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Research Article

Impact of Menu Calorie Labeling on Hypothetical Meal Choices in the United Kingdom: An Exploration of Potential Public Health Benefit Versus Risk for Disordered Eating Harm

William Colgrave, Daniel Gaffiero, Paul Staples, and Vicki Staples

Department of Psychology, University of Derby, Derby, UK

Correspondence should be addressed to Daniel Gaffiero; d.gaffiero@derby.ac.uk and Vicki Staples; v.staples@derby.ac.uk

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This study investigates the impact of calorie-labeled menus on hypothetical consumer behavior in the United Kingdom (UK), whilst exploring risk for disordered eating. A general population sample of 415 participants, diverse in age and gender, selected hypothetical meals from menus either with or without calorie information, having completed the Eating Disorder Examination Questionnaire (EDE-Q) immediately before or after menu presentation. Regression analyses showed that menu type significantly predicted calorie selection, with participants in the calorie-labeled condition choosing meals with fewer total calories compared to those in the non-labeled condition. Global disordered eating scores did not predict total calories, nor did they interact with menu type. Only the restraint (*R*) subscale of the EDE-Q was a significant independent predictor of total calories, indicating that higher *R* was associated with choosing meals with fewer calories, though this did not interact with menu type. These findings indicate that, in a hypothetical choice context, calorie information was associated with lower-calorie selections without evidence of immediate disordered eating risk. However, given the cross-sectional and correlational design, no causal conclusions can be drawn, and potential longer-term or compensatory effects (e.g., restrictive eating, purging, or exercise behaviors) were not assessed. Further longitudinal and real-world research is required to validate and expand these findings within the UK context.

Keywords: calorie labeling; disordered eating; food choice; menu presentation; obesity prevention

1. Introduction

Dining out in the United Kingdom (UK) has increased significantly over the past five decades [1], with nearly a third (32%) of adults dining out weekly between 2005 and 2015 [2]. This trend is linked to increased body weight, as studies show that only 9% of meals in 27 UK restaurant chains met public health guidelines of under 600 Kcal and 47% of menu items contained 1000 Kcal or more; half the recommended daily intake [3, 4]. In response, UK legislation, effective April 6, 2022, requires large out-of-home food sector (OHFS) businesses (e.g., restaurants, cafés, and takeaways) with more than 250 employes to display calorie information on menus, along with the recommended daily intake to encourage healthier, informed choices, and help reduce obesity [5].

The recent UK legislation mandating calorie labeling on menus reflects current behavioral science models, specifically the COM-B [6], which identifies three core components of behavior change: capability (*C*), opportunity (*O*), and motivation (*M*). *C* refers to the physical and psychological capacity to perform a behavior. *O* encompasses external factors that enable the behavior, such as the availability of calorie-labeled menus and the accessibility of lower-calorie options, which enable the behavior. *M* involves both reflective processes (e.g., conscious goals related to health) and automatic processes (e.g., habits or emotional responses) that drive behavior. Thus, calorie labeling may reduce the cognitive load associated with estimating calorie content (*C*), create visible opportunities for lower-calorie choices, and enhance *M* by supporting health-related goals.

Applying the COM-B model to healthy eating behaviors, individuals require the *C* to interpret calorie information, the *O* to access calorie information and encounter lower-calorie options in their environment, and the *M* to prioritize health goals when making menu selections. Research highlights that *C* and *O* are crucial determinants of healthy eating, but these factors are often mediated by *M* [7]. For example, the absence of calorie labeling can act as a motivational barrier by increasing the cognitive effort required to estimate caloric content, whereas the presence of labeling reduces this cognitive load and can support healthier decision-making.

In addition to enhancing *C*, calorie labeling enhances *O* by enabling social and physical cues for lower-calorie choices. Willmott and Parkinson [8], in their study of 594 participants in a weight management programme demonstrated how targeted interventions addressing *O*—such as expert advice, social support and practical resources, like meal plans and shopping lists—can encourage healthy behaviors. Qualitative findings highlighted that social *O* (e.g., discussions about food choices) and physical *O* (e.g., the availability of healthier meal options) play vital roles in behavior change. Menu labeling contributes to both: it creates social opportunities by promoting conversations about calorie and nutritional content and physical opportunities by making lower-calorie choices visible and accessible.

The effectiveness of calorie labeling on menus is uncertain, with studies yielding mixed results. Early reviews reported only two out of 13 studies showed a significant reduction in calorie consumption suggesting limited effectiveness [9, 10]. Kiszko et al. [11] reviewed 31 studies and found a minimal impact on total calorie intake. However, Bollinger et al. [12] observed a 6% decrease in calories per order in Starbucks after mandatory calorie labeling was introduced, with a 26% reduction among those who previously ordered more than 250 calories.

Existing research on calorie-labeled menus in the UK is limited. Masic et al. [13] conducted a randomized control trial (RCT) with 458 UK adults, finding that any form of nutrition labeling led participants to choose lower-calorie options over higher-calorie ones. However, the study's constrained choice setup may have inadvertently primed negative framing, limiting the applicability of the findings to real-world settings. More recently, Marty et al. [14] recruited a total of 1743 UK participants using a simulated fast-food restaurant, discovering that the availability of low-calorie options, rather than calorie labeling, led to lower calorie intake. Further considering links to the COM-B, Tapper et al. [15] found those with higher reflective *M*—individuals who consciously reflect on and plan their health-related goals—chose fewer calories, were more aware of menu labeling, and better at estimating calorie content in a hypothetical coffee shop scenario, indicating that *M* plays a crucial role in influencing eating behavior. However, they found no significant impact of calorie labeling on calorie selection among the 370 participants.

The potential for calorie labeling to exacerbate maladaptive eating behaviors, particularly among individuals with disordered eating pathology and diagnosed eating disorders (EDs), has been a concern alongside its potential effectiveness in promoting lower-calorie choices [16]. Certain groups, including women [17] and dieters [18] are typically considered more vulnerable to the onset of EDs based on existing research, although recent findings suggest the evidence is mixed [19, 20]. This overlap between groups more likely to attend to calorie information (e.g., females, dieters) and those more vulnerable to ED onset presents an important interpretive challenge. It becomes difficult to disentangle whether lower-calorie selections in response to labeling reflect general dietary goals, gendered differences in health behavior, or an underlying vulnerability to disordered eating. Calorie labeling may also function as a "safety behavior" [21] whereby individuals use calorie information to avoid high-calorie foods and manage anxiety or fear related to weight gain [22]. Research shows that women are more influenced by calorie labels than men [23–25] and dieters are more influenced than non-dieters (15). Gerend [26] found that women presented with calorie-labeled menus chose 146 fewer calories per meal compared to those without labels. Similarly, Ellison et al. [23] observed in a restaurant setting that women ordered significantly fewer calories than men when calorie information was available.

This debate is particularly important given the high prevalence of both obesity and EDs in the UK. In England, 37.9% of adults are overweight, and an additional 25.9% are classified as obese [27]. Obesity is associated with numerous adverse health outcomes, including increased risk of cardiovascular disease, diabetes and certain cancers [28]. At the same time, EDs affect approximately 2%–3% of the population (NICE, 2019) and carry severe health risks, including a mortality rate of 5.6% over 10 years for anorexia nervosa (AN) - higher than any other psychiatric disorder [17]. Concerns have been raised that obesity prevention strategies, such as calorie labeling, may unintentionally contribute to the development or exacerbation of disordered eating behaviors [29], highlighting the tension between public health strategies targeting obesity and those aiming to reduce ED prevalence [30].

Research by Haynos and Roberto [31] examined the effects of calorie-labeled menus on food choices among 716 women with disordered eating symptoms, assessed using the ED Examination Questionnaire (EDE-Q). The study found no significant overall effect of calorie labeling on calorie intake. However, individuals with AN or bulimia nervosa (BN) selected significantly fewer calories when calorie information was displayed, while those with binge-ED (BED) chose more. These findings highlight the potential for calorie labeling to differentially affect individuals based on ED pathology. Understanding the relative benefits of calorie labeling to support public health initiatives in relation to obesity reduction against potential risks for disordered eating is important considering such concerns.

While research outside the UK has explored the effects of calorie-labeled menus, the findings may not directly translate to the UK due to differences in public health frameworks, cultural attitudes towards eating, and food environments. For example, the UK's recent introduction of mandatory calorie labeling legislation in the OHFS is part of a broader strategy aimed at reducing obesity, which reflects specific policy and health priorities unique to the region [5]. Additionally, the

UK's food culture differs from that of other countries where similar studies have been conducted, such as the US, where portion sizes, dietary norms and perceptions of health messaging vary significantly and France where there is a notable difference in sugar intake [32]. Furthermore, existing UK-based research on calorie labeling is scarce, creating a critical gap in understanding its effects within the sociocultural and regulatory context of the UK.

It is also important to recognize that lower-calorie selections cannot automatically be equated with "healthier" eating. While excess energy intake is a major driver of obesity and related conditions, the nutritional quality of calories consumed, including macronutrient composition, food source, and timing has a profound impact on long-term health outcomes [33]. Moreover, excessive calorie restriction, particularly if poorly balanced nutritionally, may increase the risk of malnutrition and adverse health effects [34]. Thus, in the present study we use the term "lower-calorie" rather than "healthier" to more accurately describe the outcomes.

Given the recent policy implementation and the potential for unintended consequences among individuals with disordered eating tendencies, further UK-specific research is essential. Therefore, the present study aims to: (i) better understand the influence of calorie labeling on hypothetical food choices typical of UK OHFS (in the current study pub menus), (ii) assess its impact in relation to disordered eating, (iii) identify specific aspects of disordered eating relevant to food choices in a nonclinical sample, (iv) inform public health strategies for obesity prevention, and (v) provide evidence-based recommendations for real-world applications. This study examines the relationship between menu type (calorie-labeled vs., non-labeled) and disordered eating symptomology, as measured by the EDE-Q, as predictors of sum calorie choice in a UK population.

Based on previous literature we hypothesized that:

1. Menu type (calorie labeled vs., non-labeled) and EDE-Q scores (global [*G*] and the restraint [*R*], eating concern [EC], shape concern [SC], and weight concern [WC] subscales) will be significant predictors of sum calories chosen.
2. Menu type will be a significant independent predictor of sum calorie choice, with the calorie-labeled menu group choosing fewer calories than their noncalorie labeled menu counterparts.
3. Disordered eating symptomology (*G*, *R*, EC, SC, and WC) will be a significant independent predictor of sum calorie choice, with higher EDE-Q scores predicting fewer sum calories chosen.
4. Menu type will moderate sum calorie choice, such that the calorie labeled menus will exert more influence on those with higher disordered eating symptomology resulting in significantly lower sum calorie choices.

2. Method

2.1. Design. The study used a hypothetical menu choice design consistent with a typical UK OHFS (pub menu), with two main predictors (menu type and disordered eating) and one outcome variable (sum calories chosen). Counter-balancing of presentation order for the menu selection task and completion of the EDE-Q was employed to control for potential priming effects.

TABLE 1: Baseline demographic characteristics of participants.

Demographics	Mean ± SD or *n* (%)	Range
Age (years), Mean ± SD	30.87 ± 11.08	18–77
Gender *n* (%)		
Female	257 (61.90)	NA
Male	150 (36.10)	NA
Nonbinary/third gender	5 (1.20)	NA
Prefer not to say	3 (.70)	NA

Abbreviations: M, mean; N, number; NA, not applicable; SD, standard deviation.

2.2. Participants. Prospective sample size calculations using G*Power indicated that 158 participants were required to achieve a medium effect size with a power of 0.80. Eligibility criteria included being a UK resident, over 18 years old and not having a current or recent history (last 12 months) of an ED diagnosis or preexisting ED requiring clinical management to reflect a nonclinical, general population sample. A total of 478 participants were initially recruited via *O* sampling. After excluding 42 participants who either did not complete the study ($n = 38$), did not meet study criteria ($n = 2$); or did not select any menu items ($n = 2$), the data of the remaining 436 were data were screened and 21 (4.8%) were identified and excluded as outliers using *z*-score transformations. This resulted in a final sample of 415 available for analyses (86.8% response rate; age range 18–77 years, mean ± SD, 30.87 ± 11.08). Participants were recruited through online platforms, specifically Reddit and Facebook, with university students from a Midlands institution receiving course credit. To ensure data authenticity, IP addresses were reviewed to identify unique respondents, and survey completion times were assessed (> 120 s) via Qualtrics to detect and exclude bot activity or low-quality responses. These measures helped prevent duplicate submissions and improve data integrity. Demographic data are presented in Table 1.

2.3. Materials

2.3.1. Demographic Questionnaire. Participants were asked to state their age and gender ("Male", "Female", "Nonbinary/third gender", and "Prefer not to say").

2.3.2. EDE-Q Scale. The EDE-Q [35] was used to assess the frequency, duration, and severity of behaviors associated with EDs. The scale comprises four subscale scores (*R*, EC, SC, and WC) each representing characteristics of ED psychopathology, and a *G* score providing a holistic measure associated with an ED diagnosis. Participants report on a 7-point Likert scale from 0 to 6 (0 = "*no days*"; 6 = "*every day*") on whether they experienced ED pathology over the past 28 days (e.g., have you had a definite desire to have a totally flat stomach?) in relation to 28-items, with higher scores indicating higher ED pathology. Good internal consistency (Cronbach's $\alpha =$ 0.7–0.9), test–retest reliability, and discriminative validity have been reported for this scale [36–39].

2.3.3. Hypothetical Menu. To examine the effect of calorie labeling a hypothetical OHFS menu was modelled from common UK pub chains (Sizzling Pubs, JD Wetherspoon, Greene King, Marston's), including a choice of appetizers, main meals, burgers, and desserts with multiple vegan options. Prices were redacted and participants were asked to: "*Imagine you are attending a restaurant for dinner with friends or family. You will not be sharing food so please order for yourself and assume all dietary needs are met*". Both menus for the two experimental conditions (calorie-labeled vs., non-labeled) were identical except for calorie information. These menus are displayed in Supporting Information 1: Figure S1 and Supporting Information 2: S2.

2.4. Procedure. The online experimental study was developed using Qualtrics XM software (Provo UT; version December 2022 – March 2023) and was run between December of 2022 and March of 2023. This study adhered to the British Psychological Society (BPS) Code of Human Research Ethics and the BPS Ethics guidelines for internet mediated research (BPS, 2021) and was approved by the University of Derby College of Health, Psychology and Social Care research ethics committee (Approval Number ETH2223−1841; December 12, 2022). After gaining informed consent all participants completed the demographic questionnaire. Next, participants were randomly assigned to one of four conditions to ensure that the presentation order of the EDE-Q before or after menu presentation was randomized (using a Latin square design) to control for order effects. In condition one, participants were presented with the EDE-Q scale then the calorie labeled menu to complete the meal selection task. Condition two had the same order but presented the menu without calories. Condition three presented the meal selection task using the calorie labeled menu first, followed by completion of the EDE-Q scale and, condition four repeated this order but used the non-calorie labeled menu. Participants were fully debriefed and thanked for their time. On average participants took 7.2 min to complete the survey.

2.5. Analytic Strategy. Statistical analyses were performed using SPSS (version 27; IBM Corp.). We first examined the relationship between menu type (calorie labeled vs., non-labeled), *G* disordered eating symptomology via the EDE-Q [35] and presentation order to control for potential order effects as predictors of sum calories chosen among a UK general population sample. This analysis was then repeated for the individual subscales of the EDE-Q (R, EC, SC, and WC) for a more nuanced exploration of specific disordered eating symptomology.

Subsequent analyses (moderation and ANOVA) were performed to examine specific risks posed by calorie-labeled menus in the context of identified disordered eating symptomology appropriate to the above analyses and in relation to gender given previous literature has highlighted these groups a potentially being more influenced by calorie information on menus.

3. Results

3.1. Investigating Menu Type and EDE-Q as Predictors of Sum Calories Chosen. To assess hypotheses 1–3, two multiple regression analyses were conducted. First, a multiple linear regression was used to investigate the relationship between menu type (calorie-labeled, non-labeled), and *G* EDE-Q scores as predictors of sum calories. To control for potential order effects, EDE-Q presentation order (before, after menu selection task) was also included in the model. This was followed by a second multiple linear regression to explore the EDE-Q subscales again controlling for presentation order. Preliminary checks revealed scatterplots as linear and that assumptions of normality, linearity, and homoscedasticity were met, and variance inflation factors of multicollinearity were < 10. Both models used the forced entry method. Table 2 outlines the correlation coefficients.

The first regression equation produced a small effect size ($R^2 = 0.031$, $R^2\text{adj.} = 0.023$), and indicated that menu type, presentation order and *G* EDE-Q scores were significant predictors of sum calories chosen, $F\ (3, 411) = 4.313$, $p < 0.005$. The effect size (R^2) suggests 3.1% of variability in sum calories can be explained by variability in menu type, presentation order and *G* EDE-Q scores.

When considering the individual predictors, there was a significant negative relationship between menu type and sum calories, $t = -2.874$, $df = 414$, $p = 0.004$ with the model predicting that the calorie labeled menu type would correspond with a decrease of 351.67 sum calories chosen. However, *G* EDE-Q scores and presentation order were not significant predictors of sum calories ($p = 0.06$ and $p = 0.371$, respectively).

The second regression examining menu type, presentation order and EDE-Q subscales (R, EC, SC, and WC) produced a small effect size ($R^2 = 0.051$, $R^2 adj. = 0.037$), and indicated that menu type, presentation order and EDE-Q subscales were significant predictors of sum calories chosen, $F\ (6, 408) = 3.637$, $p = 0.002$. As above, menu type remained a significant independent predictor of sum calories chosen ($p < 0.001$).

Consideration of the individual EDE-Q subscales revealed EC, SC, and WCs were not significant predictors ($p = 0.743$, 0.642, 0.943 respectively). However, there was a significant negative relationship between *R* scores and sum calories chosen, $t = -3.227$, $df = 414$, $p = 0.001$, with the model predicting that a one unit increase in the *R* score would correspond with a decrease of 170.83 calories chosen. Again, presentation order was not a significant predictor of sum calories chosen ($p = 0.322$).

3.2. Effects of Menu Type in Relation to Disordered Eating, Gender, and R. To investigate hypotheses 4, designed to address concerns relating to the influence of calorie information for those at risk of disordered eating tendencies, a series of simple moderation analysis were conducted (using Hayes PROCESS, Hayes, 2024) to explore the extent to which menu type moderated the relationships between EDE-Q

Table 2: Correlation coefficients (significance levels) for the predictor and outcome variables.

	Σ Calories	Menu	Order	EDE-Q scores				
				Global	R	EC	SC	WC
Σ Calories	1.00	−0.144 (0.002)*	−0.042 (0.197)	−0.094 (0.028)*	−0.158 (<0.001)**	−0.47 (0.169)	−0.054 (0.137)	−0.065 (0.092)
Menu	—	1.00	0.025 (0.304)	0.033 (0.253)	0.010 (0.423)	0.061 (0.109)	0.029 (0.275)	0.023 (0.317)
Order	—	—	1.00	−0.056 (0.127)	−0.066 (0.089)	−0.038 (0.222)	−0.052 (0.145)	−0.039 (0.215)
Global	—	—	—	1.00	0.781 (≤0.001)**	0.820 (≤0.001)**	0.934 (≤0.001)**	0.948 (≤0.001)**
Restraint	—	—	—	—	1.00	0.492 (≤0.001)**	0.591 (≤0.001)**	0.625 (≤0.001)**
Eating (EC)	—	—	—	—	—	1.00	0.715 (≤0.001)**	0.738 (≤0.001)**
Shape (SC)	—	—	—	—	—	—	1.00	0.920 (≤0.001)**
Weight (WC)	—	—	—	—	—	—	—	1.00

Abbreviations: EC; eating concern, R; restraint, SC; shape concern; WC, weight concern.
*$p < 0.05$.
**$p \leq 0.001$.

scores (*G*, and subscales for R, EC, SC, and WC) and sum calories chosen. In each case, the interaction term was not significant suggesting that menu type did not moderate the relationship between *G* EDE-Q scores ($p = 0.890$) or any of the specific subscales scores *R* ($p = 0.832$), eating ($p = 0.896$), shape ($p = 0.918$), weight ($p = 0.697$), and sum calories chosen.

In addition, given the prior literature relating to the influence of calorie information for female gender on food choice, gender differences between male gender ($N = 150$, with 81 in the calorie-labeled condition and 69 in the non-labeled condition) and female gender ($N = 257$, with 117 in the calorie-labeled condition and 140 in the non-labeled condition) was explored using a 2 × 2 independent samples ANOVA. Findings showed that whilst there was a significant main effect of menu type, $F(1, 403) = 6.925, p = 0.009$ where those presented with calorie information selected significantly fewer sum-calories, there was no main effect of gender, F (1, 403) = 2.079, $p = 0.150$ and no interaction between menu type and gender, F (1, 403) = .024, $p = 0.876$ suggesting that female participants were no more influenced by calorie information being included on the menu than their male counterparts.

Finally, given the significant relationship observed in our data between R scores and sum calories chosen and the risk *R* poses for the development of EDs it was important to explore the impact of providing calorie information on *R* scores themselves. To explore the influence of providing calorie information on subsequent *R* scores a 2 × 2 independent samples ANOVA was performed for menu type and presentation order on *R* scores. Findings showed that there was no main effect of menu type F (1, 411) = 0.026, $p = 0.872$, no main effect of order $F(1, 411) = 1.886, p = 0.170$, and no interaction between menu type and presentation order F (1, 411) = 1.293, $p =$ 0.256, which suggests that being presented with calorie information prior to selecting food choices did not significantly influence *R* scores.

4. Discussion

This study tested several hypotheses: (1) menu type (calorie-labeled vs., non-labeled), EDE-Q scores (*G* and subscales) and presentation order would significantly predict sum calories chosen, (2) menu type would be a significant independent predictor, with the calorie-labeled group choosing fewer calories, (3) disordered eating symptomology would be a significant independent predictor, with higher EDE-Q scores (*G* and subscales) resulting in fewer sum calories chosen, and (4) menu type would moderate the relationship between disordered eating symptomology and food choices, such that the calorie labeled menus would exert more influence on those with higher disordered eating symptomology resulting in significantly lower sum calorie choices.

The findings provided mixed support for these hypotheses. Hypothesis 1 was supported based on the overall models, whereby menu type and EDE-Q scores for both *G* and the subscales relating to *R*, EC, SC, and WC combined to predict sum calories chosen. Hypothesis 2 was supported, as participants presented with calorie-labeled menus chose significantly fewer calories, consistent with previous studies [3, 12]. Hypothesis 3 was partially supported; while *G* EDE-Q scores did not significantly predict sum calorie choice; the *R* subscale of the EDE-Q was a significant predictor. Specifically, higher *R* scores were associated with choosing meals containing fewer calories, consistent with previous literature in relation to the influence of *R* on calorie consumption [40–42]. Hypothesis 4 was not supported, as menu type did not moderate the influence of disordered eating symptomology in relation to *R*, the only symptomology suggested as being of influence in our data. Those with higher *R* scores were no more influenced by calorie information as they did not select meals containing significantly fewer calories than those not provided with calorie information.

Our analysis also revealed no impact of gender, addressing concerns about the potential risk of providing calorie information on female food choices. Furthermore, the presence or absence of calorie information did not significantly influence dietary *R* scores, addressing concerns about the potential for calorie information to increase the risk of disordered eating symptomatology. These findings differ from some prior research suggesting that individuals with higher dietary *R* may be more sensitive to calorie information [31]. In our sample, *R* was associated with lower calorie selection overall, but this effect was not moderated by the presence of calorie labeling

The reduction in sum calorie choice observed with calorie-labeled menus supports the effectiveness of such interventions in promoting lower-calorie food choices to support healthier eating efforts, aligning with prior research [9, 10]. This suggests that providing dietary information at the point of decision-making can influence consumer behavior, aligning with the UK's public health strategies aimed at reducing obesity [5]. However, as noted in previous reviews [11], the effect size is relatively modest, highlighting that while beneficial, calorie labeling should be part of a broader suite of interventions. Our findings also go some way to alleviating concerns about the potential harms posed by the inclusion of calorie information, including for those with ED symptomology within the general population.

These findings align with the COM-B model, which posits that behavior change is influenced by *C*, *O*, and *M* [6]. Calorie menu labeling enhances *C* by providing clear, accessible information about the calorific content of menu items, allowing consumers to make informed choices that align with their health goals [7]. For individuals with varying levels of dietary *R* or disordered eating symptomology, calorie-labeled menus may alter the cognitive demands associated with estimating calorie content, given their heightened sensitivity to food-related cues [31]. However, whether this reduction in cognitive load represents a benefit or a risk is contested, as it may facilitate dietary control but could also reinforce preexisting restrictive tendencies. The findings also demonstrate how calorie labeling creates opportunities for lower-calorie choices by making lower-calorie options more visible and normalizing discussions about dietary decisions. Social and physical opportunities are further enhanced as calorie labeling reinforces social norms around healthier eating and provides tangible opportunities for consumers to align their choices with their health goals. Finally, *M*, driven by health beliefs and weight management goals, interacts with the presence of calorie labels to influence behavior. To expand, calorie labeling can act as a motivational cue, reinforcing health-conscious decision-making and supporting adherence to dietary plans. For those motivated by weight management or health improvement, calorie labels can serve as a prompt to select options aligned with these objectives [7, 8]. Taken together, by enhancing *C*, *O*, and *M*, calorie labeling not only informs but empowers consumers to make lower-calorie choices. These findings provide an important contribution to understanding behavioral mechanisms underlying calorie labeling's effectiveness and its broader role in public health strategies. Furthermore, the present study highlights the importance of investigating individual differences, such as gender and dietary *R*, to better understand the variability in responses to calorie labeling interventions. Lastly, recent population modeling studies in the USA and UK further support the public health significance of calorie labeling. These studies have demonstrated its cost-effectiveness in reducing obesity-associated cancer burden [43] and its potential to reduce of obesity and cardiovascular disease mortality in response to OHFS labeling policies [44].

Contrary to concerns in previous literature [29–31], this study did not find that *G* EDE-Q scores were a significant predictor of calorie selection, nor was there a significant main effect or interaction with menu type, unlike findings in prior research [23, 26]. This discrepancy may be due to the specific nature of disordered eating considered in the present study limited to the presence of disordered eating behavior within a general population rather than clinical sample. Previous research has tended to focus on clinical levels of disordered eating and has included participants from clinical and subclinical populations. This finding therefore contrasts with some previous research, which has shown that individuals with EDs may respond differently to calorie labeling [31]. Individuals with conditions like BN, AN, or BED might be influenced by different motivations (*M*s) when selecting food, such as compensatory behaviors or the need to gain weight if underweight [45, 46].

Whilst we did observe a significant relationship between *R* scores and sum calories chosen, this appeared to be unaffected by the presentation of calorie information (menu type) or order effects. This suggests that preexisting tendencies towards restriction were more influential than the presence or absence of calorie labeling. Importantly, calorie labeling itself did not increase *R* scores in our sample, indicating no immediate evidence of harm. However, dietary *R*, while often seen as a positive indicator of self-control and a tool for weight management [42], can be double-edged. On one hand, it can promote healthier eating habits by encouraging individuals to limit calorific intake. However, excessive *R* is associated with a risk of developing or exacerbating EDs, such as AN and BN, where a preoccupation with calorie content and strict dietary rules can lead to harmful behaviors [16]. Our findings should therefore be interpreted cautiously – highlighting how calorie labeling may support calorie reduction at a population level, but without ruling out risks in individuals with higher vulnerability to disordered eating. It is also important to exercise caution in equating this outcome with healthier eating per se. Caloric reduction may be beneficial in the context of excess energy intake and obesity prevention, but health outcomes also depend on the macronutrient composition and overall quality of the diet [33]. Furthermore, sustained calorie restriction can be associated with negative outcomes, particularly when it leads to malnutrition or exacerbates restrictive eating patterns [34]. Therefore, calorie labeling should be understood as one element in a wider set of nutritional interventions, and its impact should be evaluated not only in terms of energy reduction but also in relation to dietary balance and long-term health.

Taken together, these findings highlight both the potential and the limitations of calorie labeling. The implications are significant for public health policies that advocate for calorie labeling as a strategy to combat obesity. While such measures may be beneficial for the general population, they must be carefully implemented to avoid unintended consequences for those living with or recovering from EDs as illustrated by the work of Frances et al. [47] who found that the introduction of calorie labeling on menus is likely to adversely impact those with EDs and advocating that calorie-labeled menus should be available separately rather than routinely offered. Public health strategies should consider additional support mechanisms, such as providing education on balanced nutrition and promoting a holistic approach to health that goes beyond calorie counting. This approach would help ensure that efforts to promote healthier eating do not inadvertently harm those who may be vulnerable to the negative effects of dietary *R* and those living with EDs [13, 14] whilst also supporting those who are at risk from obesity and obesity-related harms.

4.1. Limitations. This study has several limitations that must be acknowledged. First, the use of hypothetical meal selection scenarios may not accurately represent real-world ordering and consumption patterns [11, 48]. Previous reviews have highlighted the challenges of generalizing findings from hypothetical designs to actual behavior [29]. While the hypothetical menus used in this study were derived from popular national pub menus, and online menus have become increasingly relevant due to the COVID-19 pandemic [49], such scenarios inherently limit ecological validity. Moreover, although the true purpose of the study was not disclosed to participants, it is possible that some individuals may have inferred that the research concerned calorie information and adjusted their responses accordingly. This potential for demand characteristics and socially desirable responding represents a limitation common to behavioral research of this type.

Second, the study design did not capture long-term behavioral patterns or repeated exposure effects. It remains unclear whether calorie labeling influences only initial decisions or whether its impact diminishes over time due to habituation. Third, the online survey-based approach introduces potential sample selection bias due to its reliance on university students and online platform users. The *O* sampling method raises potential concerns about representativeness, which may not significantly affect internal validity but does limit external validity. That said, this approach did offer certain strengths.

University students represent an important demographic for examining eating behaviors, as they are frequent consumers of out-of-home food and are accustomed to using digital platforms for ordering, particularly following the COVID-19 pandemic [50].

Finally, sample characteristics, including socioeconomic status (SES) and nutritional literacy - a specific form of health literacy - were not included in the current study design. Future research may want to consider these factors, as Olsen et al. [51] describe marked social differentiation across the market for eating out in the UK, suggesting some groups are more or less likely to frequent different types of OHFS, including restaurants attached to a public house (pub) as modelled in our study. Similarly, nutritional literacy is likely to influence food choices and is an important aspect of health communication [52], especially in the context of decision-making when limited dietary information is available, such as only providing calorific information as mandated in current UK legislation. In addition, current dieting status was not measured, which may have influenced participants' responses to calorie information and represents another important variable for future research.

4.2. Future Research. Future research should aim to provide actionable insights for the effective implementation of calorie labeling in restaurant settings, offering practical guidelines that optimize its impact. For instance, studies could explore how restaurants might present calorie information in ways that maximize its accessibility and influence. This could include testing menu formats that integrate calorie labels with complementary design features, such as bold fonts, strategic placement near price information or icons indicating healthier options. Additionally, exploring alternative menu presentation formats, such as physical activity calorie equivalent (PACE) labeling, traffic-light systems, and presenting items on a menu from low-to-high calories, could offer new insights into improving menu design and supporting healthier consumer choices [13, 53]. Future studies should also consider refining theoretical models of eating behavior by distinguishing between self-regulatory processes distinct from dietary *R* among the general population and specific ED presentations, such as those characterized by high *R* (e.g., AN and BN). This would help clarify the boundary between healthy and unhealthy restriction in food choices and inform tailored approaches to menu labeling that minimize the risk of reinforcing disordered eating behaviors. The exploration of diverse OHFS settings, such as those offering healthier options (e.g., Subway) versus those associated with less healthy choices (e.g., Greggs), could provide insights into the differential effects of calorie labeling in varied contexts. Similarly, research examining different meal occasions, such as lunchtime consumption versus evening dining, could reveal how meal timing influences the effectiveness of calorie labels. Finally, understanding how calorie labeling interacts with demographic and psychological factors could enable more tailored interventions. For example, recommendations for menu design based on consumer profiles (e.g., age, socioeconomic status, nutritional literacy or dietary self-regulation) could make calorie labeling more effective for diverse populations.

5. Conclusion

This study offers valuable insights into the impact of calorie-labeled menus on hypothetical consumer behavior, demonstrating that calorie information was associated with lower-calorie selections. Participants consistently chose fewer calories from menus that provided this dietary information, a trend observed regardless of *G* EDE-Q scores. Among the subscales, only dietary *R* was independently associated with lower-calorie selections, consistent with prior evidence that *R* may shape responsiveness to calorie information. Importantly, while we found no evidence of elevated disordered eating risk in this simulated context, these findings should not be interpreted as evidence that calorie labeling is universally safe or effective. Unmeasured factors, such as SES, dieting status, and nutritional literacy may influence responses to calorie information, and our study design did not capture longer-term or real-world effects. Nonetheless, calorie information on OHFS menus, particularly in UK pub-restaurants, has potential to contribute to modest reductions in population-level energy intake, which over time could help reduce the burden of obesity and related illnessses. Future research should employ longitudinal and naturalistic designs, examine diverse demographic groups, and test alternative menu formats to more fully evaluate the public health impact of calorie labeling.

Data Availability Statement

Data are available upon reasonable request.

Ethics Statement

Ethics for the present study was approved by the University of Derby College of Health, Psychology and Social care research ethics committee (Approval Number ETH2223−1841; December 12, 2022).

Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information 1. Supporting Information Figure S1 This figure shows a hypothetical restaurant menu with calorie (Kcal) labels. It includes a list of appetizers and snacks, pub favorites, gourmet burgers and desserts. This is an original figure designed and created by the first author (William Colgrave).

Supporting Information 2. Supporting Information Figure S2 This figure shows a hypothetical restaurant menu without calorie (Kcal) labels. It includes a list of appetizers and snacks, pub favorites, gourmet burgers and desserts. This is an original figure designed and created by the first author (William Colgrave).

References

[1] S.-L. Cheng, W. Olsen, D. Southerton, and A. Warde, "The Changing Practice of Eating: Evidence From UK Time Diaries, 1975 and 2000," *The British Journal of Sociology* 58, no. 1 (2007): 39–61.

[2] S. Mills, J. Adams, W. Wrieden, M. White, and H. Brown, "Sociodemographic Characteristics and Frequency of Consuming Home-Cooked Meals and Meals From Out-of-Home Sources: Cross-Sectional Analysis of a Population-Based Cohort Study," *Public Health Nutrition* 21, no. 12 (2018): 2255–2266.

[3] E. Robinson, A. Jones, V. Whitelock, B. R. Mead, and A. Haynes, "(Over) Eating Out at Major UK Restaurant Chains: Observational Study of Energy Content of Main Meals," *BMJ* (2018): k4982.

[4] NHS, "What Should My Daily Intake of Calories Be?" 2018, https://www.nhs.uk/common-health-questions/food-and-diet/what-should-my-daily-intake-of-calories-be/ [cited 2025 19/02/25];.

[5] GOVUK, "New Calorie Labelling Rules Come Into Force to Improve Nation's Health," (2022).

[6] S. Michie, M. M. van Stralen, and R. West, "The Behaviour Change Wheel: A New Method for Characterising and Designing Behaviour Change Interventions," *Implementation Science* 6, no. 1 (2011): 42.

[7] T. J. Willmott, B. Pang, and S. Rundle-Thiele, "Capability, Opportunity, and Motivation: An across Contexts Empirical Examination of the COM-B Model," *BMC Public Health* 21, no. 1 (2021): 1014.

[8] T. Willmott and J. Parkinson, "Motivation, Opportunity, and Ability: Understanding New Habits and Changes Adopted for Weight Management," *International Journal of Consumer Studies* 41, no. 3 (2017): 291–298.

[9] L. J. Harnack and S. A. French, "Effect of Point-of-Purchase Calorie Labeling on Restaurant and Cafeteria Food Choices: A Review of the Literature," *International Journal of Behavioral Nutrition and Physical Activity* 5, no. 1 (2008): 51.

[10] J. J. Swartz, D. Braxton, and A. J. Viera, "Calorie Menu Labeling on Quick-Service Restaurant Menus: An Updated Systematic Review of the Literature," *International Journal of Behavioral Nutrition and Physical Activity* 8, no. 1 (2011): 135.

[11] K. M. Kiszko, O. D. Martinez, C. Abrams, and B. Elbel, "The Influence of Calorie Labeling on Food Orders and Consumption: A Review of the Literature," *Journal of Community Health* 39, no. 6 (2014): 1248–1269.

[12] B. Bollinger, P. Leslie, and A. Sorensen, "Calorie Posting in Chain Restaurants," *American Economic Journal: Economic Policy* 3, no. 1 (2011): 91–128.

[13] U. Masic, P. Christiansen, and E. J. Boyland, "The Influence of Calorie and Physical Activity Labelling on Snack and Beverage Choices," *Appetite* 112 (2017): 52–58.

[14] L. Marty, A. Jones, and E. Robinson, "Socioeconomic Position and the Impact of Increasing Availability of Lower Energy Meals vs. Menu Energy Labelling on Food Choice: Two Randomized Controlled Trials in a Virtual Fast-Food Restaurant," *International Journal of Behavioral Nutrition and Physical Activity* 17, no. 1 (2020): 10.

[15] K. Tapper, K. Yarrow, S. T. Farrar, and K. L. Mandeville, "Effects of Calorie Labelling and Contextual Factors on Hypothetical Coffee Shop Menu Choices," *Appetite* 172 (2022): 105963.

[16] J. A. O'Dea, "Prevention of Child Obesity: 'First, do no Harm', *Health Education Research* 20, no. 2 (2004): 259–265.

[17] P. F. Sullivan, "Mortality in Anorexia Nervosa," *American Journal of Psychiatry* 152, no. 7 (1995): 1073-1074.

[18] D. Neumark-Sztainer, M. Wall, J. Guo, M. Story, J. Haines, and M. Eisenberg, "Obesity, Disordered Eating, and Eating Disorders in a Longitudinal Study of Adolescents: How do Dieters Fare 5 Years Later?" *Journal of the American Dietetic Association* 106, no. 4 (2006): 559–568.

[19] T. M. Stewart, C. K. Martin, and D. A. Williamson, "The Complicated Relationship Between Dieting, Dietary Restraint, Caloric Restriction, and Eating Disorders: Is a Shift in Public Health Messaging Warranted?" *International Journal of Environmental Research and Public Health* 19, no. 1 (2022): 491.

[20] E. T. House, M. L. Gow, N. B. Lister, et al., "Pediatric Weight Management, Dietary Restraint, Dieting, and Eating Disorder Risk: A Systematic Review," *Nutrition Reviews* 79, no. 10 (2021): 1114–1133.

[21] M. Spix, H. Melles, and A. Jansen, "From Bad to Worse: Safety Behaviors Exacerbate Eating Disorder Fears," *Behavioral Sciences* 13, no. 7 (2023): 574.

[22] S. M. Blakey and J. S. Abramowitz, "The Effects of Safety Behaviors During Exposure Therapy for Anxiety: Critical Analysis From an Inhibitory Learning Perspective," *Clinical Psychology Review* 49 (2016): 1–15.

[23] B. Ellison, J. L. Lusk, and D. Davis, "Looking at the Label and Beyond: The Effects of Calorie Labels, Health Consciousness, and Demographics on Caloric Intake in Restaurants," *International Journal of Behavioral Nutrition and Physical Activity* 10, no. 1 (2013): 21.

[24] J. W. Krieger, N. L. Chan, B. E. Saelens, M. L. Ta, D. Solet, and D. W. Fleming, "Menu Labeling Regulations and Calories Purchased at Chain Restaurants," *American Journal of Preventive Medicine* 44, no. 6 (2013): 595–604.

[25] A. Levi, K. K. Chan, and D. Pence, "Real Men do Not Read Labels: The Effects of Masculinity and Involvement on College Students' Food Decisions," *Journal of American College Health* 55, no. 2 (2006): 91–98.

[26] M. A. Gerend, "Does Calorie Information Promote Lower Calorie Fast Food Choices Among College Students?" *Journal of Adolescent Health* 44, no. 1 (2009): 84–86.

[27] NHS, "Health Survey for England, 2021: Data Tables," 2022, https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england/2021/health-survey-for-england-2021-data-tables.

[28] C. D. Bendor, A. Bardugo, O. Pinhas-Hamiel, A. Afek, and G. Twig, "Cardiovascular Morbidity, Diabetes and Cancer Risk Among Children and Adolescents With Severe Obesity," *Cardiovascular Diabetology* 19, no. 1 (2020): 79.

[29] M. B. Schwartz and K. E. Henderson, "Does Obesity Prevention Cause Eating Disorders?" *Journal of the American Academy of Child & Adolescent Psychiatry* (2009): 784–786.

[30] J. Haines and D. Neumark-Sztainer, "Prevention of Obesity and Eating Disorders: A Consideration of Shared Risk Factors," *Health Education Research* 21, no. 6 (2006): 770–782.

[31] A. F. Haynos and C. A. Roberto, "The Effects of Restaurant Menu Calorie Labeling on Hypothetical Meal Choices of Females With Disordered Eating," *International Journal of Eating Disorders* 50, no. 3 (2017): 275–283.

[32] B. Shankar, C. Srinivasan, and X. Irz, "World Health Organization Dietary Norms: A Quantitative Evaluation of Potential Consumption Impacts in the United States, United Kingdom, and France," *Applied Economic Perspectives and Policy* 30, no. 1 (2008): 151–175.

[33] M. M. Mihaylova, A. Chaix, M. Delibegovic, et al., "When a Calorie is Not Just a Calorie: Diet Quality and Timing as Mediators of Metabolism and Healthy Aging," *Cell Metabolism* 35, no. 7 (2023): 1114–1131.

[34] S. J. Hofer, D. Carmona-Gutierrez, M. I. Mueller, and F. Madeo, "The Ups and Downs of Caloric Restriction and Fasting: From Molecular Effects to Clinical Application," *EMBO Molecular Medicine* 14, no. 1 (2022): e14418.

[35] C. G. Fairburn and S. J. Beglin, "Eating Disorder Examination Questionnaire," *Cognitive Behavior Therapy and Eating Disorders* 309 (2008): 313.

[36] K. C. Berg, C. B. Peterson, P. Frazier, and S. J. Crow, "Psychometric Evaluation of the Eating Disorder Examination and Eating Disorder Examination-Questionnaire: A Systematic Review of the Literature," *International Journal of Eating Disorders* 45, no. 3 (2012): 428–438.

[37] J. M. Mond, P. J. Hay, B. Rodgers, and C. Owen, "Eating Disorder Examination Questionnaire (EDE-Q): Norms for Young Adult Women," *Behaviour Research and Therapy* 44, no. 1 (2006): 53–62.

[38] J. M. Mond, T. C. Myers, R. D. Crosby, et al., "Screening for Eating Disorders in Primary Care: EDE-Q versus SCOFF," *Behaviour Research and Therapy* 46, no. 5 (2008): 612–622.

[39] D. L. Reas, C. M. Grilo, and R. M. Masheb, "Reliability of the Eating Disorder Examination-Questionnaire in Patients With Binge Eating Disorder," *Behaviour Research and Therapy* 44, no. 1 (2006): 43–51.

[40] S. E. Racine, "Emotional Ratings of High-and Low-Calorie Food are Differentially Associated With Cognitive Restraint and Dietary Restriction," *Appetite* 121 (2018): 302–308.

[41] K. L. Wood, M. T. Barrack, V. B. Gray, et al., "Cognitive Dietary Restraint Score is Associated With Lower Energy, Carbohydrate, Fat, and Grain Intake Among Female Adolescent Endurance Runners," *Eating Behaviors* 40 (2021): 101460.

[42] D. A. Cobb-Clark, S. C. Dahmann, D. A. Kamhöfer, and H. Schildberg-Hörisch, "Self-Control and Unhealthy Body Weight: The Role of Impulsivity and Restraint," *Economics & Human Biology* 50 (2023): 101263.

[43] M. Du, C. F. Griecci, F. Cudhea, et al., "What is the Cost-Effectiveness of Menu Calorie Labelling on Reducing Obesity-Associated Cancer Burdens? An Economic Evaluation of a Federal Policy Intervention Among 235 million Adults in the USA," *BMJ Open* 13, no. 4 (2023): e063614.

[44] Z. Colombet, E. Robinson, C. Kypridemos, A. Jones, and M. O'Flaherty, "Effect of Calorie Labelling in the Out-of-Home Food Sector on Adult Obesity Prevalence, Cardiovascular Mortality, and Social Inequalities in England: A Modelling Study," *The Lancet Public Health* 9, no. 3 (2024): e178–e185.

[45] M. Burns and N. Gavey, "'Healthy Weight' at What Cost? 'Bulimia' and a Discourse of Weight Control," *Journal of Health Psychology* 9, no. 4 (2004): 549–565.

[46] S. D. Hemmingsen, R. Wesselhoeft, M. B. Lichtenstein, J. M. Sjögren, and R. K. Støving, "Cognitive Improvement Following Weight Gain in Patients With Anorexia Nervosa: A Systematic Review," *European Eating Disorders Review* 29, no. 3 (2021): 402–426.

[47] T. Frances, K. O'Neill, and K. Newman, "An Extra Fight I Didn't Ask for': A Qualitative Survey Exploring the Impact of Calories on Menus for People With Experience of Eating Disorders," *British Journal of Health Psychology* 29, no. 1 (2024): 20–36.

[48] C. A. Roberto, A. F. Haynos, M. B. Schwartz, K. D. Brownell, and M. A. White, "Calorie Estimation Accuracy and Menu Labeling Perceptions Among Individuals With and Without Binge Eating and/or Purging Disorders," *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* 18, no. 3 (2013): 255–261.

[49] S. Ozturkcan and O. Kitapci, "A Sustainable Solution for the Hospitality Industry: The QR Code Menus," *Journal of Information Technology Teaching Cases* (2023): 20438869231181599.

[50] D. Pal, S. Funilkul, W. Eamsinvattana, and S. Siyal, "Using Online Food Delivery Applications During the COVID-19 Lockdown Period: What Drives University Students' Satisfaction and Loyalty?" *Journal of Foodservice Business Research* 25, no. 5 (2022): 561–605.

[51] W. K. Olsen, A. Warde, and L. Martens, "Social Differentiation and the Market for Eating Out in the UK," *International Journal of Hospitality Management* 19, no. 2 (2000): 173–190.

[52] P. Silva, R. Araújo, F. Lopes, and S. Ray, "Nutrition and Food Literacy: Framing the Challenges to Health Communication," *Nutrients* 15, no. 22 (2023): 4708.

[53] P. J. Liu, C. A. Roberto, L. J. Liu, and K. D. Brownell, "A Test of Different Menu Labeling Presentations," *Appetite* 59, no. 3 (2012): 770–777.