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The impact of nutrition information labels on alcohol containers in Canada: an online randomized trial

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ABSTRACT

Objective: To determine if nutritional information on an alcohol container influenced consumer perceptions of product healthiness, and whether the effect of information differed by display format.
Methods: Online randomized controlled trial among adults in Canada sampled from a commercial panel (analytical sample n = 3880) in November/December 2024. Participants were randomized to view a wine product in one of four conditions: (1) control (no label), (2) Nutrition Facts table (NFT), (3) textual nutrition information, (4) Alcohol Facts table, and were asked "How healthy would it be to drink this wine regularly?" (7-point Likert-type item, very unhealthy to very healthy). Logistic regression compared the likelihood of rating the product as "a little healthy/healthy/very healthy" between conditions.
Results: Compared to the control (16.5 %), those in the NFT condition had higher odds of rating the product as "a little healthy/healthy/very healthy" (28.3 %, AOR = 1.97, 95 %CI,1.57,2.47), as did those in the textual nutrition information condition (23.8 %, AOR = 1.60, 95 %CI,1.27,2.02). There were no differences between the control condition and the Alcohol Facts table condition (18.8 %).
Conclusions: Nutritional information on alcohol products may lead consumers to falsely believe products are 'healthier'. Label design and features that make alcohol products distinct from non-alcoholic food and beverages may reduce unintended impacts.

1. Introduction

Alcohol is among the leading causes of death and disability, and is a causal risk factor for 2.6 million deaths per year globally (World Health Organization, 2024). The risk of negative health outcomes starts at a low volume of weekly alcohol consumption and generally increases in a monotonic relationship (Rehm et al., 2021; Ortolá et al., 2024; Anderson et al., 2023). Public awareness of most types of alcohol-caused health risks is low (Vallance et al., 2020; Bates et al., 2018; Scheideler and Klein, 2018; Kokole et al., 2023; Gapstur et al., 2022), likely in part due to alcohol being a highly normalized commodity sold in many food environments, including supermarkets and corner stores, alongside food and non-alcoholic beverages (Friesen et al., 2023; Gray-Phillip et al., 2018).

Product labelling is an important means of conveying health information to consumers. Compared to other controlled substances such as tobacco or cannabis, alcohol is subject to fewer labelling requirements. In most countries, alcohol products are either not required to display a health warning or require obscure warnings that do not incorporate labelling best practices (World Health Organization, 2024; Giesbrecht et al., 2022). Alcohol is subject to some, but not all, labelling regulations required of foods. In most countries, nutrient declarations for calories and key nutrients like carbohydrates, sugars, sodium and fats on alcohol product labels are voluntary, except when a claim is displayed, such as 'low in calories'. In Canada, accompanying nutrient declarations on alcohol products must be provided in the same Nutrition Facts table (NFT) format required on all food products (Government of Canada, 2025). Evaluations suggest that while nutrition claims are common on specific alcoholic beverage categories, such as ready-to-drink alcohol products, the provision of nutrient declarations (e.g., NFTs) in the absence of nutrition-related claims is rare (Demers-Potvin et al., 2023; Barons et al., 2022).

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Various approaches are being considered to revise nutrition-related labelling on alcohol to improve the transparency of the nutritional contribution of alcohol and to meet consumers' right to know what is in the products they consume (Food Standards Australia and New Zealand, 2022; Government of Ireland, 2018). In January 2025, the US Alcohol and Tobacco Tax and Trade Bureau proposed to mandate an 'Alcohol Facts' table with per-serving calorie, carbohydrate, fat, and protein content on alcohol container labels, with optional provision of sugar content, which would be similar in presentation (shape, colour, text) to the Nutrition Facts panel mandatory on food products in the US, but with clear mention of 'Alcohol' instead of 'Nutrition' in the table title (Department of the Treasury Alcohol and Tobacco Tax and Trade Bureau, 2025). The Bureau has also proposed an alternative linear 'textual' presentation of the information. Provision of nutrition information on alcohol product labels aligns with recent discussions by the Codex Committee on Food Labelling (Joint FAO/WHO Food Standards Programme Codex Committee on Food Labelling, 2025) and prior World Health Organization Regional Office for Europe recommendations (World Health Organization Regional Office for Europe, 2017).

Scant research has evaluated the impact of nutrition information on consumer perceptions of alcohol products and purchasing patterns (World Health Organization Regional Office for Europe, 2017; Hobin et al., 2022; Robinson et al., 2021). There are indications that nutrition-related information on alcohol could result in a 'health halo' that positively sways consumer perceptions related to the 'healthiness' of alcohol and reduce perceived risks associated with consumption (Cao et al., 2022; Keric et al., 2022; Atkinson et al., 2024; Hobin et al., 2024). This study aimed to determine if the presence of nutritional information on an alcohol container influenced consumer perceptions of product healthiness, and to test if the impact of the information differed by display format.

2. Methods

2.1. Study sample

Data are from a between-group experiment embedded in the Canadian arm of the 2024 International Food Policy Study, an annual repeat cross-sectional survey (Hammond et al., 2022). Data were collected via self-completed web-based surveys conducted in November–December 2024 with adults aged 18 to 100 years. Respondents were recruited through Nielsen Consumer Insights Global Panel and their partners' panels. Email and panelist dashboard application invitations with unique survey access links were shared with a random sample of panelists after targeting for demographics; panelists known to be ineligible (< 18 years) were not invited. Potential respondents were screened for eligibility and quota requirements based on age and sex. Surveys were conducted in English and French. Respondents provided consent prior to survey completion and received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Board (REB# 30829) and a Université Laval Human Research Ethics Committee (2021–318 Phases I et II A-3 R-3 / 04-12-2024).

A total of 36,271 survey invitations were sent to panelists; the survey participation rate was 14.0 % and the cooperation rate was 75.7 %. See Supplementary Fig. S1 for a participant flow diagram. Of 4318 participants assess for eligibility, 258 participants were excluded for: invalid region (unstated or ineligible due to small cell sizes in the territories); unstated sex at birth (insufficient data for weighting procedures); invalid response to a data quality question or other data quality concerns; below minimum survey completion time based on median survey time, leaving 4060 participants that completed the survey, passed data quality checks and participated in the experiment. Participants with missing data or who reported "Refuse to answer" for the primary outcome measure were removed, leaving an analytic sample of 3880 participants. Participants who responded "Don't know" for the primary outcome were retained in the sample, as "Don't know" was considered a valid response. Missingness analyses found that those who were removed did not differ by experimental condition (data not shown).

The study sample size enabled respondents to be assigned to four experimental conditions with approximately 1000 participants per condition, and provided 80 % power to detect a 6-percentage point difference in the binary primary outcome, assuming 30 % of participants in the control condition rate it that way. The study had 97 % power to detect a difference of 0.25 on the rating scale (SD 1.5, $p < 0.05$).

2.2. Experimental design

Participants were randomly allocated (simple randomization) to one of four labelling conditions featured on a fictitious brand of white wine, shown in Fig. 1. Participants were shown side-by-side images of the front of the bottle of wine and an enlarged image of the back label. The front of the bottle was identical in all conditions and did not display nutrition-related information. The labels on the back of the bottle were manipulated to display different nutrition labelling formats. White wine was selected as the experimental stimuli because wine is the second-most commonly consumed alcoholic beverage in Canada (Statistics Canada, 2025) and does not have conferred health benefits sometimes associated with red wine consumption (e.g. tannins) (Seidenberg et al., 2023).

Condition 1 (control) did not display any nutrition-related information on the back label. Condition 2 displayed the current Canadian NFT on the back label, including information for calories per serving plus 13 nutrients. Condition 3 displayed a textual description of the caloric and sugars content of the beverage in large black font with no border. Condition 4 displayed an Alcohol Facts table. In all conditions, the front label also displayed a statement of alcohol content (%ABV), container volume and country of origin information in small font; the name and address of the bottler and importer, the product type (white wine) and a statement on recycling was also shown on the back label in small font. Labels were shown in English or French, Canada's two official languages, according to the participants' preferred language for survey completion.

2.3. Survey measures

Full survey measures and response options are shown in Supplementary Table S1. Participants were shown the image on screen and were asked: "Here is an image of a bottle of wine. Please look at it closely. How healthy or unhealthy would it be to drink this wine regularly?" with response options on a seven-point Likert-type item (Very unhealthy; Unhealthy; A little unhealthy; Neither unhealthy nor healthy; A little healthy; Healthy; Very healthy) (bolding as shown to participants), "Don't know" or "Refuse to answer".

Participants reported current age (continuous) and sex at birth. Perceived income adequacy was assessed by asking, "Thinking about your total monthly income, how difficult or easy is it for you to make ends meet?", with response ranging from "Very difficult" to "Very easy". Education was assessed by asking, "What is the highest level of formal education that you have completed?", recategorized as low (high school diploma or less), medium (technical diploma or some post-secondary qualifications), and high (university degree or higher). Race/ethnicity was assessed using a previously employed measure (Government of Ontario, 2021) and responses were recategorized into Black, White, East/Southeast Asian, South Asian, Indigenous, Latino, Middle Eastern, or Another ethnicity or race category, Multiple ethnicities, or Don't know/Refuse to answer. Participants were queried about frequency of alcohol use in the last 12 months, recategorized as "None", "Some" and "Weekly".

Fig. 1. Images of experimental conditions with varying levels of nutritional information on a fictitious brand of wine shown to participants in the experimental study conducted as part of the Canadian component of the International Food Policy Study 2024 survey.

2.4. Statistical analyses

Descriptive statistics were used to characterize the study sample and product ratings by condition. Differences in socio-demographic and alcohol-use characteristics between experimental conditions were examined using chi-squared and ANOVA tests. A logistic regression model was constructed to examine the likelihood of any perception of a product as healthy (including "a little healthy," "healthy," or "very healthy") by condition. Those who reported "Don't know" for perceived healthiness ($n = 280$) were excluded from the logistic regression model but were retained in the overall sample. In a secondary analysis, a logistic regression model tested differences in reporting "Don't know" between conditions. Models were adjusted for alcohol use and socio-demographic covariates (age, sex at birth, perceived income adequacy, education, and ethnicity) to account for small differences between experimental conditions that may mask experimental condition effects. Two sensitivity analyses were conducted: 1) a logistic regression compared differences between conditions of more extreme perceptions of healthiness (healthy; very healthy), which may be more likely to influence behaviours; 2) a linear regression compared overall ratings of healthiness between conditions, assigning numerical values to the Likert-type responses for the ratings of healthiness (1 = very unhealthy, 7 = very healthy). The significance threshold was set at $P < 0.05$ for all tests. Analyses were not pre-registered as outcomes examined consumer perceptions and not health outcomes. Analyses were conducted using SAS Studio v.3.81.

3. Results

The sample description can be found in Table 1. Briefly, the sample had a mean age of 48.5 years and was comprised of 49.7 % females, 71.9 % reported White race/ethnicity, 26.7 % were considered to have low educational attainment and 36.3 % reported that it was "very difficult" or "difficult" to make ends meet. Overall, 33.0 % reported never consuming alcohol or consuming no more than a sip in the past 12 months, 36.5 % reported consuming alcohol less than weekly, and 30.6 % consumed alcohol at least weekly. ANOVA and chi-squared tests indicated no significant differences in sample profile between

Table 1
Descriptive characteristics of the sample of adults in the online experimental study, presented overall and by experimental condition and test statistics to assess differences in the randomized sample between experimental conditions, conducted as part of the Canadian component of the International Food Policy Study 2024 survey*.

	Overall (n = 3880)	Condition 1 control (no nutrition info) (n = 954)	Condition 2 Nutrition Facts table (n = 943)	Condition 3 Textual nutrition information (n = 977)	Condition 4 Alcohol Facts table (n = 1006)	P-value
Age (mean)	48.5	48.5	48.6	48.2	48.8	0.88
Female n (%)	1928 (49.7)	479 (50.2)	452 (47.9)	484 (49.5)	513 (51.0)	0.58
Perceived income adequacy						0.59
Very difficult	463 (11.9)	112 (11.7)	103 (10.9)	128 (13.1)	120 (11.9)	
Difficult	946 (24.4)	242 (25.4)	227 (24.1)	242 (24.8)	235 (23.4)	
Neither easy nor difficult	1346 (34.7)	334 (35.0)	339 (36.0)	313 (32.0)	360 (35.8)	
Easy	783 (20.2)	185 (19.4)	184 (19.5)	217 (22.2)	197 (19.6)	
Very easy	342 (8.8)	81 (8.5)	90 (9.5)	77 (7.9)	94 (9.3)	
Education n (%)						0.38
Low	1036 (26.7)	243 (25.5)	264 (28.0)	273 (27.9)	256 (25.4)	
Medium	1578 (40.7)	379 (39.7)	379 (40.2)	386 (39.5)	434 (43.1)	
High	1266 (32.6)	332 (34.8)	300 (31.8)	318 (32.6)	316 (31.4)	
Ethnicity n (%)						0.87
White only	2789 (71.9)	668 (70.0)	680 (72.1)	709 (72.6)	732 (72.8)	
East/Southeast Asian only	287 (7.4)	81 (8.5)	64 (6.8)	61 (6.2)	81 (8.0)	
South Asian only	248 (6.4)	63 (6.6)	63 (6.7)	67 (6.9)	55 (5.5)	
Black only	228 (5.9)	58 (6.1)	55 (5.8)	56 (5.7)	59 (5.9)	
Indigenous inclusive	119 (3.1)	32 (3.4)	33 (3.5)	27 (2.8)	27 (2.7)	
Mixed or other ethnicity	209 (5.4)	52 (5.4)	48 (5.1)	57 (5.8)	52 (5.2)	
Alcohol consumption n (%)						0.25
None	1279 (33.0)	298 (31.2)	307 (32.6)	342 (35.0)	332 (33.0)	
Some, but less than weekly	1415 (36.5)	353 (37.0)	336 (35.6)	369 (37.8)	357 (35.5)	
At least weekly	1186 (30.6)	303 (31.8)	300 (31.8)	266 (27.2)	317 (31.5)	

* F-test conducted for age, chi-squared tests conducted for sex at birth, perceived income adequacy, education, ethnicity, alcohol consumption.

experimental conditions.

The distributions of unadjusted participant ratings of perceived healthiness of the alcohol product by condition are shown in Fig. 2, and results from the primary and sensitivity regression analyses are shown in Table 2. In the logistic regression model (n = 3600), those in the NFT condition had 2.0 times higher odds of responding that the product was

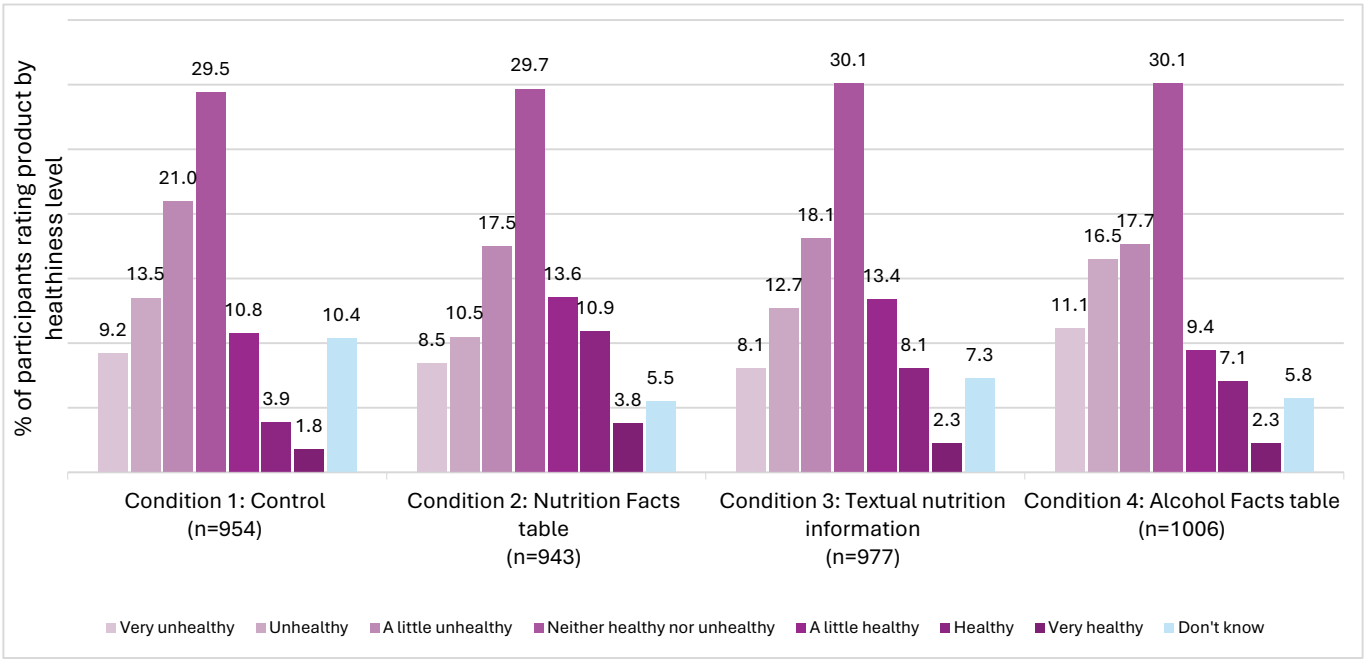

Fig. 2. Distribution of adults' perceptions of the healthiness of a fictitious brand of wine in an online experimental study testing various presentations of nutrition-related information conducted as part of the Canadian component of the International Food Policy Study 2024 survey, by experimental condition (unadjusted percentages, n = 3880).

Table 2
Regression results for primary, secondary and sensitivity analyses on perceptions of product healthiness in an online experimental study testing nutrition-related labelling on an alcohol product conducted as part of the Canadian component of the International Food Policy Study 2024 survey*.

	Primary analysis: Logistic regression (a little healthy/ healthy/very healthy) (n = 3600) AOR (95 % CI)	Secondary analysis: Logistic regression (don't know) (n = 3880) AOR (95 % CI)	Sensitivity analysis 1: Logistic regression (healthy/ very healthy) (n = 3600) AOR (95 % CI)	Sensitivity analysis 2: Linear regression with healthiness rating (n = 3600) B (95 %CI)
Nutrition Facts table vs. control	1.97 (1.57,2.47)	0.48 (0.34,0.69)	2.87 (2.06,4.01)	0.41 (0.27,0.54)
Nutrition Facts table vs. textual nutrition information	1.23 (1.00,1.52)	0.76 (0.52,1.11)	1.48 (1.12,1.97)	0.13 (0.00,0.27)
Nutrition Facts table vs. Alcohol Facts table	1.76 (1.41,2.18)	0.96 (0.65,1.41)	1.73 (1.30,2.29)	0.39 (0.26,0.52)
Textual nutrition information vs. control	1.60 (1.27,2.02)	0.63 (0.46,0.88)	1.94 (1.36,2.75)	0.27 (0.14,0.41)
Textual nutrition information vs. Alcohol Ffacts table	1.43 (1.14,1.78)	1.25 (0.87,1.81)	1.16 (0.86,1.57)	0.26 (0.13,0.39)
Alcohol Facts table vs. control	1.12 (0.88,1.42)	0.50 (0.36, 0.71)	1.67 (1.17,2.37)	0.01 (−0.12,0.14)

* Results from regression analyses adjusted for age, sex at birth, perceived income adequacy, education, ethnicity and alcohol use. AOR = adjusted odds ratio.

"a little healthy/healthy/very healthy" (AOR = 1.97, 95 % CI 1.57,2.47), and those in the textual nutrition information condition had 1.6 times higher odds of reporting that the product was "a little healthy/ healthy/very healthy" (AOR = 1.60, 95 % CI 1.27,2.02) compared to those in the control condition. There was no difference in the odds of reporting that the product was "a little healthy/healthy/very healthy" between the Alcohol Facts table condition and the control condition. Those in the NFT condition and those in the textual nutrition information condition had higher odds of responding that the product was "a little healthy/healthy/very healthy" compared to those seeing the Alcohol Facts table condition (AOR = 1.76, 95 %CI 1.41,2.18 and AOR = 1.43, 95 %CI 1.14,1.78, respectively). In sensitivity analyses examining more extreme perceptions of healthiness (i.e., "healthy/very healthy" only), the pattern of results was similar, and results also suggested that those who saw the Alcohol Facts table condition had 1.7 times higher odds of reporting that the product was "healthy/very healthy" compared to the control condition (AOR = 1.67, 95 %CI 1.17,2.37), and no differences between the textual nutrition information condition and the Alcohol Facts table condition. Sensitivity analyses using an alternative linear regression model revealed very similar conclusions to the original analysis.

Overall, 280 participants reported "Don't know" when asked to rate the healthiness of the alcohol product (Fig. 2). Compared to the control condition, participants had lower odds of reporting "Don't know" in the NFT condition (AOR = 0.48, 95 %CI 0.34,0.69), the textual nutrition information condition (AOR = 0.63, 95 %CI 0.46,0.88), and the Alcohol Facts table condition (AOR =0.50, 95 %CI 0.36,0.71).

4. Discussion

When consumers were exposed to nutritional information on alcohol product labels, they were more likely to perceive the product as 'healthy' to consume on a regular basis. From a public health perspective, this is concerning, considering all alcohol products are inherently unhealthy substances with an elevated risk for seven cancer types starting at low volume use (Rehm et al., 2021; Ortolá et al., 2024; Anderson et al., 2023). In addition, participants were more likely to report that they didn't know the healthiness of a product when there was an absence of nutritional information. This may indicate that consumers feel more informed about the healthiness of alcohol products when nutritional information is presented.

Taken together, the results align with increasing empirical research that nutritional information influences consumer perceptions of alcohol products. A recent online experiment including a condition showing the Canadian NFT found that consumers had a higher mean rating of perceived healthiness of an alcoholic seltzer beverage when the NFT was present compared to the control condition, independent of nutrition claims (Hobin et al., 2024). In Australia, an online experimental study similarly concluded that presenting nutritional information may increase the perceived healthiness of alcoholic beverage products across multiple categories, and the presence of a nutrition information panel caused participants to rate the alcoholic beverages as healthier, less harmful to health, and lower in energy, compared those without the nutrition information (Food Standards Australia and New Zealand, 2024). The Australian study did not find any effect of the nutrition information panel on behavioural outcomes. Previous qualitative research among women has also identified the potential for unintended health halos for alcohol products when nutrition information is presented (Atkinson et al., 2024).

Differences in perceptions of healthiness between experimental condition are likely a result of both the types of nutrition information provided (e.g., calories and nutrients), but more importantly, the overall visual style and presentation of the information, which appears to have the greatest impact. The US proposal for mandatory nutrition information statement on alcohol labels would require the title "Alcohol Facts"; serving size; servings per container; alcohol content as a percentage of alcohol by volume; fluid ounces of pure ethyl alcohol per serving; calories per serving; and grams of carbohydrates, fat, and protein and optional information on sugars, per serving. The Alcohol Facts table condition in the current study was developed prior to the release of the proposed US label, and provided information on calories, carbohydrates and sugars and an alcohol content statement (percentage of alcohol by volume (%ABV). While the Alcohol Facts table condition in this study was similar in format to Canada's NFT, the heading did not include the word 'Nutrition'. Most alcohol products do not contain 'nutrients of concern' found in typical nutrient declarations, such as sodium, saturated fat, or cholesterol. Low or zero levels of these nutrients on nutrition labels may mislead consumers to erroneously believe that these are 'healthier products', as indicated in prior qualitative research (Pettigrew et al., 2025). The current results may indicate that minimizing the number of nutrients displayed in nutrient declarations, and providing clear indications of 'Alcohol Facts' compared to 'Nutrition Facts' may result in fewer erroneous perceptions of healthiness compared to nutrition-oriented labelling, although future research is needed to disentangle the most important labelling components in alcohol nutrition label design.

4.1. Limitations and strengths

Limitations include that the study only tested white wine, and the generalizability to other alcohol types is unclear, as different alcoholic beverages present different nutritional profiles (e.g., calories, sugar) and thus the impact of their nutritional information on perceptions of healthiness may differ. Participants only had a one-time exposure to the

label in a simulated online setting. This study only assessed one element of relative healthiness perceptions (perceived health impact of regular consumption) and did not measure other characteristics known to influence purchasing and consumption (appeal, desire to try and buy), nor did the study test behavioural outcomes related to alcohol purchasing and use. The experiment did not test other labelling elements that could influence perceptions, including ingredients lists or health warning labels. This study is among the first to test the impact of nutritional information on modern alcohol containers, testing policy-relevant formats, including how nutrition information is presented when voluntarily provided on an alcohol product in Canada, and formats similar to what is being considered in the US. The study used a relatively large sample size and a fictitious wine brand to reduce preconceived perceptions of products or brands available on the market.

5. Conclusions

This study found that providing nutrition information for alcohol products in formats similar (or identical) to food or nonalcohol products led to perceptions of alcohol products as healthier. The findings demonstrating the influence of nutrition information on perceptions of the healthiness of alcohol products have implications for other nutrition-related labelling on alcohol products. For example, permission to display nutrient content claims on alcohol products typically requires nutrient declarations on alcohol products (Government of Canada, 2025), which is likely to amplify the impact of health-related marketing strategies being used on labels and further normalize alcohol products as safe to consume (Cao et al., 2022; Hobin et al., 2024; Haynes et al., 2024).

While the examination of the impact of nutrition labelling on alcohol perceptions is more nascent, there is an established body of literature on the effectiveness of health warning labels on alcohol to support reductions in alcohol use and alcohol sales (Zuckermann et al., 2024; Joyce et al., 2024). If alcohol policy aims to increase risk perceptions of alcohol products, health warning labels are likely to play a more important role compared to nutrition labelling. Previous research has indicated that nutrition labelling may interact with warning labels on alcohol and diminish their effect; the interaction between labelling components deserves further attention (Hobin et al., 2024).

This study provides preliminary evidence that the presence of nutrient declarations commonly required on food products on alcohol may result in consumers perceiving alcoholic beverage products as healthy. Health halos associated with the provision of nutritional information may be somewhat reduced by using alternative nutrition labelling formats that limit information that could be misinterpreted to convey an inherent health or nutritional benefit of the product. In particular, alternative nutrition labelling may seek to ensure that alcohol products do not appear more similar to food and non-alcoholic beverages.

Disclosure of funding and conflicts of interest

DH has provided paid expert testimony on behalf of public health authorities in response to legal challenges from the food and beverage industry. Funding for the International Food Policy Study was provided by a Canadian Institutes of Health Research (CIHR) Project Grant (PJT-162167). LV is supported by funds from the Canada Research Chairs program.

Statement of potential conflicts of interest

DH has provided paid expert testimony on behalf of public health authorities in response to legal challenges from the food and beverage industry.

CRediT authorship contribution statement

Lana Vanderlee: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Christine M. White:** Writing – review & editing, Project administration, Investigation, Data curation. **David Hammond:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Data curation. **Erin Hobin:** Writing – review & editing, Methodology, Conceptualization.

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Declaration of competing interest

David Hammond reports financial support was provided by Canadian Institutes of Health Research. Lana Vanderlee reports financial support was provided by Canada Research Chairs program. David Hammond reports a relationship with public health authorities that includes: Paid expert testimony. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2025.108475.

Data availability

Data will be made available on request.

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