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Beyond Labels: Exploring Consumer Preferences for Plant-Based Meat Labeling Policies

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ABSTRACT

Whether meat-related terms should be permitted on the labels of plant-based meat alternatives is hotly debated. Utilizing survey data featuring a discrete choice experiment, we examine consumer responses to plant-based meat alternatives under three labeling scenarios: no restrictions; a ban on meat-related terms; and a requirement for a qualifying statement. We find stronger preferences for plant-based meat alternatives in an unregulated labeling environment versus a ban on meat-related terms or when label qualifiers are present. Label qualifiers perform similarly to a ban. A latent class model identifies consumer segments with heterogeneous responses to the labeling policy environment.

1 | Introduction

Advances in food processing technology, coupled with consumer concerns about the health, ethical, and environmental attributes of food products, have fueled growth in the market for plant-based meat alternatives. While plant-based meat substitutes (e.g., traditional veggie burgers) are by no means new, the recent generation of products utilizes plant protein isolates such as pea and soy, along with ingredients such as beet juice or yeast-extract heme proteins to mimic the taste, texture, and look of meat.

Alarmed by the apparent growing popularity of plant-based meat alternatives, meat industry advocates have lobbied for regulations to restrict the use of meat-related terms on the labels of plant-based meat alternatives, claiming that these terms mislead and confuse consumers (Pitkoff 2021; Demartini et al. 2022; Demuth et al. 2023; Lähteenmäki-Uutela et al. 2021). Policies for the labeling of plant-based meats remain in a state of flux. In the United States, labeling regulations represent a patchwork of different approaches across different states, while the European Union has not yet developed a clear set of regulatory guidelines, leading some member states to develop national-level approaches (Demartini et al. 2022). In contrast, Canada has enacted regulations at the federal level governing the labeling and nutritional composition of plant-based meat alternatives (see the next section for details). The Canadian regulatory approach provides a useful point of comparison between an outright ban on the use of meat-related terms and unregulated labeling.

We examine the regulatory labeling environment for the use of meat-related terms (e.g., ground) on plant-based meat alternatives. Specifically, we investigate consumer responses to these products under scenarios where: (a) firms face no restrictions on the use of meat-related terms (unregulated scenario); (b) the use of meat-related terms is permitted but with qualifiers (qualifier

scenario); (c) the use of meat-related terms is prohibited (ban scenario).

We also explore the drivers of consumer preferences for plant-based meat alternatives, including how consumers respond to environmental versus health (nutrition) framing on product labels. Canadian regulations require plant-based meat alternatives and simulated meat products to contain a protein efficiency rating of at least 40. As such, most of these products would qualify for a protein content or quality claim. We compare consumer reactions to two regulated protein claims commonly used in Canada: protein content ("Excellent Source of Protein") and protein quality ("Complete Source of Protein") claims. Similar claims exist in the United States and European Union, though different standards are used to determine whether these claims can be displayed on labels.

To answer these questions, we design a consumer survey with a discrete choice experiment (DCE) featuring information treatments pertaining to three regulatory scenarios (unregulated, qualifier, ban). Within the information treatments, respondents choose from "ground meat" products containing pea, soy, or beef, with a protein (health) and a carbon footprint (environmental) label claim. The survey is administered to an online sample of Canadian consumers. Using a choice modeling framework, while consumers generally prefer beef over plant-based options, we find stronger preferences for the pea and soy options in an unregulated labeling environment versus a scenario in which meat-related terms are banned or a scenario in which meat-related terms are permitted but with qualifiers (as is the case in Canada). The use of qualifiers performs similarly to a ban. Health (protein) claims tend to influence choices more than an environmental claim (carbon footprint), while a "Complete Source of Protein" (quality) claim is more effective than an "Excellent Source of Protein" (content) claim. Accounting for heterogeneity in consumer preferences with a latent class model reveals a more nuanced picture. We identify consumer segments with distinct preferences for plant-based versus beef products, for health versus environmental claims, and for whom the use of meat-related terms has differing effects.

We contribute to the literature in two ways: our main contribution lies in the use of information treatments to simulate three approaches for regulating the use of meat-related terms on alternative protein products. Our work differs from recent contributions, such as Demuth et al. (2023) and Asioli et al. (2022), by explicitly incorporating regulatory scenarios in which meat-related terms are allowed but with qualifiers (as currently in use in Canada and some US states), or an outright ban on all meat-related terms (as in use or proposed in some US states). Given the recent review of plant-based meat labeling regulations in Canada and the European Union, along with ongoing regulatory debates in other countries such as the United States, our research offers a timely addition to policy discussions.

Our second contribution adds to the literature on the drivers of consumer preferences for plant-based meat alternatives, identifying consumer segments with distinct preferences. Prior research has examined a variety of issues, including perceptions of plant-based versus lab grown meat (Slade 2018; Van Loo et al. 2020), the effect of ingredient lists for plant-based burgers (Holt et al. 2024), the effect of health and environmental information nudges on online purchase of meat alternatives (Segovia et al. 2023), and the effect of gain versus loss message framing on preferences for artificial meat products (Zhang et al. 2022). We provide a more nuanced understanding of consumer preferences by explicitly exploring heterogeneity and unpacking the effect of different types of labeling claims on the demand for plant-based meat alternatives.

The remainder of the paper is organized as follows. The next section synthesizes related literature on consumer preferences for plant-based proteins and provides a brief overview of labeling policies. We then provide details of the survey design, discrete choice experiment with regulatory labeling treatments, and survey sample characteristics. We outline our empirical specifications in Section 4. We then present results from multinomial logit and latent class models. We conclude with a discussion of policy and market implications.

2 | Plant-Based Meat Alternatives: Consumer Preferences, Information, and Labeling Policies

Plant-based meat alternatives represent a small, but growing category of food products, generating both interest among consumers and consternation among some meat industry stakeholders. Our survey and experimental design leverage insights from the literature regarding the salient motivations for consuming plant-based meat alternatives. Meat-reducing diets are growing in popularity, and plant-based meat alternatives are often positioned as a pathway to facilitate dietary change (Bazoche et al. 2023). Prior research has linked consumer interest in plant-based meat alternatives to health and ethical (e.g., environmental, animal welfare) motivations (Slade 2018; Van Loo et al. 2020; Ortega et al. 2022; Asioli et al. 2023).

Information plays a pivotal role in shaping consumer preferences, particularly when labeling information aligns with a consumer's social identity. Previous studies find health information (e.g., protein labels) to be more effective than ethical motivations in nudging consumers toward plant-based meat alternatives (Segovia et al. 2023). Provision of environmental information can also shift preferences toward plant-based options (Edenbrandt and Lagerkvist 2021), though Van Loo et al. (2020) find relatively small effects. Asioli et al. (2023) suggest the effects of information provision differ across geographic regions and contexts, with health, convenience, carbon footprint, and sensory information having disparate effects on preferences in the UK, Spain, and Denmark. Studies confirm that most consumers prefer meat-only over plant-based burgers, with hybrid (beef/plant protein) products occupying a middle ground (Asioli et al. 2023; Slade 2018; Tonsor et al. 2023; Holt et al. 2024).

From a policy perspective, regulations around the labeling of plant-based meat alternatives are intended to mitigate information asymmetry. Whether the use of meat-related terms on the labels of plant-based meat alternatives benefits (informs) or misleads consumers is hotly contested. Meat industry advocates, including the United States Cattlemen's Association and the National Cattlemen's Beef Association, have petitioned strongly for restrictions on the use of meat-related terms (Demuth

et al. 2023; Zhao et al. 2023). In contrast, critics argue that restricting the use of meat-related terms contravenes rights with respect to free speech and challenge the assertion that consumers are confused by these labels (Gleckel 2021).

Reflecting this division, a marked inconsistency in labeling environments exists across national and state-level jurisdictions. Several US states enacted legislation banning the use of terms such as "meat" and "beef" on plant-based meat alternatives on the premise that this terminology misleads consumers. At least 13 states have passed legislation regulating plant-based food labeling, with several others proposing legislation (Pitkoff 2021; Zhao et al. 2023). While some US states (Arkansas, Missouri) legislated to prohibit the use of meat-related terms, others (e.g., Montana, Oklahoma, Georgia) allow qualified labeling with a statement indicating the food is plant-based. In some cases (e.g., Arkansas), restrictive state-level labeling laws were subsequently struck down through legal challenges. With an emerging patchwork of state-level legislation, the U.S. Food and Drug Administration (FDA) considered federal-level legislation to clarify the definition of "meat" and the use of meat-related terms on plant-based products (Demuth et al. 2023). In January 2025, the FDA issued draft guidance for industry regarding the labeling of plant-based alternatives to animal-derived foods, with recommendations on best practices for naming and labeling plant-based foods (FDA 2025).

Similar debates have emerged in the European Union. Although European legislation restricts use of the word "meat" and species-specific names (beef, pig meat, chicken) only to products of animal origin, the use of other meat-related terms (burgers, sausages, etc.) is not restricted (Lähteenmäki-Uutela et al. 2021). The regulatory situation in the European Union has been characterized as a legal void (Demartini et al. 2022). In the absence of clear EU-level legislation, individual member states have enacted labeling laws, with France banning the use of "meaty" names on plant-based foods in 2021 (Lähteenmäki-Uutela et al. 2021).

In Canada, the federal government regulates the labeling and composition of plant-based meat alternatives, which are defined by the Canadian Food Inspection Agency (CFIA) as products that do not contain any meat or poultry products but seek to imitate the appearance of meat or poultry products (CFIA 2023a). Appearance includes sensory characteristics, such as visual appearance, texture, flavor, odor, and/or whether the food is advertised and represented as comparable to a meat product (CFIA 2023a). The plant-based meat alternative must be identified by a common name that includes the word "simulated" (e.g., simulated beef, simulated steak) and include the disclaimer "contains no meat." If these qualifiers are included on product labels, meat-related terms such as "burger" or "ground beef" can be used on plant-based meat alternatives.

Canadian composition rules require that plant-based meat alternatives adhere to minimum protein standards. A plant-based product imitating beef requires a protein rating of at least 40 and must not exceed maximum requirements for fat content (CFIA 2023b). The regulated minimum protein content level (protein rating ≥ 40) qualifies all plant-based meat alternatives for "an excellent source of protein" front-of-package label (CFIA 2023c) (a protein content claim). If the product contains all essential amino acids while qualifying for a "source of protein" (a protein rating of ≥ 20), it qualifies for "a complete source of protein" label (a protein quality claim). The standards for both protein claims are regulated by CFIA. Industry stakeholders expressed interest in determining which type of protein claim (excellent vs. complete source of protein) resonated most with Canadian consumers in the context of plant-based meat alternatives.

The CFIA undertook a public consultation on proposed guidelines for the labeling of simulated meat and poultry in late 2020, clarifying the definition of simulated meat and poultry products (2023a) but making no changes to the requirements for label qualifiers (simulated, contains no meat) and product composition. Meat industry stakeholders such as the Canadian Cattlemen's Association, the Canadian Meat Council, and the Quebec Cattle Producers Federation argued that meat-related terms on plant-based alternatives are misleading to consumers, advocating unsuccessfully for a ban on their use in Canada.

The Canadian regulatory approach—allowing the use of meat-related terms but with qualifiers and establishing nutritional composition standards for plant-based foods—stands in contrast to the regulatory quagmire that exists in the United States and elsewhere (Muso-Veloso and Juana 2021). We provide a timely assessment of consumer responses to the labeling of plant-based proteins under different regulatory scenarios.

3 | Survey Design and Sample Characteristics

3.1 | Discrete Choice Experiment

Data were collected through an online survey featuring a discrete choice experiment administered to 1203 English-speaking Canadians between February and March 2022.[1] Participants were recruited from an online consumer panel. A screener question excluded respondents who did not have primary or shared responsibility for grocery shopping. The survey instrument is available in Appendix S1.

Respondents completed a discrete choice experiment in which they chose between three ground meat products and a no purchase option. Respondents were encouraged to make choices as if they were in a real grocery store, emphasizing the importance of honest responses. Our choice sets feature product images to further enhance the realism of the choice task. Each ground meat product featured four attributes (see Table 1 for a full list of attributes and attribute levels). The products were either beef, pea, or soy-based, allowing us to evaluate preferences for pea or soy plant proteins relative to beef. As discussed in the previous section, health and environmental concerns are important motivations for choosing plant-based proteins, and are prominently featured in the marketing strategies of firms within this sector. Attributes representing two front-of-package labeling claims (protein and environmental impact) were included in the experimental design. The protein claim attribute allows us to evaluate how consumers respond to a protein content claim (excellent source of protein) versus a protein quality claim (complete source of protein), as well as its relative importance over other attributes.[2] Survey respondents were provided

with the official definitions of "Excellent" and "Complete" source of protein prior to completing the DCE (see Appendix S1).

Our third attribute—an environmental claim, was framed as a "Certified Carbon Neutral" claim. Survey participants were informed that a product with a Certified Carbon Neutral label claim "means that a product's carbon emissions are offset by carbon sequestration and green energy use." Our experimental design therefore allows us to compare the relative value to consumers of health versus environmental claims on plant-based meat alternatives. Finally, our DCE design includes six price levels, which encompass low-to-high end prices for ground beef and plant-based alternatives in Canada.

Survey respondents were randomly assigned to three labeling treatments, corresponding to a scenario where labeling was not regulated ("unregulated"), meat related terms are allowed but with a required qualifier, consistent with current Canadian regulations ("qualifier"), and a meat-related terms ban scenario ("ban"). In the unregulated scenario, both pea and soy products were labeled as "Ground Beef," with "Made with pea/soy protein" included in small print on the product label. Our rationale for this design is informed by legal debates over the "truth in labeling" laws enacted in several US states (e.g., Arkansas), which govern the permissibility of marketing strategies and product labels in the plant-based protein sector. Initially, truth in labeling laws would have banned any meat-related terms on plant-based meat alternative labels, even if clearly modified by words like "vegan" or "plant-based" (Pitz 2020). Meanwhile, in Oklahoma, the Plant Based Food Association enacted legal action against the State's law which would require plant-based disclaimers of equal size to the product's name on labels of plant-based meat alternatives (Watson 2021).

The unregulated labeling treatment serves as an opportunity to understand how consumers respond to labels counterfactual to these legal outcomes. Therefore, information regarding the pea- or soy-based nature of the product is included in small print toward the bottom of the label, while environmental and nutrition claims are presented prominently. We conjecture that even in an unregulated environment, firms will not intentionally deceive consumers (indeed, some consumers will actively seek out plant-based proteins). Thus, while the disclaimers are less prominent, they are not removed entirely. These labels could be realistically considered a "worst-case scenario" from the perspective of meat industry advocates. They form a baseline for the most lenient of policy environments as a basis of comparison with stricter regulation. Figure 1 shows an example of a choice set in the unregulated label policy treatment. Note, that the four product attributes (beef/pea/soy, protein claim, environmental claim, price) varied across the choice sets.

Product labels in the qualifier treatment reflect current Canadian regulations, requiring disclaimers (qualifying statements) stating that the product is a simulated meat product and contains no meat. Furthermore, the "made with pea/soy protein" information is more obvious, positioned toward the top of the label. The design of product labels in this treatment is informed by labels found in Canadian grocery stores. Figure 2 illustrates a choice set in the qualifier regulatory treatment.

The third information treatment represents a scenario in which the use of meat-related terms (such as "ground") is banned and

TABLE 1 | Choice experiment attributes and levels.

Attribute	Levels
Product source	Beef, pea-based, soy-based
Protein claim	None, an excellent source of protein, a complete source of protein
Environmental claim	None, certified carbon neutral
Price (CAD$/500 g)	$5.00, $6.50, $8.00, $9.50, $11.00, $12.50

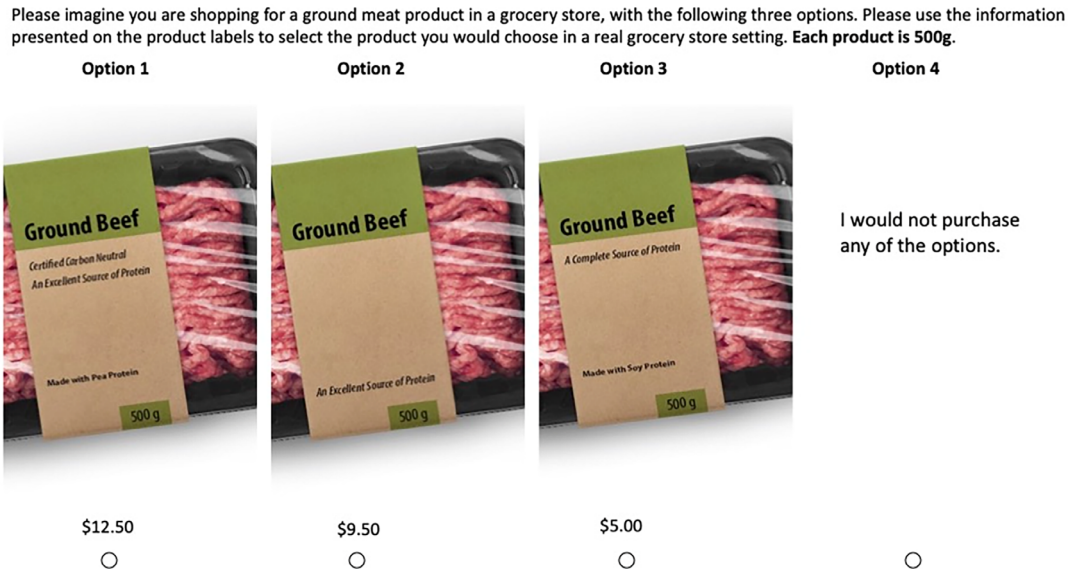

FIGURE 1 | Example of a choice set in the unregulated labeling treatment.

reflects the situation in some US states, as discussed in the previous section. We opted for the term "crumble" in place of "ground" for the pea and soy products, based on an existing Beyond Meat ground beef alternative product that uses this terminology, since any wording alluding to traditional meat products is not permitted in this scenario. In a meat-related terms ban scenario, the available descriptors for these products are (by design) quite limited. Any negative connotations associated with this product name would therefore be consistent with the objectives of our study in determining how labeling policies affect consumer demand. Figure 3 illustrates a choice set from the meat-related terms ban treatment.

A Bayesian D-efficient experimental design results in 36 choice sets, which were randomly allocated to six choice blocks, yielding six choice tasks in each block. Each choice set was specified to include one beef, one pea, and one soy product, along with a no-purchase option to mimic the typical selection available in Canadian grocery stores.[3] After being randomly assigned to one of the three labeling policy treatments, each survey respondent was then randomly assigned to one of six choice blocks. The ordering of the products (beef/pea/soy) from left to right was randomized to mitigate ordering bias in the choice experiment (except for the no purchase alternative on the right-hand side).

3.2 | Data and Sample Characteristics

The target population was English-speaking Canadians with primary or shared responsibility for grocery shopping. Age and province of residence quotas reflective of the census population were implemented during recruitment. The sociodemographic characteristics of the sample are reasonably representative of

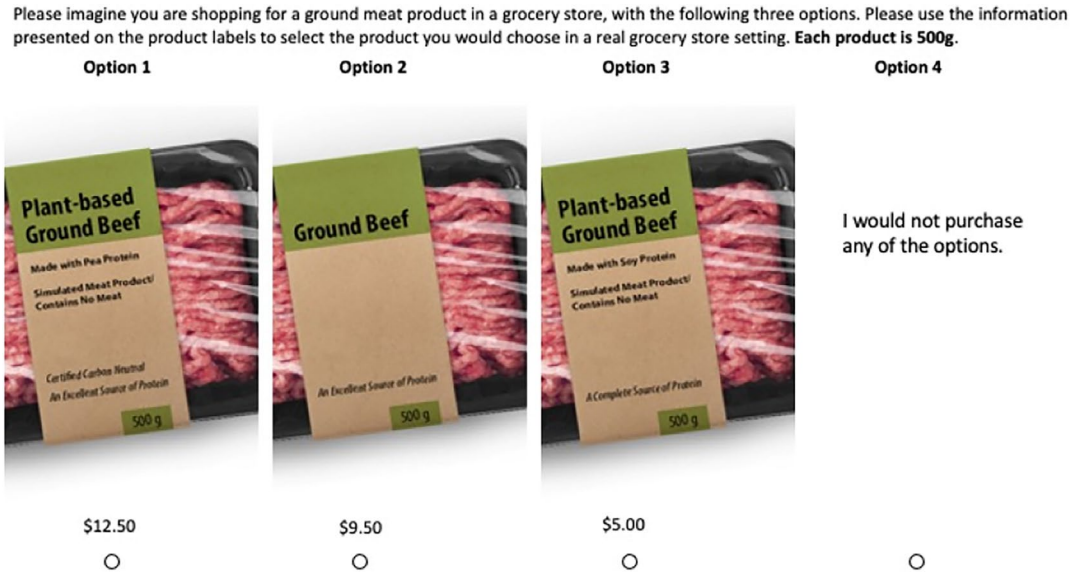

FIGURE 2 | Example of a choice set in the qualifier labeling treatment.

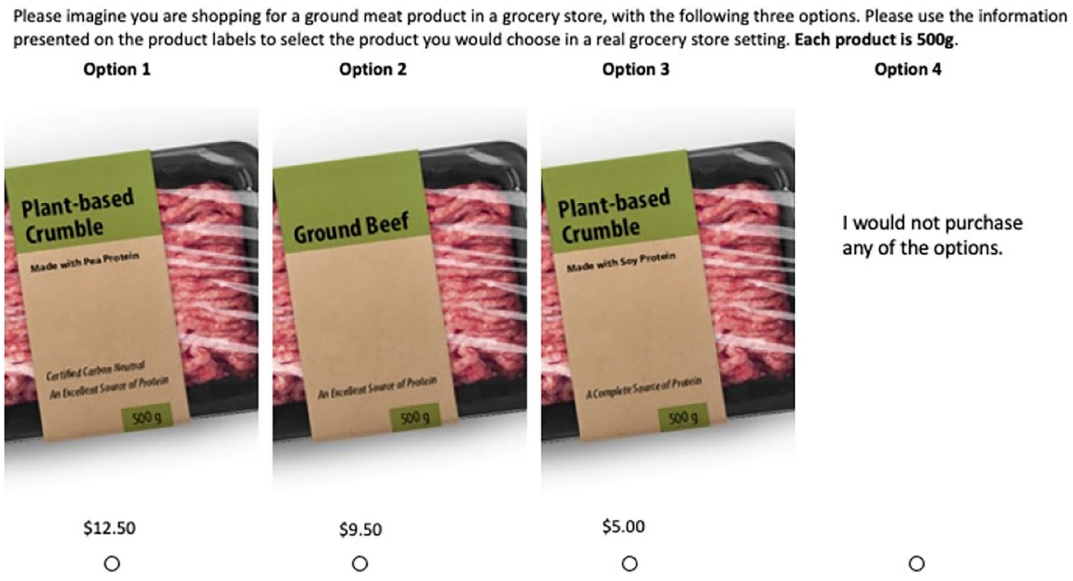

FIGURE 3 | Example of a choice set in the meat-related terms ban labeling treatment.

the Canadian population and can be found in Appendix A of Appendix S2.

Additional data on dietary preferences, experiences, and attitudes provide key variables for our subsequent empirical analysis, as follows. Our sample is dominated by individuals who identify as omnivore (73%), followed by flexitarian[4] (19%), vegetarian (3.5%), pescatarian (2%), and vegan (2%). The rate of meat avoidance (combined 7.5%) aligns with the literature at around 5%–10% both in Canada (Slade 2018) and other countries (Malek et al. 2019). Instances of consumers mistaking a plant-based meat alternative for a real meat product when grocery shopping in real life were relatively rare, with only 10.5% of respondents indicating this had happened to them. We utilize meat avoidance, flexitarianism, and self-reported consumer confusion as dummy variables in the empirical analysis.

Prior to completing the choice experiment, we elicited respondents' food values using an adaptation of the food values from Lusk and Briggeman (2009), where respondents rate the importance of a series of attributes when purchasing food. Appendix B of Appendix S2 reports average food values for the sample. Consistent with previous Canadian studies, food safety, price, taste, and health/nutrition rank in the top four food values on average, with naturalness and environmental sustainability falling toward the middle (Yang and Hobbs 2020). We utilize respondents' food value scores for health, environment, taste, familiarity, and naturalness in the subsequent regression analysis. Finally, we evaluate respondents' degree of food neophobia using a scale adapted from Pliner and Hobden (1992). On average, the sample is slightly neophobic (2.6 out of 5).

4 | Empirical Modeling

We model consumer choices using a standard random utility model (McFadden 1974; Train 2002). Consumer n chooses among J alternatives to maximize their utility U_{nj}. Random utility theory dictates that the drivers of utility U_{nj} can be separated into observable and stochastic components, specified as follows.

$$U_{nj} = V_{nj} + \varepsilon_{nj} \tag{1}$$

V_{nj} is defined as a function of observable determinants of utility, and ε_{nj} is the unobserved, stochastic elements of utility (Train 2002). We estimate the following random utility function specification.

$$U_{njt} = \alpha_{njt} + \beta_{nt} X_{njt} + \varepsilon_{njt} \tag{2}$$

U_{njt} is the utility consumer n, assigned to labeling policy treatment t, derives from choosing alternative j, a ground beef, pea-based, or soy-based alternative product. The alternative specific constant (ASC) α_{njt} captures the utility associated with the alternative (beef, pea, soy, or no purchase) corresponding to product j. X_{njt} is a vector of product attributes (protein label claims, carbon neutral label claim, and price), while β_{nt} is a parameter vector of the utility obtained by consumers from each component of X_{nt}. Finally, ε_{njt} represents the stochastic component of consumer n's utility for alternative j.

Since each choice set contains one alternative for each protein source, alongside the "no purchase" option, the utility function specified in Equation (2) can be decomposed into separate utility functions for each alternative in the choice experiment, where consumer n's utility is a function of the alternative they select, and zero otherwise.

$$U_{\text{beef},njt} = \alpha_{\text{beef},nt} + \beta_{nt} X_{njt} + \varepsilon_{\text{beef},njt} \tag{3a}$$

$$U_{\text{pea},njt} = \alpha_{\text{pea},nt} + \beta_{nt} X_{njt} + \varepsilon_{\text{pea},njt} \tag{3b}$$

$$U_{\text{soy},njt} = \alpha_{\text{soy},nt} + \beta_{nt} X_{njt} + \varepsilon_{\text{soy},njt} \tag{3c}$$

$$U_{\text{no purchase}} = \alpha_{\text{no purchase}} \tag{3d}$$

In typical discrete choice models, the "no purchase" utility function is normalized to zero. This is done to satisfy the fact that ASCs can only be estimated for $J-1$ alternatives (Hensher et al. 2015), which allows the utility estimates to be interpreted relative to the case where a product is not selected. We opt to specify the ASC α_{njt} such that pea and soy utility estimates are interpreted relative to the utility associated with selecting a beef product for more straightforward and relevant results. Therefore, we normalize the utility function for the beef alternative to zero, such that the utility estimates for pea and soy products (and the no purchase ASC) are interpreted relative to beef. However, this parameterization implies that preferences are not comparable between selecting a product and the "no purchase" option. To alleviate this issue, we include a parameter inverse to the "no purchase" utility parameter in the utility functions of the pea and soy products and normalize the no purchase utility function to zero, thus accounting for preferences broadly associated with purchasing a product while maintaining comparability between beef and plant-based alternatives. The purchase parameter represents the average utility for purchasing a product not captured by the other model parameters (Hensher et al. 2015), in this case including the utility associated with choosing beef, alongside any other motivations. Therefore, the utility functions representing each alternative in the choice experiment can be specified as follows.

$$U_{\text{beef},njt} = \alpha_{\text{purchase},nt} \tag{4a}$$

$$U_{\text{pea},njt} = \alpha_{\text{purchase},nt} + \alpha_{\text{pea},nt} + \beta_{nt} X_{njt} + \varepsilon_{\text{pea},njt} \tag{4b}$$

$$U_{\text{soy},njt} = \alpha_{\text{purchase},nt} + \alpha_{\text{soy},nt} + \beta_{nt} X_{njt} + \varepsilon_{\text{soy},njt} \tag{4c}$$

$$U_{\text{no purchase}} = 0 \tag{4d}$$

Finally, each alternative specific parameter is interacted with label policy treatment t, where the unregulated treatment is left out of the dummy chain. Therefore, pea and soy parameters are

interpreted relative to beef in the unregulated labeling treatment; preferences for pea and soy alternatives in the qualifier and ban treatments are interpreted relative to pea and soy alternatives in the unregulated labeling treatment, and purchase parameters are interpreted relative to "no purchase" in the same labeling treatment. This specification of utility functions allows for relevant parameter interpretations, explaining how consumer preferences vary across products and label policy treatments.

Our base model is a multinomial logit model (MNL). The MNL is derived when the distribution of the stochastic error term ε_{nj} is assumed to be independently identically distributed (IID) extreme value (Train 2002). The multinomial logit model is advantageous in being relatively simple to estimate, providing broad, average utility parameters across a sample of consumers and facilitating the calculation of WTP estimates. However, the MNL model is limited by its inability to account for preference heterogeneity and violation of independence of irrelevant alternatives (IIA) assumptions in an iterative choice experiment.

To account for these drawbacks, we extend this analysis with a latent class model (LCM), which allows us to incorporate unobserved preference heterogeneity and relax the IIA assumption (Shonkwiler and Shaw 2001; Boxall and Adamowicz 2002).[5] The LCM employs discrete distributions to explain underlying preferences for product alternatives and attributes, determined by a class membership function utilizing consumer characteristics data (Hensher et al. 2015). The LCM therefore estimates the average utility parameters for ground beef and plant-based alternatives within each class or segment of consumers, alongside the relative likelihoods of each class membership parameter influencing membership in a given class or segment. The LCM derivation and a discussion of class membership parameters can be found in Appendix C of Appendix S2. Table 2 identifies and describes the variables used in our empirical modeling.

5 | Empirical Results

5.1 | Multinomial Logit Model Results

Table 3 contains estimated parameter values for the multinomial logit model (column 2) and the latent class model (columns 3–7). Coefficients are interpreted as the average marginal utility consumers derive from each attribute. As expected, the coefficient for price is negative and significant. Coefficients for the pea and soy alternatives are interpreted relative to beef in the unregulated label policy treatment. The negative and statistically significant coefficients reflect a preference for beef over plant-based options, consistent with prior literature (Slade 2018; Asioli et al. 2023; Tonsor et al. 2023; Holt et al. 2024). The interaction terms *Pea Qualifier*, *Pea Meat-related Terms Ban*, *Soy Qualifier*, and *Soy Meat-related Terms Ban* account for the effect of labeling policies on preferences for plant-based alternatives relative to the unregulated scenario. These coefficients are interpreted relative to the pea/soy parameters, implying that the interaction terms are interpreted relative to the protein source in the unregulated label scenario. Therefore, negative and significant values for these parameters in the MNL specification (column 2) indicate that plant-based options are preferred under the unregulated policy framework relative to both a meat-related terms ban and the use of qualifiers. In other words, while beef is strongly preferred to plant-based meat alternatives in the unregulated label policy treatment, labels under qualifier and ban policy frameworks reduce preferences for plant-based meat alternatives even further. Our results align with prior expectations. Ground beef is generally preferred to plant-based alternatives, while plant-based options are most preferred when label language is unregulated. The small difference in utility between the qualifier and ban treatments in the MNL results suggests that label disclaimers, such as required under Canadian regulations, are functionally similar to a meat-related terms ban. A Wald test confirms that the qualifier and ban treatments in the MNL model are not statistically different for pea ($p = 0.66$) or soy ($p = 0.99$).

The certified carbon neutral, excellent source of protein, and complete source of protein claims are valued by consumers, as expected. The MNL parameter estimates suggest that our sample prefers a complete source of protein claim (obtaining a full suite of amino acids) to an excellent source of protein claim (high protein content). A Wald test confirms that the coefficients on an excellent and complete source of protein are statistically different ($p = 0.0024$). Consumers exhibit stronger preferences for the health and nutrition claims (complete or excellent source of protein) than they do for the environmental claim (carbon neutral), consistent with Segovia et al. (2023). Carbon neutral is statistically different from an excellent source of protein at 5% significance ($p = 0.03$) in the MNL model. On average, respondents preferred to choose a product rather than select the no-purchase option, as shown by the positive and significant parameter estimates for the purchase parameters.

5.2 | Latent Class Model Results

Columns 3–7 of Table 3 present the LCM, providing deeper insights into the underlying heterogeneity in consumer preferences. Based on standard model fit criteria (Boxall and Adamowicz 2002) we estimate a 5-class model (see Appendix D of Appendix S2 for model fit statistics). Class probabilities indicate the probability of respondents falling into each class. Class membership parameters are interpreted relative to Class 5 (committed meat eaters). Prefer not to say responses (89) for the income variable were filtered out of the sample, leaving a sample size of 1114 respondents for this estimation.

The utility and class membership parameters indicate marked differences across the five classes in consumer responses to the product attributes per se, as well as the effect of labeling on preferences for plant-based meat alternatives. Price remains negative and significant across classes, though with contrasting magnitudes. Protein claims generally elicit positive utility values, typically greater in magnitude than the environmental claim. Beef is strongly preferred by four of the five classes, while the policy effects vary significantly across segments of consumers. We provide a discussion of each class below.

TABLE 2 | Model variables and specifications.

	Variable description
Product attribute, protein source, and label policy treatment interaction (α, X) variables	
Purchase	Alternative specific constant for purchasing a product. Interpreted as the preferences for purchasing a product in the unregulated label policy treatment[a]
Purchase qualifier	Alternative specific constant for purchasing a product in the qualifier label policy treatment[a]
Purchase meat-related terms ban	Alternative specific constant for purchasing a product in the meat-related terms ban label policy treatment[a]
Purchase pooled treatments	Alternative specific constant for purchasing a product, pooled across treatments. Only used in the LCM model[a]
Pea	Interaction dummy = 1 for a pea-based product[b]
Pea qualifier	Interaction dummy = 1 for a pea-based product in the qualifier label policy treatment[c]
Pea meat-related terms ban	Interaction dummy = 1 for a pea-based product in the meat-related terms ban label policy treatment[c]
Soy	Interaction dummy = 1 for a soy-based product[b]
Soy qualifier	Interaction dummy = 1 for a soy-based product in the qualifier label policy treatment[c]
Soy meat-related terms ban	Interaction dummy = 1 for a soy-based product in the meat-related terms ban label policy treatment[c]
An excellent source of protein	Dummy = 1 if the product displays "An Excellent Source of Protein" label claim
A complete source of protein	Dummy = 1 if the product displays "A Complete Source of Protein" label claim
Certified carbon neutral	Dummy = 1 if the product displays a "Certified Carbon Neutral" label claim
Price	6-level continuous variable ranging from \$5.00 per 500 g to \$12.50 per 500 g
Class membership (Z) indicators (LCM)	
Meat avoid	Dummy = 1 if the consumer adheres to a vegan, vegetarian, or pescatarian diet
Flexitarian	Dummy = 1 if the consumer adheres to a flexitarian diet
Conservative	Dummy = 1 if the consumer is politically conservative
Under \$100 k	Dummy = 1 if the consumer earns less than \$100,000 per year before taxes
Millennial	Dummy = 1 if the consumer is between the ages of 18–34
Senior	Dummy = 1 if the consumer is over 65 years old
Neophobic	Dummy = 1 if the consumer's food neophobia score is 3 out of 5 or higher
Eastern Canada	Dummy = 1 if the consumer resides in Ontario, Quebec, or the Maritime provinces
Food values health	1–5 Likert scale regarding the importance of health and nutrition in food purchasing decisions[d]

(Continues)

TABLE 2 | (Continued)

	Variable description
Food values environment	1–5 Likert scale regarding the importance of environmental sustainability in food purchasing decisions[d]
Food values taste	1–5 Likert scale regarding the importance of taste in food purchasing decisions[d]
Food values familiarity	1–5 Likert scale regarding the importance of familiarity in food purchasing decisions[d]
Food values naturalness	1–5 Likert scale regarding the importance of naturalness in food purchasing decisions[d]
Confused	Dummy = 1 if the consumer reported confusing a plant-based meat alternative for real meat while grocery shopping in the past

[a]Interpreted relative to the "no purchase" option in the same label policy treatment.
[b]Interpreted relative to beef in the unregulated label policy scenario.
[c]Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product. Captures the effect of labeling policy relative to the absence of it.
[d]Where 1 is not important at all and 5 is extremely important.

5.2.1 | Class 1: Health-Focused Omnivores

We characterize Class 1 as "Health-focused Omnivores." Constituting 15% of respondents, these consumers tend to be younger and place a higher value on environmental sustainability in their food purchasing decisions relative to Class 5. They are less likely to be politically conservative and less likely to view naturalness as an important consideration in food purchases. These consumers exhibit strong preferences for both protein claims, and while they prefer beef (relative to pea/soy), their preferences are weaker than those of the other three meat-preferring classes. Aside from consumers who already purchase plant-based meat alternatives, this segment may be the most likely to begin incorporating plant-based meat alternatives into their diet, particularly if labels emphasize protein quality and content. However, these consumers are also price sensitive, which may hinder a switch to plant-based meat alternatives as their prices tend to exceed those of meat.

This group of consumers responds differently under the labeling policy scenarios. There is no significant difference in preferences between the unregulated base scenario and the qualifier label treatment. However, a meat-related terms ban would reduce the likelihood of these consumers choosing plant-based meat alternatives, given the significant decline in utility for both pea and soy ground meat alternatives in the ban treatment.

5.2.2 | Class 2: Price-Conscious Meat-Eaters

Class 2 represents approximately 15% of respondents. These are meat eaters and significantly less likely to adhere to a flexitarian diet relative to Class 5 (the "committed meat-eaters"). This is the only group that is likely to be food neophobic, and they are the most price-sensitive by a wide margin. They are indifferent to protein claims and discount products with a carbon neutral label. These consumers strongly prefer beef to plant-based meat alternatives and are unaffected by the label policy treatments, with the exception of preferences for pea-based products under a meat-related terms ban. Overall, this class of respondents appears to be relatively impervious to label information and is instead driven by price and established meat-eating habits.

5.2.3 | Class 3: Non-Purchasers

Class 3 (12% of respondents) is primarily defined by a tendency to choose the no-purchase option in the choice experiment. They are less likely to choose the ground beef or plant-based alternatives, even though they display relatively low levels of price sensitivity. While these consumers respond positively to "A Complete Source of Protein," their preferences are weaker than other classes, and they are indifferent toward either an Excellent Source of Protein or a Certified Carbon Neutral label claim. When these consumers do elect to "purchase" a product in the DCE, they prefer beef, though the strength of those preferences are not to the degree of Classes 2 or 5. These consumers are not very sensitive to labeling policy, only experiencing a significant decline in utility for the soy product where labels include qualifying statements.

The class membership parameters shed light on the propensity to be non-purchasers. Consumers in this class are highly likely to adhere to a meatless or meat-reducing diet. While this appears to conflict with the observation that when they opt to purchase a product in the DCE, they tend to choose beef, it is worth noting that naturalness is important to these consumers. It is possible that these consumers may be meat avoiders to the degree that even plant-based analogs are unappealing. If they are already comfortable with meatless cooking, they may be less interested in meat simulants. The parameters associated with label claims and food values indicate that these preferences are not necessarily driven by nutritional or ethical motivations (such as environmental sustainability); rather, these consumers may perceive plant-based meat alternatives as unnatural. Prior work (Holt et al. 2024) shows that longer, more complex ingredient lists, as often found on plant-based meat alternatives, reduce consumers' utility, perhaps due to associations with naturalness.

TABLE 3 | Consumer preferences for plant-based meats: MNL and LCM model results.

		LCM				
Variable	**MNL**	**LCM Class 1: Health-focused omnivores**	**LCM Class 2: Price-conscious meat-eaters**	**LCM Class 3: Non-purchasers**	**LCM Class 4: Sustainability-focused meat-reducers**	**LCM Class 5: Committed meat-eaters**
Class probability	—	15%	15%	12%	25%	33%
Utility parameters						
Price	−0.242***	−0.963***	−1.126***	−0.139**	−0.233***	−0.221***
An excellent source of protein	0.273***	0.776***	−0.418	0.208	0.754***	0.633***
A complete source of protein	0.447***	0.963***	0.021	0.603**	0.988***	0.995***
Certified carbon neutral	0.164***	0.450***	−0.632***	0.199	0.756***	−0.019
Pea[a]	−1.073***	−0.826***	−4.725***	−1.226***	0.738***	−4.115***
Pea qualifier[b]	−0.474***	−0.023	−0.378	−0.005	−0.033	−0.152
Pea meat-related terms ban[b]	−0.531***	−1.011**	−1.884*	−6.432	−0.154	−0.640
Soy[a]	−1.037***	−0.519**	−4.976***	−0.555*	0.584***	−4.448***
Soy qualifier[b]	−0.689***	−0.092	−0.145	−1.112*	−0.306	−0.787
Soy meat-related terms ban[b]	−0.689***	−1.863***	−7.323	−0.792	−0.176	−0.108
Purchase unregulated	2.306***	—	—	—	—	—
Purchase qualifier	2.663***	—	—	—	—	—
Purchase meat-related terms ban	3.182***	—	—	—	—	—
Purchase pooled treatments[c]	—	10.51***	9.81***	−1.822***	2.317***	5.477***
Class membership parameters (Class 5 = reference)						
Meat avoid		0.426	0.539	4.000***	4.522***	
Flexitarian		0.143	−0.729*	1.014***	1.248***	

(Continues)

TABLE 3 | (Continued)

Variable	MNL	LCM				
		LCM Class 1: Health-focused omnivores	LCM Class 2: Price-conscious meat-eaters	LCM Class 3: Non-purchasers	LCM Class 4: Sustainability-focused meat-reducers	LCM Class 5: Committed meat-eaters
Conservative		−0.582*	−0.289	−0.69**	−0.404	
Income < $100,000		−0.118	0.213	0.753***	−0.041	
Millennial (18–35 years)		1.078***	−0.056	−0.083	0.672***	
Senior (65+)		−1.148***	−0.328	−0.312	−0.619**	
Neophobic		0.075	0.414*	0.249	0.0339	
Food values health		−0.250	−0.177	0.087	−0.081	
Food values environment		0.271**	−0.188	0.081	0.555***	
Food values taste		−0.064	0.042	−0.248	−0.195	
Food values familiarity		−0.205	−0.218*	−0.444***	−0.344***	
Food values naturalness		−0.258*	0.110	0.323**	0.204	
Confused		0.243	0.109	0.039	0.639**	
Constant		1.123	0.633	−0.970	−1.149	
Model statistics			**MNL**			**LCM**
Number of respondents (6 choices each)			1203			1114
Number of choices			7218			6684
Pseudo R^2			0.199			0.492
Pseudo adjusted R^2			0.198			0.480
Log-likelihood			−8016			−4710

[a]Interpreted relative to the beef product in the unregulated label policy treatment.
[b]Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product. Captures the effect of labeling policy relative to the absence of it.
[c]*Purchase pooled treatments* combines purchase-related preferences from across the three treatments to facilitate successful model convergence.
*Significance at $p < 0.10$; **significance at $p < 0.05$; ***significance at $p < 0.01$.

The labeling policy impacts on this segment are rather limited. Non-purchasers are not sensitive to labeling policy, and label claims do little to stimulate demand. This class poses a challenge for the plant-based meat alternative industry, suggesting that some meat-reducing consumers are not interested in plant-based meat alternatives.

5.2.4 | Class 4: Sustainability-Driven Meat-Reducers

Class 4, the second largest, accounts for 25% of respondents and is the only segment exhibiting positive utility for plant-based meat alternatives relative to beef. Consumers in this segment are not particularly price sensitive. They tend to be younger and are highly likely to adhere to vegan, vegetarian, pescatarian, or flexitarian diets. While familiarity is less likely to drive their food purchase decisions, these consumers are more likely to value environmental sustainability and have the strongest positive preferences for the carbon neutral label claim among all five classes. Tonsor et al. (2023) identify a similar segment of American consumers (25%), who select a plant-based meat alternative instead of beef in a binary choice scenario, many of whom adhere to meatless or meat-reducing diets.

While Class 4 consumers are strongly influenced by labeling information about protein content and quality (as well as environmental sustainability), they are not influenced by the labeling context with respect to the use of meat-related terms on product labels. Parameter estimates for pea and soy products in both the qualifier and meat-related ban treatments were not significantly different from the unregulated scenario. This may reflect a strong preference for plant-based meat alternatives regardless of the terms permitted on product labels. Curiously, Class 4 is the only group to have confused a plant-based meat alternative for real meat in the past.

5.2.5 | Class 5: Committed Meat-Eaters

We characterize our largest segment, comprising one-third of respondents, as "Committed Meat-Eaters." These consumers exhibit a strong aversion to plant-based meat alternatives, as reflected in the large, negative parameter estimates for *Pea* and *Soy*. Both protein claims are viewed positively, while these consumers are indifferent to the carbon neutral claim. The labeling policy environment has no effect on these consumers, who are unlikely to purchase plant-based meat alternatives regardless of the language and framing in these labels. In this respect, Class 5 consumers are similar to Class 2; however, our "committed meat-eaters" are not nearly as price-sensitive and are more likely to be flexitarian.

6 | Policy Implications

Our primary research question is concerned with whether consumer demand for plant-based meat alternatives is affected by the regulation of meat-related terms on product labels. Our results suggest that plant-based ground "beef" is generally most preferred in an unregulated market, albeit still considerably less than beef. The labels in our unregulated market treatment were designed such that the plant-based nature of the product is identifiable but minimized. While not intentionally deceptive, there is potential room for confusion, particularly if consumers are inattentive. Furthermore, in an unregulated environment, the use of deliberately deceptive labeling practices remains a possibility.

In aggregate, consumer preferences for plant-based meat alternatives decrease to similar degrees between the use of qualifiers (current Canadian regulations) and a meat-related terms ban, implying that these two regulatory mechanisms are effectively similar. Our result would seem to negate the argument from meat industry advocates that moving to a stricter regulatory environment by banning the use of meat-related terms is necessary to combat consumer misperceptions. The mandatory disclaimers in place in Canada appear sufficient to differentiate plant-based meat alternatives from real meat, addressing any concerns about information asymmetry with respect to product composition. For jurisdictions currently developing a regulatory approach to the labeling of plant-based meat products, our results suggest that allowing the use of meat-related terms, but with a requirement for clearly stated disclaimers (such as "simulated meat"), represents a useful alternative to an outright ban.

The similarity between the two regulatory approaches somewhat diminishes when accounting for preference heterogeneity. We find a heterogeneous demand response with respect to whether consumers choose a plant-based meat alternative versus a meat product in an unregulated environment. This heterogeneity is far less evident in the qualifier treatment, with only one group (Class 3, Table 3) experiencing marginally significant effects for soy products. Greater heterogeneity in consumer choices is evident under a meat-related terms ban, particularly for health-focused omnivores and price-conscious meat-eaters. The remaining segments, constituting nearly 60% of respondents, are not significantly affected by the labeling policy. Therefore, while we find evidence that the labeling environment influences choices, this appears to be the case for specific subsets of consumers.

Although consumer preferences for plant-based meat alternatives are strongest in an unregulated market, this does not necessarily imply that deregulation of plant-based meat alternative labeling is optimal. The demand effects of labeling policy must be weighed against the goals of that policy. In this case, disclaimers are used to inform consumers about the plant-based nature of meat alternatives, so that they have better information when purchasing these products. Nearly 11% of respondents reported mistaking a plant-based meat alternative for real meat in the past, indicating that a policy mechanism that alleviates these issues is beneficial to consumers. The current regulatory approach in Canada seems to strike a balance between informing consumers and permitting the use of meat-related terms by firms in the plant-based meat alternative sector, allowing them to broaden the appeal of their products.

We also examined the drivers of consumer preferences for plant-based meat alternatives, and the salience of environmental versus nutrition claims on product labels, including responses to official (regulated) protein content versus protein quality claims. Regulated protein claims elicit positive and significant WTP estimates for most consumer groups. This is particularly apparent in

consumer segments that are already purchasing plant-based meat alternatives. Promoting these attributes to health-focused omnivores represents a promising strategy for the plant-based meat alternative sector. Protein claims elicit a stronger demand response than an environmental claim. Our results also point to the salience of a minimum protein requirement for plant-based alternatives and regulating the use of protein claims on these products.

We also find differences in preferences between the two official protein claims allowable on plant-based meat alternatives in Canada: "An Excellent Source of Protein," and "A Complete Source of Protein." Consumers tend to prefer the latter, implying that a full suite of amino acids is important. While we provided descriptions of these protein label claims, it is also possible that respondents were simply more responsive to the word, and associated perceptions, of "Complete" than "Excellent," rather than the specific details of the protein claim. All plant-based meat alternatives sold in Canada must have a protein efficiency rating of at least 40, qualifying these products for the "Excellent Source of Protein" label claim (CFIA 2023a). However, if products contain the necessary suite of amino acids to warrant the "Complete Source of Protein" claim, promoting this attribute is likely to elicit a positive demand response. While plant-based meat alternative firms are already communicating the nutritional benefits of these products to consumers, protein attributes are often communicated quantitatively—typically in grams of protein per serving—rather than qualitatively as in our choice experiment. Qualitative label claims in general tend to be more salient (Villas-Boas et al. 2020). The extent to which quantitative versus qualitative communication of protein information elicits a different response from consumers represents a useful avenue for further research.

Our research assesses Canadian consumer preferences for plant-based meat alternatives under different labeling policy scenarios, finding that the current regulatory approach in Canada—allowing meat-related terms with a disclaimer—is generally effective. A useful extension would be to examine consumer preferences in other jurisdictions, including France and some US states, where bans on meat-related terms have been implemented to different degrees. Evaluations of the demand effects of a meat-related terms ban on other meat alternatives (e.g., plant-based sausages, burgers), or the use of alternative product names to "crumble" in place of "ground," would also be fruitful areas for further research.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Endnotes

[1] This research received approval from the Behavioural Research Ethics board of The University of Saskatchewan in January 2022 (BEH-3129). The survey was administered by the Canadian Hub for Applied and Social Research at The University of Saskatchewan. Informed consent was obtained.

[2] These official protein claims are regulated in Canada and are in fairly common usage. We included these label claims in our empirical design due to interest from industry stakeholders in understanding whether these claims resonate with consumers, and whether consumers differentiate between them. A product label may contain "An Excellent Source of Protein" claim if the product has a protein efficiency rating greater than 40. A product label may contain "A Complete Source of Protein" claim if the product has a protein efficiency rating greater than 20 alongside a full suite of essential amino acids.

[3] While each choice set contained one beef, pea, and soy product, this was not a labeled choice experiment. Respondents could ascertain the protein source of the product by reading the product label.

[4] Flexitarians are defined as those who choose to eat meat less frequently than omnivores, but do not abandon it entirely like vegetarians or vegans. This is often a conscious decision related to health or environmental motivations (Peschel and Grebitus 2023).

[5] We also present a random parameters logit model (RPL) in Appendix E of Appendix S2. The RPL assumes that preference heterogeneity is continuously distributed at the individual level, and we estimate parameters of this distribution. The LCM contrasts the RPL by assuming discrete distributions of preferences (Greene and Hensher 2003), where respondent characteristics in the class membership equations explain these discrete distributions and the sources of preference heterogeneity.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Appendix S1:** Consumer survey instrument. **Appendix S2:** aepp70013-sup-0002-AppendixS2.docx.