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QUANTITATIVE RESEARCH

Efficacy of calorie labelling for alcoholic and non-alcoholic beverages on restaurant menus on noticing information, calorie knowledge, and perceived and actual influence on hypothetical beverage orders: a randomized trial

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Abstract

Objectives To test the efficacy of calorie labelling for alcoholic and non-alcoholic beverages on restaurant menus on noticing calorie information, calorie knowledge, and perceived and actual influence on hypothetical beverage orders.

Methods Participants included upper-level university students of legal drinking age residing in Ontario, Canada ($n=283$). Using a between-groups experiment, participants were randomized to view one of two menus: (1) *No Calorie Information* (control), and (2) *Calorie Information* adjacent to each beverage. Participants completed a hypothetical ordering task, and measures related to noticing calorie information, calorie knowledge, and actual and perceived influence of calorie information on beverages ordered were assessed. Linear, logistic, and multinomial logistic regression models were used to examine the four outcomes.

Results The odds of noticing calorie information were significantly higher in the Calorie Information (72.6%) versus No Calorie Information condition (8.0%) (OR = 43.7, 95% CI: 16.8, 113.8). Compared to those in the No Calorie Information condition, participants in the Calorie Information condition had significantly lower odds of responding 'Don't know' (OR = 0.04, 95% CI: 0.02, 0.09), underestimating (OR = 0.06, 95% CI: 0.02, 0.2), and overestimating (OR = 0.05, 95% CI: 0.02, 0.2) versus accurately estimating calories in beverages ordered. No significant differences were observed between menu labelling conditions in the calories in beverages ordered or the perceived influence of calorie information on the number of beverages ordered.

Conclusion Exposure to menus with calorie information increased consumers noticing the calorie information, and accurately estimating calories in alcoholic and non-alcoholic beverages ordered. These results have implications for policy-makers considering mandatory menu labelling policy inclusive of alcoholic beverages.

Résumé

Objectifs Évaluer l'effet de l'inscription de la valeur calorique des boissons alcoolisées et non alcoolisées sur les probabilités de remarquer cette information et la connaissance de la valeur calorique, et sur l'influence, réelle ou perçue, sur des commandes hypothétiques de boissons.

Méthodologie Les participants étaient des étudiants universitaires avancés ayant l'âge légal pour consommer de l'alcool et vivant en Ontario, au Canada ($n=283$). On les a répartis au hasard en deux groupes : 1) ceux du premier groupe ont consulté un menu *sans valeurs caloriques* (groupe témoin) et 2) ceux du second groupe ont consulté un menu indiquant les *valeurs caloriques* à côté de chaque boisson. Les participants ont ensuite fait des commandes hypothétiques et on a mesuré les données suivantes : probabilité de remarquer les valeurs caloriques, connaissance des valeurs caloriques et influence, réelle ou perçue, de cette information sur le choix des boissons. Des modèles de régression linéaire, logistique et logistique multinomiale ont été employés pour analyser les données recueillies.

Résultats Les probabilités de remarquer les valeurs caloriques étaient beaucoup plus élevées dans le groupe *valeurs caloriques* (72,6 %) que dans le groupe *sans valeurs caloriques* (8,0 %) (RC = 43,7, IC à 95% : 16,8–113,8). Comparés à ceux du groupe *sans valeurs caloriques*, les participants du groupe *valeurs caloriques* avaient beaucoup moins de

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chances de répondre « Je ne sais pas » (RC = 0,04, IC à 95% : 0,02–0,09), de donner une réponse trop basse (RC = 0,06, IC à 95% : 0,02–0,2) ou trop haute (RC = 0,05, IC à 95% : 0,02–0,2) que d'estimer précisément le nombre de calories dans les boissons commandées. Aucune différence significative n'a été observée entre les deux groupes quant au nombre de calories contenues dans les boissons commandées ni dans l'influence perçue des valeurs caloriques sur le nombre de boissons commandées.

Conclusion Le fait d'inscrire les valeurs caloriques sur le menu augmente les probabilités que les consommateurs remarquent les valeurs caloriques, et facilite l'estimation précise de la valeur calorique des boissons alcoolisées ou non alcoolisées commandées. Ces résultats ont une incidence pour les décideurs qui envisagent de rendre obligatoire l'inscription des valeurs caloriques sur les menus, y compris pour les boissons alcoolisées.

Keywords Food label · Calories · Randomized controlled trial · Alcohol · Food policy

Mots-clés Étiquette nutritionnelle · calories · essai clinique randomisé · alcool · politique alimentaire

Introduction

Alcohol is regularly consumed by 2.4 billion people globally and represents a significant yet often overlooked source of energy (GBD, 2016 Alcohol Collaborators). Aside from being an addictive substance causally associated with more than 200 health conditions, alcohol has 7 cal/g, which, when compared to macronutrients, is the second highest energy value per gram after fat at 9 cal/g (World Health Organization, 2004). Energy from alcohol has limited to no nutritional value and is typically consumed in addition to other dietary sources, rather than as a substitute, often resulting in increased energy intake (Kwok et al., 2019; Yeomans, 2010). Nationally representative data indicate alcohol is among the top 5 contributors to total energy intake among adults (Kirkpatrick et al., 2019), and contributes more than 10% of adult drinkers' daily total energy intake in Canada, the United Kingdom, and the United States (Butler et al., 2016; Shelton & Knott, 2014; Sherk et al., 2019). Consistently, men consume a higher proportion of their daily total energy intake from alcohol than females (Butler et al., 2016; Kirkpatrick et al., 2019; Shelton & Knott, 2014; Sherk et al., 2019). Alcohol has also been identified as a risk factor for excess energy intake among young people because of the prevalence of frequent alcohol consumption and binge drinking within this population (Battista & Leatherdale, 2017). Review evidence from eight studies found consistent results that people are largely unaware of the energy content of alcoholic beverages (Robinson et al., 2021a, b), and a separate review showed people may be less likely to pay attention to liquid calories as compared to food calories (Almiron-Roig et al., 2013). These characteristics can have important implications for the overconsumption of energy; however, the specific mechanistic relationships between alcohol use and obesity are complicated and remain unclear (Traversy & Chaput, 2015). Considering alcohol is a widely consumed, energy-dense commodity that contributes significant calories to average daily diets, a reduction in alcohol consumption is a potentially important component of a comprehensive obesity prevention strategy.

Public health organizations are now endorsing interventions aimed at reducing population-level alcohol consumption as an obesity prevention measure (Ananthapavan et al., 2020; Dietary Guidelines Advisory Committee, 2020; Jané-Llopis et al., 2020). Calorie labelling on menus/menu boards in restaurants is one policy lever for supporting more informed and lower caloric choices when eating outside the home (Hawkes & Allen, 2013). This approach is becoming increasingly more common given at least one third of budgets are spent on foods prepared outside the home in Canada and the UK, and more than 50% in the USA (Government of the UK, 2020; Statistics Canada, 2021a; US Department of Agriculture & Economic Research Service, 2020). Moreover, both lab and naturalistic studies have found consumers frequently underestimate the calories in restaurant foods, and menu labelling information can help reduce this underestimation (Block et al., 2013). Review evidence examining menu labelling generally concludes this intervention has limited impact on calories purchased among the entire population, yet has a significant impact on awareness and self-reported use of nutrition information and is an effective approach for supporting consumer knowledge of the calorie content of ordered items (Bleich et al., 2017).

Jurisdictions around the world have implemented calorie labelling legislation for all food and beverage items on restaurant menus (US Government, 2010; Government of South Australia, 2012; Government of Ontario, 2015a), but not all menu labelling policies require the calories in alcoholic beverages to be labelled. Moreover, in most countries, alcohol is also the only consumer beverage that is exempt from regulations mandating a nutrition panel on container labels (Joint FAO/WHO, 2019). In Canada, alcoholic beverages account for approximately 12% of

food service sales, and in the USA, consumer spending on alcoholic beverages in away-from-home food establishments increases approximately 2% annually (PR Newswire Association LLC, 2016; Statistics Canada, 2021b). In 2015, market research with more than 1000 Canadians reported that 19% of alcoholic beverages are consumed at restaurants, bars, and hotels or banquet halls (Boesveld, 2015). A systematic review of six lab-based experimental studies assessing the influence of alcohol container labels with calorie information or calorie plus other nutrition and serving size information on intentions to consume or actual consumption found no effects (Robinson et al., 2021a, b); yet, none of these studies were conducted in Canada or tested calorie labels for alcoholic beverages on restaurant menus. Research is needed to examine the effect of mandatory menu labelling on consumer awareness of the calories in alcoholic beverages and on alcohol consumption in restaurants.

In 2017, the USA implemented federal legislation requiring major restaurant chains to post calorie information adjacent to individual food and beverage items, including alcoholic beverages, on menus/menu boards (US Government, 2010). Before the federal legislation was implemented in the USA, the implementation of local or state menu labelling laws was associated with a 1.2% reduction in self-reported past-month alcohol use relative to jurisdictions without labelling laws (Restrepo & Ali, 2017). Policy effects on alcohol use were greater among men than among women, and among ethnic minorities as compared to those identifying as white. No federal menu labelling policy has been implemented in Canada; however, in 2017, Ontario was the first Canadian jurisdiction to mandate major chain restaurants to post calorie information on menus as part of the Healthy Menu Choices Act (hereafter, 'Act') (Government of Ontario, 2015a). Under the Act, calorie information must be displayed adjacent to each standard food and beverage item on menus/menu boards. Alcoholic beverages, however, are exempt from this requirement as long as a summary table with calorie information for standard size and strength wine, beer, and spirits is displayed in close proximity to where the alcoholic beverages are listed on the menu. This exception for alcohol was a compromise to the Ontario restaurant lobbyists' contention that the legislation's primary purpose is to address childhood obesity (Government of Ontario, 2015b). Recently, the UK released results of a public consultation on a proposal to federally mandate calorie labelling for food and non-alcoholic beverages at the point-of-choice in large chain restaurants (UK Department of Health & Social Care, 2020). In the proposal, beverages with over 1.2% alcohol by volume are exempt from posting calorie labels.

The aims of this study were to experimentally test the efficacy of calorie labelling for alcoholic and non-alcoholic beverages on restaurant menus on the extent to which consumers report noticing calorie information and perceive calorie information to influence their beverage selection decisions, as well as on the calories in consumers' hypothetical beverage orders and consumers' ability to accurately estimate calories in their beverages ordered.

Methods

Study design

A between-groups experiment was conducted in February–April 2017 among university students. Students were randomized to view an actual restaurant beverage menu altered to one of two calorie labelling conditions: (1) *No Calorie Information* (control); and (2) numeric *Calorie Information* adjacent to each individual beverage, including both alcoholic and non-alcoholic beverages, in the same font as the listed beverages (Fig. 1). A contextual statement indicating daily energy recommendations was also provided at the bottom of the menu. In the Calorie Information condition, the calorie content for branded alcoholic and non-alcoholic beverages was obtained from the brand's publicly accessible website in 2016, and for the generic alcoholic and non-alcoholic beverages, from the Canadian Nutrient File database (Government of Canada, 2018). Other than calorie labelling information, all menu information was held constant.

Sample

Participants included students enrolled in upper-level undergraduate health, nutrition, hospitality, policy, and healthcare courses at one of three universities in Ontario. All students in a convenience sample of classes who were in attendance the day of data collection were invited to participate in the study. Eligible participants were aged 19 years and over, the legal drinking age in Ontario, enrolled as a student at one of the participating universities, able to understand English, and had not previously participated in the study. Participants were told the study was examining Canadians' food and drink choices at restaurants and pubs, without mentioning nutrition, diet, or calories in any recruitment messages in order to minimize self-selection bias. The study received clearance from the Research Ethics Board at Public Health Ontario plus the three participating universities, and all participants provided partially informed consent, which was implied by their completion and submission of the survey. Only partially informed consent was achieved, as participants were not fully informed of the purpose of the study in order to reduce social desirability bias.

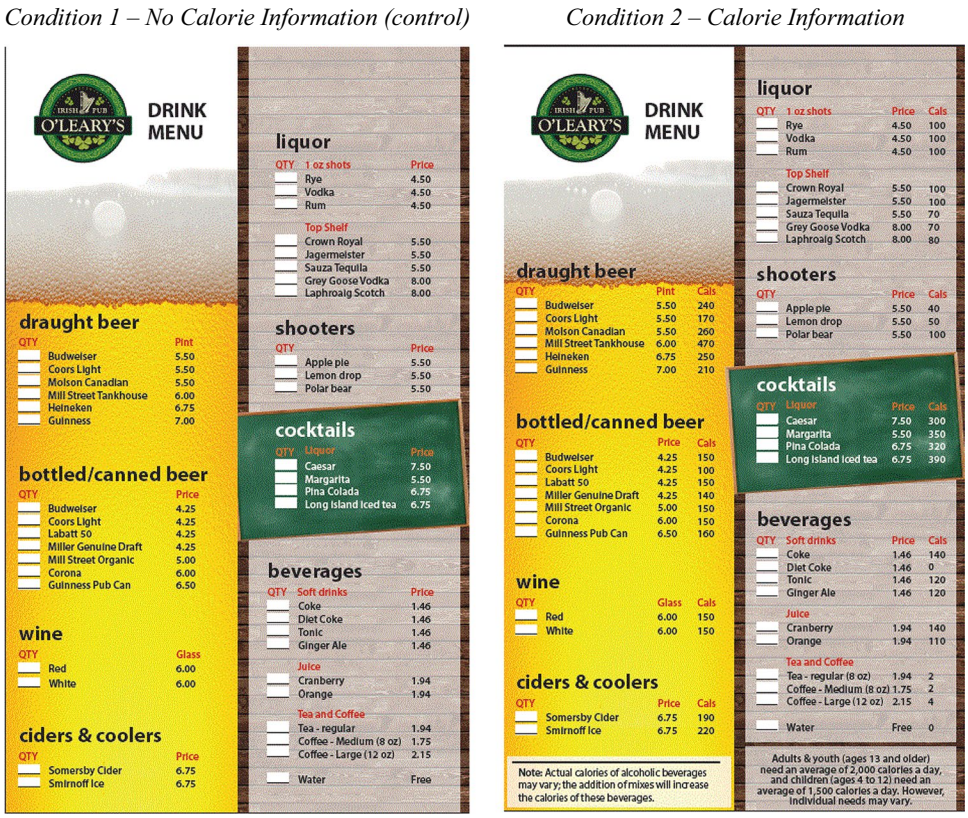

Fig. 1 Sample of pub beverage menus by experimental condition

Protocol

Each student who attended a participating class on the day of the study was given an envelope upon entering the classroom. The envelopes contained study materials according to one of the two experimental menu labelling conditions, and had been previously shuffled and sequentially numbered to randomly assign participants to conditions. Participants and research staff were blinded to allocation of the experimental conditions. Before starting the survey, a Research Assistant read an information letter to students introducing the study and what was required to participate in the study, emphasizing the minimum age requirement of 19 years. Students were asked to complete their survey independently and to respect the privacy of their neighbours as they completed their surveys, similar to when writing an exam. Students submitted their surveys in the provided envelope at the end of the 10-min study period and the sealed envelopes were collected by research staff. Students who chose not to participate were asked to submit their blank surveys in the provided envelope at the end of the study period.

Measures

All measures used in this study are defined in the Supplementary Materials—Table 1S.

To assess the efficacy of calorie labelling on beverages ordered in a hypothetical ordering task, participants were instructed to imagine they are at a pub for drinks with their friends and to record which drinks they would order for themselves and how many of each type of drink. Participants could also select None of the above, Don't know, or Prefer not to answer as response options. Participants were not given a spending limit.

Noticing calorie information on the menu was assessed by asking participants, 'Without referring back to the menu, what type(s) of information did you notice on the menu? (Check all that apply)'. Response options included Fat, Calories, Alcohol Drinking Guidelines, Sodium, Price, Other, Don't know, or Prefer not to answer.

Participants were asked, 'To what extent, if at all, did the calorie information influence the number of drinks that you ordered?' Response options included Not at all, Not much, Neutral, Somewhat, Very much, Don't know, or Prefer not to answer. Responses were confirmed affirmative if participants selected 'Somewhat' or 'Very much'. The question was asked of all participants, including participants in the *No Calorie Information* condition, to control for false positive responses and social desirability bias (e.g., providing responses viewed as desirable or more favourable by others) between conditions.

Participants were asked, 'Approximately how many calories are in the drink(s) that you ordered?' and were

prompted to enter the number of calories as an open-ended response, with Don't know and Prefer not to answer as options. Responses were coded as 'accurate' if they were within ± 10% of the actual number of calories in their selected beverage(s), with responses greater or less than this threshold categorized as 'overestimate' or 'underestimate', respectively.

Socio-demographic characteristics included age, sex (Male, Female, Don't know, Prefer not to answer), and ethnicity (White, Other, Don't know, Prefer not to answer). Alcohol consumption level was derived using two survey measures assessing consumption frequency and quantity. The frequency measure was: 'During the past 12 months, how often did you usually drink alcoholic beverages? This means any type of alcohol, including beer, wine, hard liquor, or coolers.' Response options included Never, Less than once a month, Once a month, 2 to 3 times a month, Once a week, 2 to 3 times a week, 4 to 6 times a week, Every day, Don't know, or Prefer not to answer. The quantity measure was: 'On the days when you drank alcoholic beverages in the past 12 months, about how many did you usually drink in a single day?' Participants were prompted to enter the number of drinks as an open-ended response; Don't know or Prefer not to answer were also offered as response options. Participants who responded 'Never' to the first measure were categorized as 'Non-consumers', and their responses to the second measure were not considered. If participants indicated they consumed alcohol in the past 12 months, their responses to the second measure were categorized as 'Low or medium volume consumer' (< 3 per drinking day) or 'High volume consumer' (≥ 3 per drinking day). Participants who responded Don't know or Prefer not to answer, or did not enter a response for either of the two alcohol consumption measures, were categorized accordingly. Body weight goals were measured by asking participants: 'Which of the following are you trying to do about your weight?' Response options included Lose weight, Gain weight, Stay the same weight, Not trying to do anything about my weight, Don't know, or Prefer not to answer. Health consciousness level was measured by asking participants the extent to which they agree or disagree with the following statement: 'I am usually concerned/conscious about what I eat and drink.' Responses were recorded on a 5-point Likert scale anchored with 1 = Strongly disagree and 5 = Strongly agree. Responses were categorized as 'Low concern' (1–3), 'High concern' (4–5), Don't know, or Prefer not to answer. Belief that alcohol can cause cancer was measured by asking participants, 'To what extent do you agree or disagree that drinking alcohol can cause breast cancer?' Responses were categorized as 'Do not agree' (Strongly disagree, Disagree, or Neither agree nor disagree), 'Agree' (Agree or Strongly agree), Don't know, or Prefer not to answer.

Statistical analyses

Chi-square tests were used to assess differences in sample characteristics and *t*-tests were used to assess differences in age between conditions. Four separate linear, logistic, and multinomial logistic regression models were used to examine associations between conditions and noticing calorie information on the menu, perceived influence of calorie information on the number of beverages ordered, the calories in beverages ordered, and ability to accurately estimate the amount of calories in beverage(s) ordered. $p < 0.05$ was used for significance. Condition was entered as a categorical variable, with the following covariates: age, sex, ethnicity, alcohol consumption level, body weight goals, health consciousness level, and knowledge that alcohol can cause cancer. All covariates were adjusted for in the analysis, regardless of significance. Participants responding 'Prefer not to answer' or with missing/illegible responses were excluded from regression models ($n = 38$). Those who responded 'Don't know' to the measures assessing health consciousness level ($n = 2$) and body weight goals ($n = 1$) were excluded from regression models because these responses were approximately 1% of total responses and could not be combined with another category. Those who responded 'Don't know' to alcohol consumption level ($n = 26$) were excluded from regression models because these responses were approximately 9% of total responses and could not be combined with another category. Although the alcohol consumption level measure derived from consumption frequency and quantity is standard in alcohol epidemiology, a sensitivity analysis was conducted using the frequency measure only in the regression models. This sensitivity analysis was conducted because, of the 26 participants who responded 'Don't know' in the alcohol consumption level measure, the majority ($n = 25$) responded 'Don't know' to the quantity measure. Sensitivity analyses modelling three additional outcomes—the total number of beverages ordered, the number of alcoholic beverages ordered, and the calories in alcoholic beverages ordered—were also conducted to further examine the influence of restaurant menus with calorie labelling on alcoholic beverage orders. Finally, two-way interactions between condition and covariates were tested in subsequent models for all four primary outcomes. All analyses were conducted using SAS Enterprise Guide 8.2 Update 1 (8.2.1.1223).

Results

Sample characteristics of participants are in Table 1. There were no significant differences in socio-demographic or health-related characteristics between conditions.

Table 1 Sample characteristics, by experimental condition ($n = 283$)

	No calorie information ($n = 137$) % (n)	Calorie information ($n = 146$) % (n)	Total ($n = 283$) % (n)
Age [mean (SD)]	22.5 (3.3)	22.9 (4.4)	22.7 (3.9)
Sex			
Male	21.9 (30)	28.1 (41)	25.1 (71)
Female	72.3 (99)	68.5 (100)	70.3 (199)
Prefer not to answer	0.7 (1)	0.7 (1)	0.7 (2)
Missing/illegible	5.1 (7)	2.7 (4)	3.9 (11)
Ethnicity			
White	29.2 (40)	20.6 (30)	24.7 (70)
Other	63.5 (87)	74.7 (109)	69.3 (196)
Missing	7.3 (10)	4.8 (7)	6.0 (17)
Alcohol consumption level			
Non-consumer	10.2 (14)	15.1 (22)	12.7 (36)
Low/medium volume (< 3 per drinking day)	39.4 (54)	41.8 (61)	40.6 (115)
High volume (≥ 3 per drinking day)	31.4 (43)	26.0 (38)	28.6 (81)
Don't know	8.0 (11)	10.3 (15)	9.2 (26)
Prefer not to answer	3.7 (5)	2.7 (4)	3.2 (9)
Missing/illegible	7.3 (10)	4.1 (6)	5.7 (16)
Body weight goals			
Lose weight	53.3 (73)	49.3 (72)	51.2 (145)
Gain weight	8.8 (12)	13.0 (19)	11.0 (31)
Stay the same weight	19.7 (27)	24.7 (36)	22.2 (63)
Not try to do anything	11.0 (15)	8.2 (12)	9.5 (27)
Don't know	0.7 (1)	0.0 (0)	0.4 (1)
Prefer not to answer	0.7 (1)	1.4 (2)	1.1 (3)
Missing/illegible	5.8 (8)	3.4 (5)	4.6 (13)
Health consciousness level			
Low	39.4 (54)	38.4 (56)	38.9 (110)
High	58.4 (80)	57.5 (84)	58.0 (164)
Don't know	0.0 (0)	1.4 (2)	0.7 (2)
Prefer not to answer	0.7 (1)	0.0 (0)	0.4 (1)
Missing	1.5 (2)	2.7 (4)	2.1 (6)
Believe alcohol can cause cancer			
Don't agree	56.2 (77)	47.3 (69)	51.6 (146)
Agree	22.6 (31)	24.7 (36)	23.7 (67)
Don't know	17.5 (24)	24.7 (36)	21.2 (60)
Prefer not to answer	0.7 (1)	1.4 (2)	1.1 (3)
Missing	2.9 (4)	2.1 (3)	2.5 (7)

Noticing calorie information on the menu

In total, 72.6% ($n = 106$) of participants in the *Calorie Information* and 8.0% ($n = 11$) of participants in the *No Calorie Information* condition reported noticing calorie information on the menu. Regression results indicate significantly higher odds of noticing calorie information in the Calorie Information versus No Calorie Information control condition (OR = 43.7, 95% CI: 16.8, 113.8; Table 2). No significant interactions between condition and covariates were observed in a subsequent model.

Perceived influence of calorie information on the number of beverages ordered

In total, 24.0% ($n = 35$) of participants in the Calorie Information and 16.1% ($n = 22$) in the No Calorie Information condition perceived the calorie information to influence the

number of beverages ordered. Regression results indicate no significant differences between conditions (OR = 1.9, 95% CI: 0.9, 3.9; Table 2). No significant interactions between condition and covariates were observed in a subsequent model.

Total calories in beverages ordered

Overall, the mean number of beverages ordered (excluding water) was 3.1 (SD = 2.9) in the Calorie Information and 2.9 (SD = 2.4) in the No Calorie Information condition (Fig. 2). As shown in Table 2, regression results indicate no significant differences in the calories ordered between the Calorie Information [501.6 cal (SD = 540.3)] and No Calorie Information [464.4 cal (SD = 394.7)] conditions [64.7 (SE = 58.9), $p = 0.27$]. No significant interactions between condition and covariates were observed in a subsequent model.

Ability to accurately estimate calories in beverages ordered

Figure 3 provides the crude percentage of participants who underestimated, accurately estimated, overestimated, or

Table 2 Influence of menu labelling condition on noticing calorie information on the menu, perceived influence of calorie information on the number of beverages ordered, and total calories in beverages ordered ($n = 216$)

	Noticing calorie information on the menu		Perceived influence of calorie information on number of beverages ordered		Total calories in beverages ordered	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	Coefficient (Std. error)	*p*-value
Calorie information (vs. No calorie information)	43.7 (16.8–113.8)	< 0.0001	1.9 (0.9–3.9)	0.07	64.7 (58.9)	0.27

Logistic and linear regression models were adjusted for participant age, sex, ethnicity, alcohol consumption level, body weight goals, health consciousness level, and knowledge that alcohol can cause cancer. Threshold for significance: $p < 0.05$

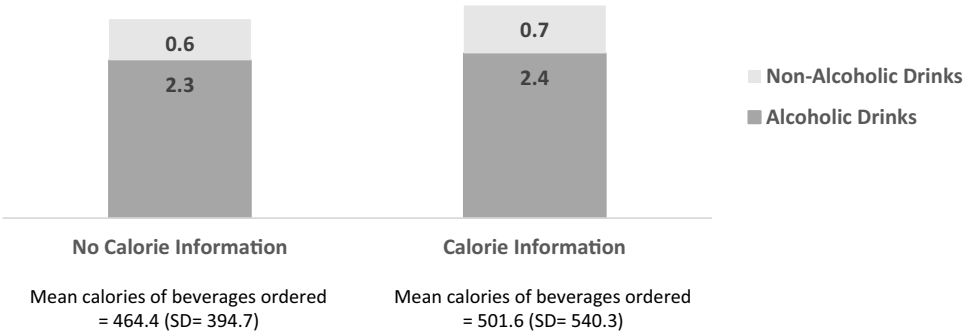

Fig. 2 Mean number of beverages ordered (excluding water) by beverage type and experimental condition ($n = 283$)

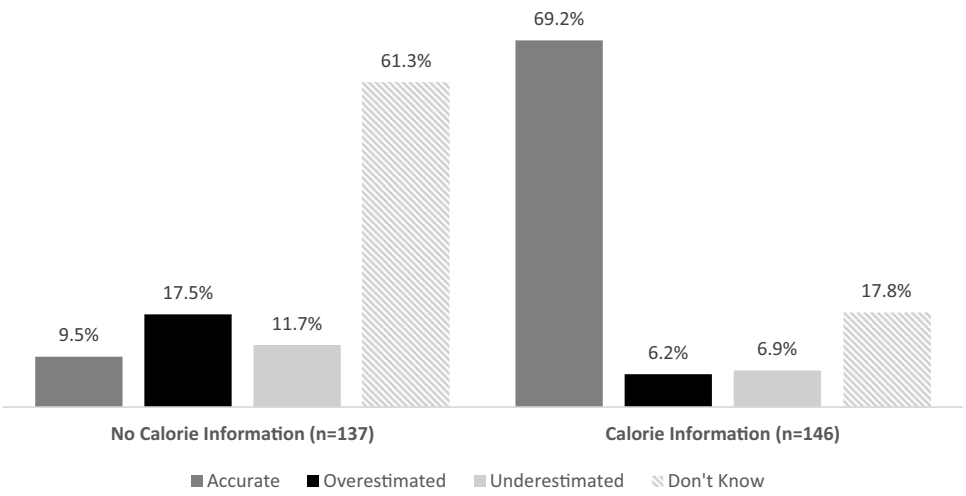

Fig. 3 Crude percentage of participants who underestimated, accurately estimated, overestimated, or reported that they 'Don't know' the calories in the beverages they ordered by experimental condition (%) ($n = 283$). Responses were coded as 'accurate' if they were within ± 10% of the actual number of calories in the beverage(s) ordered, with any responses greater or less than this threshold categorized as overestimate or underestimate, respectively

responded 'Don't know' when asked to estimate the number of calories in the beverage(s) ordered from the menu by experimental condition. Overall, 40.3% ($n=114$) of participants accurately estimated, 38.9% ($n=110$) responded 'Don't know', and 11.7% ($n=33$) overestimated and 9.2% ($n=26$) underestimated the number of calories in their ordered beverages. Results of the adjusted multinomial logistic regression model indicate, compared to the No Calorie Information condition, participants in the Calorie Information condition had significantly lower odds of responding 'Don't know' (OR = 0.04, 95% CI: 0.02, 0.09), underestimating (OR = 0.06, 95% CI: 0.02, 0.2), and overestimating (OR = 0.05, 95% CI: 0.02, 0.2) versus accurately estimating calories in the beverages ordered (model results not shown). No significant interactions between condition and covariates were observed in a subsequent model.

Sensitivity analyses

No notable differences were found in the sensitivity analyses examining the odds of noticing calorie information, perceiving calorie information to influence the number of beverages ordered, total calories in beverages ordered (Supplementary Table 2S), or providing accurate calorie estimates (Supplementary Table 3S). Additionally, regression results continue to indicate no significant differences between menu labelling conditions and the number of total beverages ordered, the number of alcoholic beverages ordered, or the calories in alcoholic beverages ordered (Supplementary Table 4S).

Discussion

This study is the first empirical study examining calorie labelling for alcoholic beverages on restaurant menus conducted in Canada. The findings indicate that displaying calorie information on restaurant beverage menus did not influence the number of calories in the beverages ordered in a hypothetical ordering task. Yet, the results show the majority of participants noticed the calorie information when it was included on the menu, and being exposed to calorie information on menus increased consumers' knowledge of the calorie amounts in beverages ordered, similar to previous studies conducted internationally (Bleich et al., 2017; Bollinger et al., 2011; Robinson et al., 2021a, b).

The amount of calories in beverages ordered was not significantly different between menu labelling conditions. These results are consistent with the broader menu labelling literature, studies observing menu labelling to have a modest influence on restaurant food and non-alcoholic beverage orders, with differences between restaurant settings, consumer types, and food/beverage type (Bleich et al., 2017). For example, in a study examining transactions before and after the implementation of the New York City menu labelling law, there was a 6% decrease in mean calories per transaction in New York City restaurant locations with calorie labels relative to comparison restaurant sites without calorie labels, driven by changes in food, not beverage, calories (Bollinger et al., 2011). This study, however, did not examine alcoholic beverage purchases. Further research is necessary to confirm whether menu labelling interventions differentially influence beverage calories ordered, particularly alcoholic beverages, compared to food calories ordered in restaurants. Additionally, as only immediate responses were measured, potential longer-term influences were not captured, such as learning effects.

Overall, when asked to estimate the calorie content in the beverages ordered in the hypothetical task, 61% of participants reported 'Don't know' in the No Calorie Information condition, and 18% in the Calorie Information condition, suggesting these participants were so unsure they were unable or unwilling to guess. These findings are striking yet consistent with previous studies observing very low consumer knowledge of the calorie content in beverages, particularly alcoholic beverages (Bollinger et al., 2011; Robinson et al., 2021a, b). In this study, adding calorie labels adjacent to individual beverages on menus proved critical for participants to accurately estimate calories in their selected beverages. This is a key finding as jurisdictions implement or propose implementing calorie labelling legislation in restaurants, given that alcoholic beverages are often excluded from labelling policy. The World Health Organization argues that access to accurate product information is a consumer right and recommends nutrition labelling for alcoholic beverages that is consistent with that on non-alcoholic beverages (Jané-Llopis et al., 2020).

This study has limitations. First, the study was conducted as a hypothetical ordering task, rather than in a naturalistic environment, and thus does not represent actual ordering behaviours, and may have minimized the influence of other salient factors known to affect consumers' noticing of calorie information in restaurant settings. The experimental design is a strength and the results contribute to the existing literature by providing insights on the efficacy of calorie labelling for alcoholic beverages on restaurant menus. Next, this study included a sample of young adults who were enrolled in a health-related university course, and therefore results may not be generalizable to the wider Canadian population. Finally, it is possible this study is underpowered to detect anything but large differences between groups in the number of calories in beverages ordered in the hypothetical task. The large standard errors around the main effect estimates suggest a substantial amount of unexplained variation in this model.

Completion of studies testing the effect of calorie labels for alcoholic and non-alcoholic beverages on menus on purchases in a larger and more diverse sample of adults is needed to generate more precise estimates. A more diverse sample would also allow for the disaggregation of variables relating to sex, ethnicity, and alcohol consumption level to further explore their relationships with calorie labelling on restaurant beverage menus. Future research may also explore the relationship between calorie labelling for alcoholic beverages on restaurant menus and industry behaviour, such as reducing portion sizes and offering 'lower calorie' product options, as suggested in studies investigating UK restaurant calorie labelling and the energy content of food and non-alcoholic beverages offered on menus (Robinson et al., 2021a, b; Theis & Adams, 2019).

Conclusion

This research found disclosing calorie information for alcohol and non-alcoholic beverages on restaurant beverage menus led to the majority of consumers noticing calorie information and greater knowledge of the number of calories in beverages ordered in a hypothetical ordering task. There was no evidence of an effect on the amount of calories in beverages ordered in the hypothetical ordering task, but future studies should examine the potential impact on behavioural outcomes in larger trials and on actual beverage purchases and consumption.

Contributions to knowledge

What does this study add to existing knowledge?

- Exposure to restaurant beverage menus with calorie information for both alcoholic and non-alcoholic beverages led to the majority of consumers noticing calorie information, and accurately estimating calories in alcoholic and non-alcoholic beverages.
- There was no evidence of an effect on the amount of calories in beverages ordered in the hypothetical ordering task, but future studies should examine the potential impact on behavioural outcomes in larger trials and on actual beverage purchases and consumption.

What are the key implications for public health interventions, practice or policy?

- These results have implications for policy-makers considering mandatory menu labelling policy inclusive of alcoholic beverages.

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Declarations

Conflict of interest The authors declare no competing interests.

Ethics approval This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Research Ethics Board at Public Health Ontario plus the three participating universities.

Consent to participate Informed consent was obtained from all individual participants included in the study.

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