses were carried out by repeating the three models with data from participants who correctly guessed the aims of the study removed. In further (not pre-registered) sensitivity analyses, the first model was repeated with mediators that were not involved in moderation pathways removed to test the robustness of the interaction between calorie labelling and weight control motivation.

2.7. Exploratory data analysis

Exploratory analyses (not pre-registered) included (a) evaluating calorie estimation accuracy across menu items, (b) analysing item-specific changes in outcome expectancies and (c) conducting qualitative analysis of participants' reasons for their menu choices. These analyses were included to provide additional context and to aid interpretation of the primary findings.

In particular, qualitative data analysis on the reasons behind menu selections was conducted to provide deeper insight into participants' decision-making processes and help contextualise the quantitative findings. These data were analysed using content analysis. Nine themes were identified, six of which were related to the mediator and moderator variables. A subset of the responses (10%) was double coded by a second coder and the initial inter-observer reliability ranged from 91% to 100% across the 9 themes. Inconsistencies were discussed between the two coders until 100% agreement was reached.

3. Results

3.1. Data screening

A total of 602 participants completed the study. As per the pre-registration, 25 participants were excluded due to failing the attention ($n = 4$) and consistency checks ($n = 21$). This resulted in a total sample of 577. Five participants (0.9%) indicated their sex as 'other/prefer not say' and 19 participants (3.3%) responded to the dieting status question as 'prefer not to say'. These participants were excluded from all analyses involving the respective variables. Seven participants (1.2%) selected more than one hot drink from the menu (5 in the control group and 2 in the experimental group). As per the pre-registration, these participants were excluded from analyses of choice data.

3.2. Descriptive statistics

A summary of participant characteristics in each condition is provided in Table 1.

3.3. Confirmatory analyses: effects of labelling and outcome expectancies on calories selected

As per the pre-registered protocol, three moderated mediation models with bootstrap confidence intervals were used to test the direct effects of labelling on calories selected, as well as the indirect effects via change in the five outcome expectancies (relating to weight control, health, price, value and fullness). In Model 1, weight control motivation and health motivation were entered as moderators and all five outcome expectancy changes were entered as mediators. To avoid repeating analyses, Models 2 and 3 only included the outcome expectancy changes relevant to the moderators in each model. In Model 2, price and sensory appeal motivation were entered as moderators, and change in value and taste expectations were entered as mediators. In Model 3, hunger was entered as a moderator and change in fullness expectations was entered as a mediator.

Table 1
Participant characteristic as a function of condition.

Characteristic	Calorie labelling (n = 290)	No calorie labelling (n = 287)
Percentage females[a]	51%	49%
Percentage first language English	94%	95%
Age in years (*M, SD*)	46 (16)	45 (16)
Education		
No formal qualifications	2%	1%
1-3 GCSEs or equivalent	5%	2%
4+ GCSEs or equivalent	10%	11%
A-level or equivalent	15%	20%
Certificate of higher education or equivalent	3%	4%
Diploma of higher education or equivalent	5%	4%
Bachelors' degree or equivalent	39%	37%
Master's degree or equivalent	18%	18%
Doctoral degree or equivalent	4%	5%
Percentage dieting to lose weight[b]	43%	37%
Hunger on VAS (*M, SD*)	39 (25)	44 (27)
Drinks bought from coffee shop per month[c] (*M, SD*)	4.9 (6.0)	4.5 (5.9)
Health motivation (*M, SD*)	2.9 (0.8)	2.8 (0.8)
Weight control motivation (*M, SD*)	2.3 (0.8)	2.2 (0.8)
Price motivation (*M, SD*)	2.9 (0.6)	3.0 (0.7)
Sensory appeal motivation (*M, SD*)	3.2 (0.6)	3.2 (0.6)

[a] n = 288 (calorie labelling) and 284 (no calorie labelling) due to missing values.
[b] n = 280 (calorie labelling) and 278 (no calorie labelling) due to missing values.
[c] Calculated by multiplying drinks brought per week by 4. If drinks per week was less than 1, participants reported number of drinks brought per month. Responses of less than once a month were converted to 0.

3.3.1. Model 1: weight control and health motivation as moderators

The mean calorie content of items selected from the menu was 371 kcal ($SD = 261$) in the labelling condition and 392 kcal ($SD = 249$) in the no labelling condition, with a small effect size (Cohen's $d = -0.08$). The direct effect of calorie labelling on calories selected was not significant ($b = -29$, $SE = 22$, 95% CI [−72, 14], $p = 0.18$), therefore the hypothesis that participants who view the calorie labelled menu would select items with a lower calorie content than those who view the control menu was not supported.

The hypothesised moderated mediation model with coefficients for each pathway is presented in Fig. 2. Calorie labelling was associated with a significantly greater change in menu item weight control expectations ($b = 2.42$, $SE = 0.56$, 95% CI [1.31, 3.52], $p < 0.001$), health expectations ($b = 2.94$, $SE = 0.54$, 95% CI [1.88, 4.00], $p < 0.001$), and value for money expectations ($b = 1.70$, $SE = 0.55$, 95% CI [0.62, 2.77], $p = 0.002$) as predicted. However, calorie labelling did not significantly affect change in taste expectations ($b = 0.99$, $SE = 0.77$, 95% CI [−0.52, 2.50], $p = 0.20$) or fullness expectations ($b = 0.96$, $SE = 0.65$, 95% CI [−0.32, 2.25], $p = 0.14$).

Contrary to predictions, total calories selected was not significantly affected by change in menu item weight control expectations ($b = 1.56$, $SE = 1.69$, 95% CI [−1.75, 4.88], $p = 0.36$), change in health expectations ($b = 3.24$, $SE = 1.78$, 95% CI [-0.26, 6.75], $p = 0.07$), change in value for money expectations ($b = 2.13$, $SE = 1.69$, 95% CI [−1.18, 5.44], $p = 0.21$), change in taste expectations ($b = -1.83$, $SE = 1.19$, 95% CI [−4.16, 0.51], $p = 0.13$), or change in fullness expectations ($b = -2.60$, $SE = 1.41$, 95% CI [−5.38, 0.17], $p = 0.07$).

3.3.1.1. Mediation. Consistent with the findings above, the effect of calorie labelling on total calories selected was not mediated by change in weight control expectations ($b = 3.78$, $SE = 4.17$, 95% CI [−4.27, 12.46]), change in health control expectations ($b = 9.52$, $SE = 5.68$, 95% CI [−0.15, 22.11]), change in value for money expectations ($b = 3.61$, $SE = 3.81$, 95% CI [−2.57, 12.53]), change in taste expectations ($b = -2.60$, $SE = 2.42$, 95% CI [−8.30, 0.96]), or change in fullness expectations ($b = -1.81$, $SE = 1.99$, 95% CI [−6.55, 1.33]).

3.3.1.2. Moderation. Contrary to predictions, weight control motivation did not moderate the effect of calorie labelling on total calories selected ($b = -48.80$, $SE = 27.98$, 95% CI [−103.75, 6.15], $p = 0.08$) or on change in weight control expectations ($b = 0.74$, $SE = 0.73$, 95% CI [−0.69, 2.16], $p = 0.31$). Furthermore, weight control motivation did not moderate the effect of change in weight control expectations on total calories selected ($b = 1.56$, $SE = 2.12$, 95% CI [−2.60, 5.72], $p = 0.46$). Similarly, health motivation did not moderate the effect of calorie labelling on change in health expectations ($b = 0.38$, $SE = 0.70$, 95% CI [−0.99, 1.75], $p = 0.58$), or the effect of change in health expectations on total calories selected ($b = 1.40$, $SE = 2.33$, 95% CI [−3.18, 5.99], $p = 0.55$).

3.3.2. Model 2: price and sensory appeal motivation as moderators

The hypothesised moderated mediation model with coefficients for each pathway is presented in Fig. 3. The pattern of results for the change in value and taste expectation variables followed Model 1, however in this model (contrary to predictions) a greater change in taste expectations was significantly associated with a *decrease* in total calories selected ($b = -3.12$, $SE = 1.19$, 95% CI [−5.45, −0.78], $p = 0.01$).

3.3.2.1. Moderation. Contrary to predictions, price motivation did not moderate the effect of calorie labelling on change in value for money expectations ($b = 0.18$, $SE = 0.81$, 95% CI [−1.42, 1.78], $p = 0.82$), or the effect of change in value for money expectations on total calories

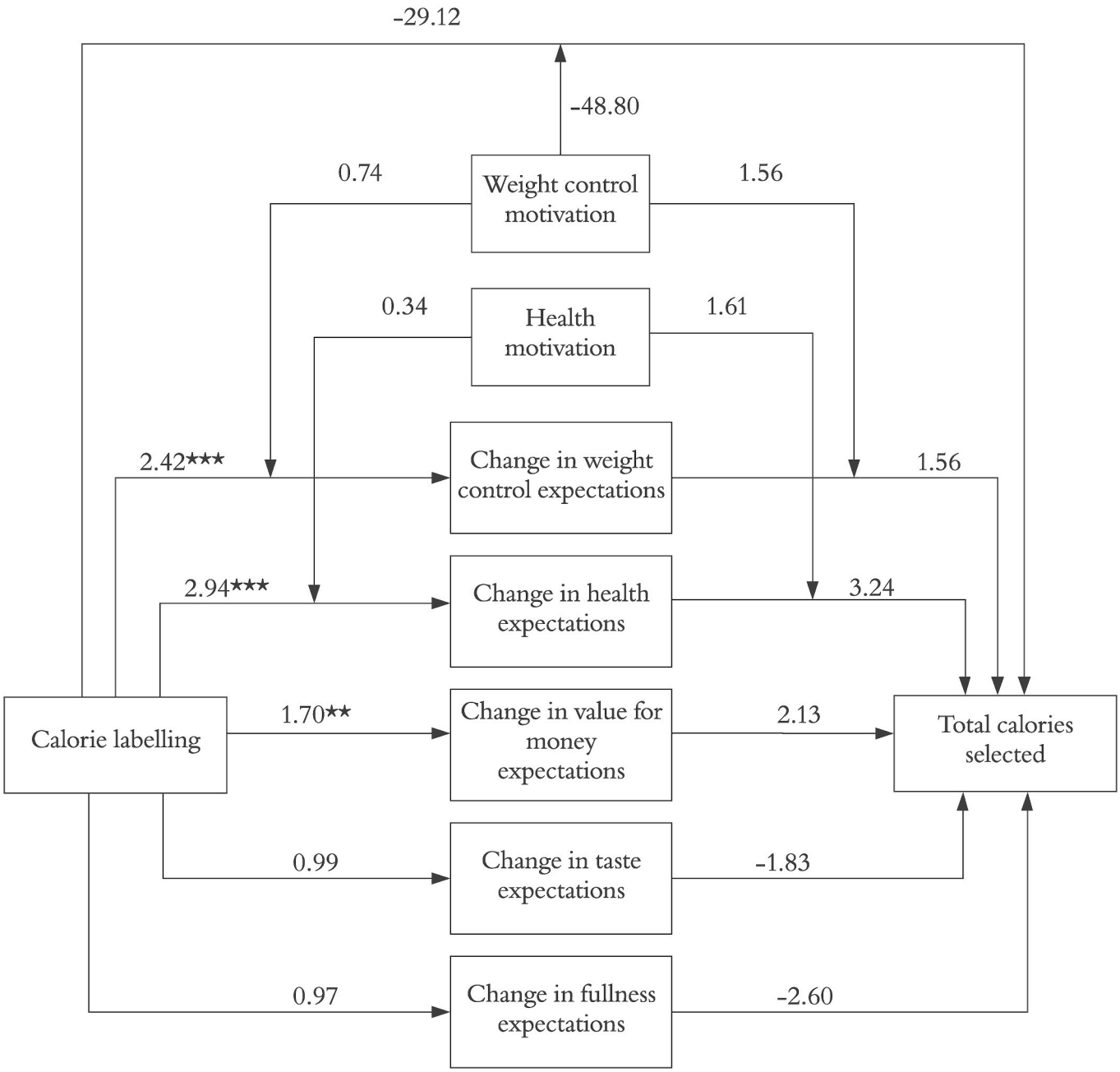

Fig. 2. Hypothesised Model 1 with coefficients, *p < 0.05, **p < 0.01, ***p < 0.001.

selected ($b = -3.83$, $SE = 2.42$, 95% CI [−8.59, 0.92], $p = 0.11$). Similarly, sensory appeal motivation did not moderate the effect of calorie labelling on change in taste expectations ($b = 0.36$, $SE = 1.31$, 95% CI [−2.21, 2.93], $p = 0.78$), or the effect of change in taste expectations on total calories selected ($b = -1.16$, $SE = 1.94$, 95% CI [−4.96, 2.64], $p = 0.55$).

3.3.3. Model 3: hunger as a moderator

The hypothesised moderated mediation model with coefficients for each pathway is presented in Fig. 4. The pattern of results for the change in fullness expectation variable was the same as Model 1.

3.3.3.1. Moderation. Contrary to predictions, hunger levels did not moderate the effect of calorie labelling on change in fullness expectations ($b = 0$, $SE = 0.03$, 95% CI [−0.05, 0.05], $p = 0.96$), or the effect of change in fullness expectations on total calories selected ($b = -0.02$, $SE = 0.05$, 95% CI [−0.12, 0.08], $p = 0.66$).

3.3.4. Sensitivity analysis

As per the pre-registration, the 3 models were repeated with data from aim guessers excluded. A total of 108 participants (18.9%) guessed the aims of the study, therefore the analyses were repeated with the remaining 462 participants. The association between calorie labelling and change in taste expectations became significant in Model 1 ($b = 1.77$, $SE = 0.86$, 95% CI [0.07, 3.46], $p = 0.04$). The pattern of results remained unchanged for the rest of the findings.

In further sensitivity analyses, Model 1 was repeated without the 3 mediators that were not moderated in the model (change in value for money, taste and fullness expectations). In this model the interaction between calorie labelling and weight control motivation became significant ($b = -55.29$, $SE = 27.87$, 95% CI [−110.02, −0.55], $p = 0.048$), suggesting that the effect of calorie labelling on total calories selected

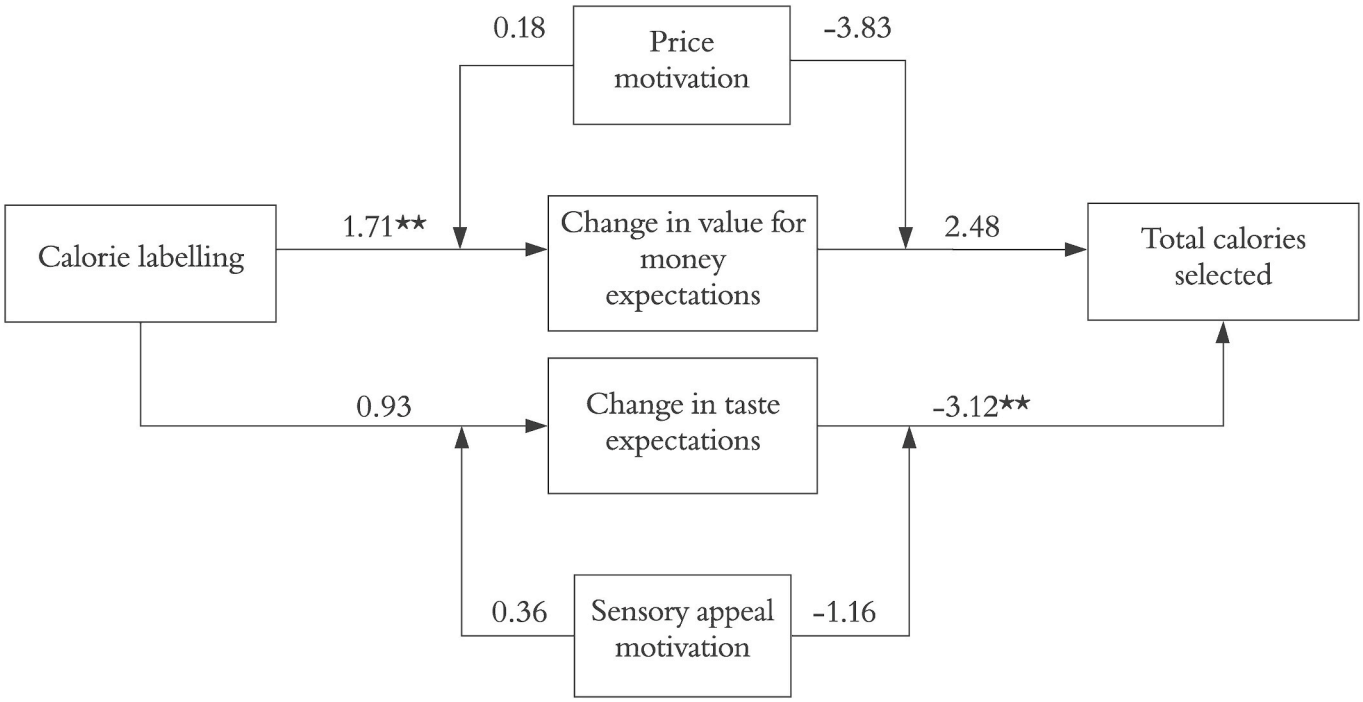

Fig. 3. Hypothesised Model 2 with coefficients, *p < 0.05, **p < 0.01, ***p < 0.001.

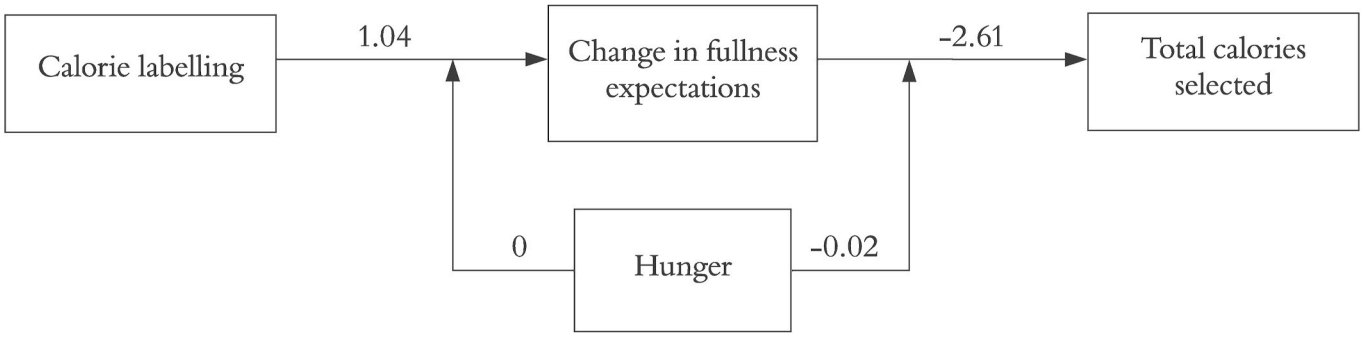

Fig. 4. Hypothesised Model 3 with coefficients, *p < 0.05, **p < 0.01, ***p < 0.001.

depended on the level of weight control motivation. Together, the variables accounted for approximately 0.67% of the variance in total calories selected, $R^2 = 0.01$, $F(1,561) = 3.94$, $p = 0.05$. Simple slopes for the association between calorie labelling and total calories selected were tested for low (−1 SD below the mean), moderate (mean), and high (+1 SD above the mean) levels of weight control motivation. Calorie labelling was significantly associated with total calories selected for high levels of weight control motivation ($b = -70.88$, $SE = 30.95$, 95% CI [−131.68, −10.08], $p = 0.02$), but not for moderate ($b = -28.12$, $SE = 21.70$, 95% CI [−70.73, 14.50], $p = 0.20$), or lower levels of weight control motivation ($b = 14.64$, $SE = 30.21$, 95% CI [−44.69, 77.98], $p = 0.63$). Fig. 5 plots the simple slopes for the interaction. The Johnson-Neyman technique showed that calorie labelling significantly reduced total calories selected when weight control motivation was above 2.61, which represented 36% of the sample. However, when aim guessers were removed, the interaction between calorie labelling and weight control motivation became non-significant ($b = -50.19$, $SE = 32.40$, 95% CI [−113.87, 13.49], $p = 0.12$). The pattern of results for the rest of the findings remained unchanged.

3.4. Exploratory analysis

3.4.1. Calorie estimate accuracy

Table 2 shows the actual calories in each menu item and the mean estimates provided by participants in each condition. The items are listed in ascending order of calorie content for drinks then food. The results show that on average participants in both conditions tended to overestimate the calorie content of low-calorie items such as tea and Americano and underestimate the calorie content of high-calorie items such as Latte and hot chocolate.

Mean estimate accuracy across the 10 menu items were computed for each participant using the absolute difference between their estimates and the actual calorie content. Lower estimate accuracy values indicated greater accuracy. Spearman's correlations showed that estimation accuracy was significantly higher among those who were younger ($n = 577$, $r = 0.11$, $p = 0.01$), and those with higher health motivation ($n = 577$, $r = -0.09$, $p = 0.03$) and weight motivation ($n = 577$, $r = -0.13$, $p = 0.001$).

A Mann-Whitney test showed that those who were in the calorie labelling condition were significantly more accurate than those in the control condition ($n = 577$, $Mdn = 64.3$ and 94 respectively, $U = 23207$, $p < 0.001$). A further Mann-Whitney test showed that participants who

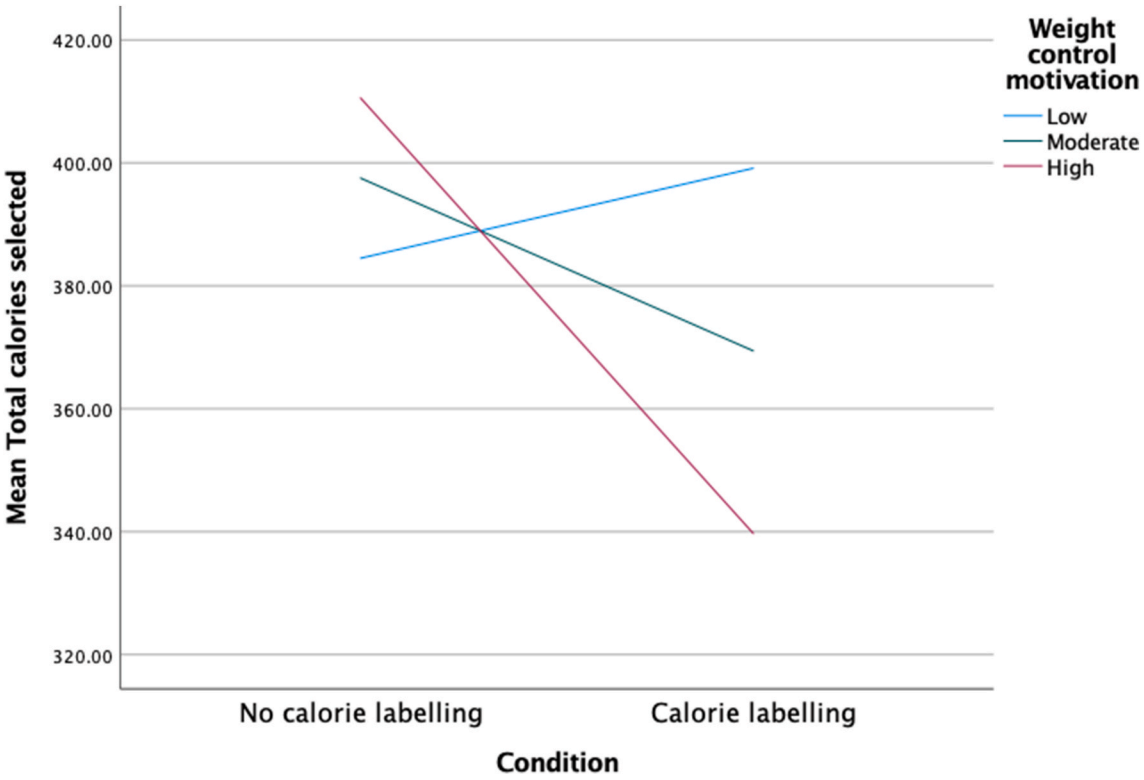

Fig. 5. Simple slopes for the interaction between calorie labelling and weight control motivation in sensitivity analysis of Model 1.

Table 2
Actual and estimated calories in each menu item.

Menu item	Calories	Mean (95% CI) estimated calories: calorie labelling	Mean (95% CI) estimated calories: no calorie labelling
Water	0	2 (1, 3)	5 (4, 7)
Tea	10	50 (44, 56)	65 (58, 72)
Americano	27	67 (60, 75)	77 (66, 88)
Cappuccino	163	165 (155, 174)	156 (142, 170)
Latte	201	175 (166, 184)	158 (145, 172)
Hot chocolate	319	265 (253, 277)	227 (207, 247)
Hot chocolate with whipped cream and chocolate flake	502	375 (358, 392)	341 (311, 370)
Banana	105	87 (81, 93)	83 (74, 92)
Belgian chocolate brownie	373	317 (303, 331)	319 (292, 346)
Blueberry muffin	452	327 (312, 342)	286 (260, 312)

reported they were dieting to lose weight were significantly more accurate than those who were not dieting ($n = 558$, $Mdn = 66.6$ and 86.2 respectively, $U = 47266.5$, $p < 0.001$). Female participants also reported more accurate calorie estimates than male participants ($n = 572$, $Mdn =$ 74.2 and 84.6 respectively, $U = 44777.5$, $p = 0.05$).

3.4.2. *Change in weight control, health, value for money and taste expectations for each item on the menu*

Mean change in weight control, health, value for money and taste expectations for each item on the menu are presented in Table 3. Items are listed in ascending order of calorie content for drinks then food. As expected, overall mean changes for weight control, health and value for money expectations were greater in the calorie labelling condition than in the no labelling condition.

In line with predictions, in the calorie labelling condition weight control and health expectations tended to increase for lower calorie drinks where people had overestimated calories (see Table 2) and decrease for higher calorie items where people had underestimated calories. The exceptions were for the hot chocolate with whipped cream and the chocolate brownie, which may have been constrained by floor effects in the weight and health control ratings (see Table S1 and S2 in supplementary materials). Importantly, this pattern did not emerge in the no labelling condition.

For value for money expectations, no clear patterns emerged. Thus, our prediction that higher calorie items would be viewed as better value for money was not supported. Our predictions regarding taste expectations were also not supported as higher calorie drinks showed a greater decline in taste expectations compared to lower calorie drinks. Likewise, contrary to predictions, taste expectations decreased for the two high calorie food items but increased for the lower calorie banana. Interestingly, this pattern was observed across both the labelling and no labelling conditions. This finding may aid interpretation of the significant association between change in taste expectations and calorie selection observed in Model 2; a greater change in taste expectations was associated with reduced calorie selection since expectations decreased more for higher calorie food and drink items. See supplementary materials for additional exploratory analyses.

3.4.3. *Qualitative data*

Analysis of participants' reasons for their menu selections revealed nine key themes, six of which were related to the mediator and moderator variables. A description of each theme is presented in Table 4 with example responses. The themes relate to factors that were considered during the decision-making process rather than the specific reasons for the participant's choice.

The percentages of responses that were coded in each theme across the total sample and the two conditions are presented in Table 5. The themes are presented in order of most common to least common. The most common reason stated related to taste and the least common reason related to calories and weight control across both conditions. However, reasons relating to weight control tended to be more common in the calorie labelling condition than the no labelling condition. See

Table 3
Mean change in outcome expectations for each menu item as a function of condition.

Menu item (price; pence per calorie)	Weight control expectations, mean change (*SD*)		Health expectations, mean change (*SD*)		Value for money expectations, mean change (*SD*)		Taste expectations, mean change (*SD*)	
	Calorie labelling	No calorie labelling	Calorie labelling	No calorie labelling	Calorie labelling	No calorie labelling	Calorie labelling	No calorie labelling
Water (£1.20; >120.0p)	1.9 (21.8)	−1.0 (18.0)	−0.0 (15.0)	−1.3 (18.5)	3.3 (19.2)	3.8 (17.8)	−3.5 (27.0)	−4.1 (25.2)
Tea (£1.70; 17.0p)	5.6 (26.1)	−5.0 (23.7)	7.8 (22.8)	0.3 (19.0)	−1.5 (17.8)	−0.4 (13.9)	−3.2 (22.0)	−5.7 (20.1)
Americano (£1.70; 6.3p)	5.0 (26.5)	−7.2 (20.2)	10.5 (24.5)	−0.8 (16.3)	−4.9 (17.7)	−2.0 (17.1)	−4.8 (18.8)	−3.0 (16.8)
Cappuccino (£2.05; 1.3p)	−2.1 (20.2)	−2.8 (16.1)	0.8 (19.8)	0.4 (14.0)	−5.2 (15.1)	−3.7 (14.0)	−10.2 (19.4)	−9.0 (19.0)
Latte (£2.05; 1.0p)	−4.8 (19.4)	−2.1 (16.2)	−1.1 (16.9)	−0.1 (13.7)	−5.8 (16.2)	−2.1 (15.1)	−11.4 (20.3)	−7.9 (18.2)
Hot chocolate (£2.10; 0.7p)	−3.2 (13.0)	−0.4 (12.2)	−0.4 (12.4)	0.8 (10.2)	−6.2 (16.0)	−3.5 (14.5)	−8.3 (27.9)	−8.5 (23.4)
Hot chocolate with whipped cream and flake (£2.70; 0.5p)	−0.6 (11.4)	0.0 (11.9)	1.0 (11.9)	1.4 (10.6)	−5.1 (17.2)	−3.7 (15.7)	−7.4 (28.4)	−6.5 (26.1)
Banana (£0.70; 0.7p)	−3.5 (23.1)	3.3 (21.1)	−9.4 (19.7)	−6.0 (14.4)	2.3 (17.6)	2.5 (16.8)	8.4 (24.1)	3.0 (24.0)
Belgian chocolate brownie (£1.70; 0.5p)	0.4 (13.1)	0.1 (9.6)	2.4 (10.3)	1.3 (9.8)	0.1 (16.5)	0.6 (15.4)	−3.1 (24.3)	−5.2 (24.0)
Blueberry muffin (£1.70; 0.4p)	−2.3 (15.6)	1.2 (12.9)	−1.8 (12.9)	0.2 (13.8)	−0.6 (17.8)	1.4 (16.1)	−5.0 (24.4)	−3.5 (23.6)

Table 4
Themes identified describing participants' reasons for menu choices.

Theme	Description	Example
Weight control	Reasons relating to the calorie content of the item or its potential to support weight control.	*"I picked a drink that was lower in calories so there wouldn't be guilt about having the brownie."*
Health	Reasons relating to the healthiness or nutrition content of the item.	*"Trying to choose something fairly healthy."*
Value for money	Reasons relating to the price or value for money of the item.	*"It seemed the most reasonably priced item on the menu. I wanted the cheaper item."*
Taste	Reasons relating to the taste of the item, liking, wanting, enjoying, or preferring the item, finding it appealing, or the item being a favourite.	*"I like chocolate so a hot chocolate with all the extras stands out. I also picked the brownie because I like chocolate."*
Fullness	Reasons relating to the heaviness or satiety potential of the item.	*"I normally would pick a latte. It would fill me up without being too filling."*
Hunger	Reasons relating to current hunger levels.	*"I'm not hungry so I barely looked at the food section."*
Habits	Reasons relating to usual coffee shop orders or habits.	*"These are the items that I would usually purchase from a coffee shop."*
Treat	Reasons relating to wanting a treat or reward.	*"I wanted to treat myself a bit."*
Other	Reasons relating to caffeine content, time of day, weather, hydration, comfort, having limited options, dietary constraints, mood or no particular reason.	*"Water because I am vegan and most other options were not vegan."*

Table 5
Proportion of responses in each theme.

Theme	Total sample (n = 570)	Calorie labelling (n = 288)	No calorie labelling (n = 282)
Taste	71%	72%	70%
Habits	32%	28%	36%
Other	17%	17%	17%
Value for money	14%	13%	14%
Health	12%	14%	10%
Hunger	12%	9%	14%
Treat	10%	9%	11%
Weight control	7%	12%	2%

supplementary materials for additional qualitative data analyses.

4. Discussion

This study extends our understanding of the effects of calorie labelling on consumer behaviour by demonstrating that labelling influences consumer's beliefs about menu items, particularly their expectations about menu items' ability to support weight control and health. We found that overall changes in weight control and health expectations about menu items were greater in the calorie labelling condition. Specifically, expectations became more positive for lower calorie items where participants tended to overestimate calorie content and more negative for higher calorie items where participants tended to underestimate calorie content. However, contrary to expectancy-value frameworks (e.g., Ajzen, 1991; Bandura, 1986), these changes in expectations did not translate into changes in item selection for participants who valued these outcomes (i.e. those who reported high weight control and health motivation). The study therefore failed to find evidence for the proposal that calorie labelling influences calorie selection via changes in weight control and health expectations. It is possible that the absence of impact on item selection simply reflects the intention-behaviour gap that is widely acknowledged in social cognition models (Sheeran, 2002). This reflects a wider criticism of focusing on conscious, reflective decision-making processes only, which may be less commonly used by individuals when engaging in everyday, high frequency, low-risk decisions such as food choice. It could be the case that despite the change in outcome expectancies, participants' behaviour was still primarily driven by more automatic, habitual processes. Nevertheless, this would not rule out the possibility that a change in outcome expectancies could influence behaviour over a longer timeframe, assuming exposure to calorie information can cause long-term changes to expectancies.

The study also supports assumptions that calorie labelling helps increase knowledge about food calorie content as exploratory analyses showed higher calorie estimation accuracy in the calorie labelling (vs. no labelling) condition of the experiment. This finding is in contrast with Tapper et al.'s (2022) findings, though this may be because their study had a smaller sample size and thus may have been underpowered. The finding broadly aligns with other research that has explored effects of labelling on calorie estimates of both food (Cawley et al., 2021) and alcoholic drinks (Robinson et al., 2021). This is an important finding as it suggests that even if labelling does not have an immediate effect on behaviour, it may still enhance consumer knowledge of calorie content, which may translate into behaviour change over time and/or in other settings (e.g., eating less later in the day).

Contrary to our predictions, the study found no significant overall effects of menu labelling on the calorie content of items selected from the hypothetical coffee shop menu. This finding aligns with the previous work by Sinclair et al. (2014), Cantu-Jungles et al. (2017), Tapper et al. (2022) and Polden et al. (2025) which also reported no overall effects.

However, it fails to support previous reviews reporting modest effects of labelling on calories selected or consumed (Clarke et al., 2025; Crockett et al., 2018; Long et al., 2015; Robinson et al., 2023; Zlatevska et al., 2018). Nevertheless, it is interesting to note that although there was no overall effect of labelling, mean calories selected were in the predicted direction (5% decrease relative to no labelling) with a small effect size which aligns with the effect sizes reported in previous reviews (Clarke et al., 2025; Long et al., 2015; Robinson et al., 2023).

Sensitivity analyses revealed a significant interaction between weight control motivation and labelling, whereby individuals with higher weight control motivation selected fewer calories. However, it is important to note that in other analysis models this effect was not replicated. Nonetheless, potential moderation by weight control motives is supported by qualitative data that showed a greater percentage of participants in the calorie labelling condition spontaneously mentioned weight control when describing the reasons for their choice. Given the exploratory nature and inconsistency of results across analyses, they should be interpreted cautiously. Further research is required to understand if weight control motives reliably moderate the effect of calorie labelling on consumer behaviour under some contexts but not others, as studies to date have tended not to find moderation effects (Finlay et al., 2023; Robinson et al., 2023).

The study also explored potential unintended effects of calorie labelling on value for money, taste and fullness expectations, as participants could use calorie content as proxies for these. Although there was a significant effect on value for money expectations, more detailed examination of the data suggested that value for money expectations were not driven purely by price per calorie. Perhaps other considerations, such as health and enjoyment, also influenced decision making here. It is possible this may differ for different subsets of the population and further research would be needed to explore this. It is also possible that decision making here was influenced by the fact that participants were prompted to evaluate the items on a range of dimensions, which may have then subsequently influenced the way they assessed value for money. Labelling did not appear to affect fullness expectations and did not influence taste expectations in the main analysis, however, an effect emerged in the sensitivity analysis when aim guessers were removed whereby participants in the calorie labelling condition reported an increase in taste expectations, which may warrant further exploration in future research.

Interestingly, contrary to predictions, we found a greater change in taste expectations was associated with reduced calorie selection in one of the models. Perhaps for some participants, the action of choosing items from the menu elicited increased mental simulation of sensory interaction with the item which in turn allowed them to more accurately ascertain that they would not necessarily enjoy the high calorie items in the current moment as much as one might expect given their status as highly palatable foods/drinks. This aligns with the grounded cognition theory of desire (Papies et al., 2017) as well as research showing associations between mindfulness (e.g. attending to current thoughts and feelings) and healthier eating (Tapper, 2022). Examination of changes in taste outcome expectancies for individual items supports this interpretation, as there was a greater decline in taste expectations for higher calorie items compared to lower calorie items.

However, it could be argued that the practical importance of some of the findings related to outcome expectancies may be limited in a coffee shop context, where purchases are often supplementary to meals and driven by hedonic considerations. In this setting, consumers may not expect a hot drink to fulfil satiety or nutritional goals in the same way as food or meal choices, which may reduce the relevance of certain outcome expectancies such as fullness or eating healthily at the point of decision-making. As such, the weak or absent associations between these expectancies and calorie selection may reflect contextual constraints specific to a coffee shop ordering context. It may therefore be important for future research to examine these mechanisms in relation to food menus and meal decisions.

There are also several further limitations of the present study that should be considered. Participants were prompted to rate menu items on multiple dimensions before making their choice, which may have primed certain considerations that could have influenced their decision making. In the calorie labelling condition, participants were also provided with calorie information the second time they made these ratings, giving them additional time to process this information. Furthermore, a relatively high proportion of participants (approximately 19%) correctly guessed the aims of the study. Although sensitivity analyses excluding these participants did not change the overall pattern of results, awareness of study aims may nonetheless have influenced responses. This is particularly relevant for the observed moderating effect of weight control motivation in our exploratory analyses, which was no longer significant after excluding aim guessers. A further limitation pertains to our measure of food choice motives, which were measured at the trait level reflecting importance of health, weight control, price and sensory appeal on ‘a typical day’. Given the shifting, transitory nature of goals and motivation (Shah et al., 2002; West & Michie, 2020) it is possible this measure failed to accurately capture the motives influencing participants at the point of decision-making. This mismatch between trait-level assessment and a situational choice task may have contributed to the absence of robust moderation effects. As such, future research may benefit from assessing more context-specific food choice motives. The study also assessed hypothetical menu choices as opposed to actual purchasing or consumption behaviour. While this design facilitated the examination of underlying mechanisms, it limits ecological validity and means that findings may not fully reflect real-world behaviour.

Nevertheless, the study has notable strengths, including a large and representative sample, pre-registered analyses and a strong theoretical framework, which enhance the robustness of the findings. Future research should examine the effects of calorie labelling in real-life coffee shop settings to confirm whether these patterns hold in naturalistic contexts and allow stronger conclusions to be drawn about the implications of calorie labelling for public health policy. For example, field experiments could be conducted comparing purchases made in coffee shops with and without labelling, combined with short exit surveys to capture beliefs and expectations. Additionally, mobile ordering platforms offer an innovative way for testing these effects whereby calorie visibility can be experimentally manipulated, and short surveys can be administered in-app immediately post-purchase to measure beliefs and expectations. Future research could also extend the mediation modelling approach used in this study to alternative labelling formats that may be more impactful than calorie labelling, such as front-of-package labels or menu warning labels, to examine the role of cognitions in explaining their effects on behavioural outcomes.

CRediT authorship contribution statement

Khaleda Ahmadyar: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Eric Robinson:** Writing – review & editing, Methodology, Conceptualization. **Katy Tapper:** Writing – review & editing, Resources, Methodology, Formal analysis, Conceptualization.

Ethical statement

The study received ethics approval from the City St Georges, University of London Psychology Department Research Ethics Committee.

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Declaration of competing interest

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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.2026.108582.

Data availability

The study data is available on the Open Science Framework at: https://osf.io/fkvz5.

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