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Vegetarian, vegan, or plant-based? Comparing how different labels influence consumer evaluations of plant-based foods

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ABSTRACT

Market actors have a role to play in enabling sustainable food transitions. One challenge for these actors is how to promote plant-based foods in ways that appeal to a growing number of consumers. Here we test how different plant-based related labels affect consumer appraisals of a range of foods (cookies, sausages, cheese, chocolate, pasta). In two studies (pre-registered; $N_{USA} = 1148$, $N_{Germany} = 491$), we examined the effects of a 'vegetarian', 'vegan', or 'plant-based' label (compared to no label) on five attributes (healthy, tasty, ethical, pure, environmentally friendly) related to the products. We also measured self-reported likelihood to purchase the products. Overall, the results indicated that the 'plant-based' label was slightly more appealing to participants than the 'vegetarian' and 'vegan' labels. However, contrary to our expectations, neither consumers' information-seeking tendencies nor their pre-existing attitudes toward plant-based foods influenced (i.e., moderated) the effects of the labels. Anticipated taste was a strong and consistent predictor of purchase likelihood for all labeled products, but the ethical and pure attributes also accounted for unique variance in this outcome variable. Taken together, our findings and discussion provide insights into the role of labels and label terminology on consumer appraisals of plant-based foods.

1. Introduction

Growing concerns with the health of the people and the planet have recently prompted deep transformations in global and local food systems, which include production-side measures such as technological improvements, and large-scale changes in overall consumption patterns such as increased plant-based eating (Eisen & Brown, 2022; IPCC, 2022; Willett et al., 2019). Animal-sourced food products tend to have higher environmental impact than plant-based foods, including plant-based sources of protein (Lucas et al., 2023; Willett et al., 2019; Xu et al., 2021). However, the market for protein-rich food products in industrialized Western societies is dominated by animal products and mainstream market structures still reinforce the practice of eating meat as a normalized aspect of food consumption (Dagevos & Verbeke, 2022; Gravely & Fraser, 2018; Tjärnemo & Södahl, 2015). Against this backdrop, market actors play a role in enabling transitions toward more sustainable food systems, and one challenge for these actors is how to promote plant-based food products and practices in ways that appeal to increasingly larger numbers of consumers (Aschemann-Witzel et al., 2021; Graça et al., 2019). Interventions aimed at reshaping the contexts in which food choice, acquisition, and consumption take place may help promote increasingly plant-based diets and lifestyles (De Boer & Aiking, 2019; Graça et al., 2023; Onwezen, 2022). Context-based interventions informed by the principles of choice architecture are often seen as a promising means of enabling change while minimizing psychological reactance (Thaler & Sunstein, 2009; Vandenbroele et al., 2020).

Choice architecture broadly refers to designing the features of a micro-environment – (e.g., a physical supermarket or an online-store) or an object (e.g., product) – in ways that facilitate particular (e.g., more sustainable) outcomes (Ensaff et al., 2015; Ferrari et al., 2019; Hollands et al., 2013). Nudging is used to alter individuals' choices in predictable ways without using coercion (Thaler & Sunstein, 2009). Common nudge strategies in food choice architecture include placement nudges, which can focus on changing the environment in which food is purchased or consumed, such as changing the order or location of options to increase the visibility and accessibility of healthier or more sustainable choices

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(Ensaff et al., 2015; Hollands et al., 2013; van der Vliet et al., 2024). Common nudge strategies in the food domain also include property nudges, which can focus on changing perceived attributes of the products themselves to make healthier or more sustainable choices more appealing. These include subtle environmental cues such as changes in portion or package size, plate size, relative availability, order of presentation of different foods, and perceived number of people choosing a given food (Hollands et al., 2013; van der Vliet et al., 2024; Vandenbroele et al., 2020). Strategically designed product-related posters, stickers, or labels that make target norms or beliefs more salient in the context of food choice can also be used to alter the perceived properties of food products (Ensaff et al., 2015; Hollands et al., 2013; Prada et al., 2019). Here, we examine the impact of labels and label terminology on consumer perceptions and purchase intentions of plant-based foods.

1.1. Labels, nomenclatures, and consumer appraisals of plant-based food products

Nudges that alter the perceived properties of food products (e.g., using labels) can be seen as a potentially promising (i.e., potentially effective, low-cost, scalable) intervention to promote more sustainable choices. For example, when consumers are presented with food products in the context of everyday food practices, this triggers routine consumption framings (e.g., taste preferences) that tend to exclude other framings associated with the impact of such products (e.g., environment, health, or animal welfare; Korzen & Lassen, 2010). Using 'ethical' or 'environment-friendly' labels on plant-based meals and products may arguably merge competing frames of meal as 'everyday food' vs. meal as 'environmental impact' and nudge consumers to adopt ethical and/or more sustainable choices (Visschers et al., 2015). Informational and environmental cues may also be used to convey prevailing norms about specific foods (Prinsen et al., 2013), and there has been increasing interest in investigating if these cues (e.g., labels) can be applied to plant-based products, framing these products as increasingly available, familiar, appetizing, and embedded in point of purchase contexts (e.g., Besson et al., 2020; Marshall et al., 2022; Noguerol et al., 2021; Stremmel et al., 2022; van der Vliet et al., 2024). Several systematic reviews and meta-analyses in the health domain have indicated that the use of labels as a nudge strategy may help steer consumers' choice towards healthier products (Arno & Thomas, 2016; Cecchini & Warin, 2016; Shrestha et al., 2023).

To examine the role of labeling strategies in the promotion of plant-based food products, one important question needs to be considered from the onset, which is how consumers react to different nomenclatures that can be used to label these products. Several studies have found that using different names to refer to a given product may impact consumer appraisal of the product. Bryant and Barnett (2019) observed that using the terms 'clean meat' and 'animal free meat' when referring to cultured meat (i.e., meat grown from animal stem cells) generated more positive attitudes toward the product compared to the term 'lab grown meat'. It has also been shown that 'gluten-free' labels may activate halo effects (i.e., the presence of a positive feature causing people to more favorably evaluate other, sometimes unrelated, features) with food products being perceived as more healthful, less caloric, and less processed (Prada et al., 2019), and 'organic' labels may increase perceived healthiness, sometimes at the expense of anticipated liking (e.g., Schuldt & Hannahan, 2013). A study compared how young consumers evaluated three different dietary categories usually linked with plant-based eating (i.e., 'vegan', 'vegetarian', 'plant-based') and found overall more favorable attitudes towards the term 'plant-based' compared to the other categories (Faber et al., 2020). The study focused on 'vegan', 'vegetarian' and 'plant-based' categories in abstract but did not test these labels applied to specific products. More recently, a study by Stremmel et al. (2022) tested how vegan labels affected consumers' appraisal and intentions toward labeled products and found mixed effects on products categorized as "unexpectedly vegan", namely a spread with herbs and a chocolate spread. The products that were labeled as vegan scored lower in taste expectations and higher in perceived healthfulness and sustainability, which were linked with higher consumption intentions (Stremmel et al., 2022). However, the study did not consider the effect of different terminologies linked with plant-based eating (i.e., vegetarian, vegan, plant-based) and the scope was limited to four products from a single product category (sandwich spreads) with consumers from a single cultural context (Germany). This means that there is still limited evidence on the role of plant-based related labels in promoting positive appraisals of food products that may align with transitions to less animal-centric, more sustainable food systems (Lucas et al., 2023; Willett et al., 2019; Xu et al., 2021).

The common definition of vegetarian food is that it does not contain products made from dead animals (i.e., no mammal meat, poultry, fish, or shellfish), and the definition of vegan food is that it does not contain any animal products (e.g., no animal flesh, no eggs, no dairy, no gelatin), although confusion sometimes arises, as some people do not consider the flesh of birds or fish to be "meat" (Ruby, 2012). The increasingly popular term "plant-based" can be fuzzier still. Although many use the term interchangeably with "vegan", others use it to describe food that is mostly made from plants, but may contain some amount of animal products. This is especially the case when talking about "plant-based diets" (Storz, 2022), where some understand this to mean only plant foods, whereas others understand it to mean mostly plant foods. As such, it is of interest to test how consumers respond to labels with different nomenclatures when seeing these labels on foods that otherwise appear very similar, and to examine whether the different labels alter the perceived characteristics of the products.

1.2. The present work – aim and hypotheses

This work aims to identify how different plant-based related labels may impact consumer appraisal and likelihood of purchasing a range of food products. More specifically, we compared the effects of a 'vegetarian', 'vegan', or 'plant-based' label (compared to no label) on five product traits (healthy, tasty, ethical, pure, environmentally friendly) pertaining to five different products (cookies, sausages, cheese, chocolate, pasta), as well as self-reported likelihood of purchasing the products. We selected a range of product traits to capture possible expressions of 'halo' or 'horn' effects driven by the labels (i.e., when people's broader evaluation of an object is overly influenced by the presence of a positive or negative feature, respectively; Burton et al., 2015), and targeted different products to capture effects across a range of product categories, the traditional version of which are either fully animal-based (cheese and sausages) or contain relatively small to no amounts of animal-sourced ingredients (cookies, chocolate, pasta). We also considered how consumer-related variables (attitudes toward plant-based food, information seeking) might shape the effects of the (vegan, vegetarian, plant-based) labels. The rationale was that the different nomenclatures might impact consumer appraisals in different ways depending on participants' pre-existing attitudes toward plant-based food and their tendency to look for product-related details when acquiring food products.

To increase the ecological validity of the labels, we followed Stremmel et al. (2022) and used the V-Label system because it is one of the most common and established labels for vegetarian and vegan products across countries. In addition, to strengthen the robustness of our findings, we collected data with participants from two countries (Study 1, USA; Study 2, Germany) and explored if the results would be similar or dissimilar in samples from these two contexts.

Before beginning data collection, we pre-registered the sampling plan, variables, and analytical plan on the Open Science Framework (https://osf.io/kte9u/?view_only=df268bde1ffa4ab292a50e7744a5e4bd). We predicted that:

1. Participants would give different scores in the traits “healthy, tasty, ethical, pure, and environmentally-friendly" and “likelihood of purchasing” products displaying a (vegan, vegetarian, plant-based) V-Label relative to unlabeled products (non-directional hypothesis).
2. There would be a positive relationship between information-seeking and differences between labeled and unlabeled products (directional hypothesis) and between positive attitudes toward plant-based foods and evaluations of the labeled products (directional hypothesis).
3. Information seeking and attitudes toward plant-based foods would moderate the effect of label type on consumer perceptions of food products (non-directional hypothesis).

We chose to recruit participants from the USA and Germany for two primary reasons. First, V-Labels are commonly used on many different food products throughout Germany (and the EU more widely) yet seldom used in the USA. Second, levels of per capita meat consumption in the USA are among the highest in the world (125 kg combined of poultry, beef, pork as of 2020; Ritchie et al., 2023). In Germany, per capita meat consumption is considerably lower (77 kg combined of poultry, beef, and pork as of 2020; Ritchie et al., 2023) and appears to be declining, with figures from 2021 being the lowest in 30 years (Bundesministerium for Ernährung und Landwirtschaft, 2022). Thus, we could test the effects of V-Labels in a context where V-Labels are familiar and meat consumption is on the decline, and a context where V-Labels are likely less familiar and meat consumption is stable and extremely high. Second, V-Labels are commonly used on many different food products throughout Germany (and the EU more widely) yet seldom used in the USA.

2. Study one

2.1. Participant recruitment

Using G*Power 3.1.9.2 (Faul et al., 2009), we determined that a sample size of $N = 969$ would be required to obtain 80% power to detect an effect size of $f = 0.10$ or higher at $\alpha = 0.05$ in a between-subjects ANOVA with three groups. Anticipating a ~10% data discard rate for participants who fail attention checks, we aimed to recruit at least 1050 people.

Participants were initially recruited through advertising on Facebook in April–June of 2019, targeting people in the USA who “liked” any of the big supermarkets in the country (e.g., Safeway, Walmart, Trader Joe’s, Whole Foods), to take part in an online study with the neutral title of “Consumer Impressions of Food Products”. Participants were given the opportunity to enter in a draw for one of several $100 USD supermarket gift cards. Participants who chose to enter the draw entered a contact email address via a separate link provided at the end of each study, to keep their responses anonymous.

If recruitment via Facebook was unsuccessful, our original plan in the pre-registration was to recruit additional paid participants via Mechanical Turk. To have both American and German participants sourced from the same platform, we instead chose to recruit additional participants via Prolific in July 2019, who were paid a modest sum for their time (both Mechanical Turk and Prolific are online platforms commonly used to recruit research participants; for an overview of these platforms and their reliability see Aguinis et al., 2021; Douglas et al., 2023).

2.2. Sample characteristics

A total of 1268 participants began the survey (967 via Facebook, 301 via Prolific). After discarding those who failed the attention check (see Materials; 74 in the vegetarian label condition, 26 in the vegan label condition, and 64 in the plant-based label condition), the final sample size was 1148 (865 via Facebook, 283 via Prolific).

The final sample consisted primarily of women (79%). Participants ranged in age from 18 to 87 (M_{age} = 45.19, SD_{age} = 14.78). Most participants (56%) had a combined annual household income of less than $50,000 USD. There was wide variation in educational attainment, with the majority (77%) having completed at least some university. Most of the sample (83%) identified as omnivores, and most participants (76%) reported being the primary decision maker in purchasing groceries for their household. For a summary of demographics for both this study and Study 2, see Table 1.

2.3. Procedure

Each study began with a participant information statement and consent form. After indicating their consent, participants completed the measures in the materials section via Qualtrics, in the order listed. Materials and data for this and Study 2 are available via the OSF (https://osf.io/me6h5/?view_only=1b4a1e31e94d4da3821dcdc782e986c6). This project was approved by the Human Research Ethics Committee of the lead author’s university.

2.4. Materials

2.4.1. Product evaluations

Participants were shown five pairs of food products: cookies, sausages, cheese, chocolate, and pasta. Each pair of products comprised two images— one product in plain packaging, and one that also carried a V-Label (see Fig. 1 for an example). Each participant was randomly assigned to one of three label conditions: (vegetarian label, vegan label, or plant-based label), and to one of two order conditions (labeled product first, labeled product second). The products were presented in a randomized order for each participant.

Participants were asked to evaluate each product pair, on the properties of healthy, tasty, ethical, pure, and environmentally-friendly. This was done on a series of 7-point scales, adapted from Hartmann et al. (2018), and formatted as follows: “A is much healthier (−3), A is

Table 1
Demographics for study 1 and study 2 participants.

	Study 1: USA (N = 1148)	Study 2: Germany (N = 491)
Age	M = 45.19; SD = 14.78	M = 31.16, SD = 10.88
Source	75% Facebook 25% Prolific	44% Facebook 56% Prolific
Gender	79 % women 18% men 1% non-binary <1% unspecified	64% women 35% men 1% non-binary <1% unspecified
Diet	83% omnivore 13% partial vegetarian 2% vegetarian 1% vegan 1% unspecified	73% omnivore 12% partial vegetarian 10% vegetarian 6% vegan <1% unspecified
Education	2% less than high school 21% high school 33% some university 32% Bachelor’s degree 11% Master’s degree 2% Doctorate or professional degree	3% Hauptschule (lowest compulsory) 9% Realschule (leads to vocational) 32% Gymnasium (leads to university) 10% Fachschule (vocational degree) 26% Bachelor’s degree 16% Master’s degree 3% Doctorate
Household grocery purchasing	76% primary decision maker 20% shared responsibility 3% provided input <1% not involved at all 1% unspecified	59% primary decision maker 31% shared responsibility 9% provided input 1% not involved at all

Sample Product Pair for Sausages in the Vegan Label, Labeled Product Second Condition

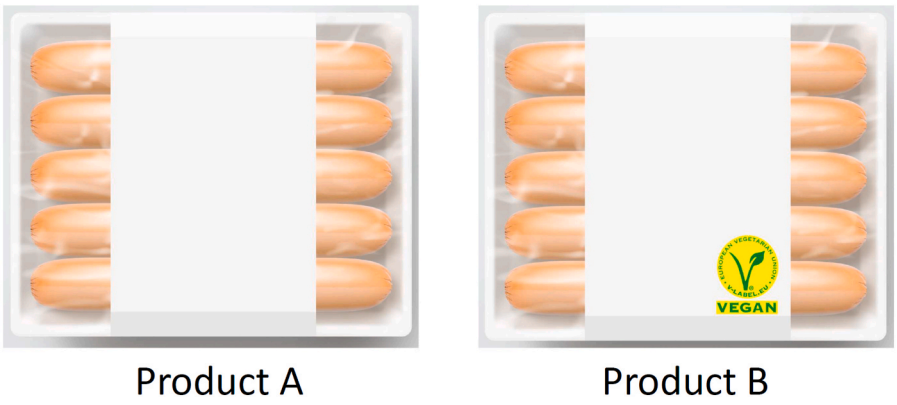

Fig. 1. Sample product pair for sausages in the vegan label, labeled product second condition.

moderately healthier (−2), A is slightly healthier (−1), A and B are equally healthy (0), B is slightly healthier (1), B is moderately healthier (2), B is much healthier (3)". Similarly, for each product, participants were asked the question: "Assuming that you were interested in buying this product and that both options cost the same, which one you would choose?" on scale ranging from "would definitely choose A (−3)" to "would definitely choose B (3)"

2.4.2. V-label recognition

As an attention check, participants were shown three different V-Labels (vegan, vegetarian, and plant-based) and asked to identify which of the labels they had been shown in the previous section of the survey. Participants who selected an incorrect label were deemed to have failed the attention check. Then, participants were asked if they had ever seen each of the V-Labels on a product in a grocery store in real life (yes/no).

2.4.3. Information seeking

Participants indicated the extent to which they seek information on food packages with seven randomly-ordered items from Grunert et al. (2014), on a scale of always (4), often (3), occasionally (2), rarely (1) or never (0): "When buying food and drink products, how often do you look for the following information on food packaging? Ingredients list; nutrition information (e.g., energy (calories), fats, sugars); claims about nutritional benefits (e.g., low fat, reduced salt); claims about health benefits (e.g., lowers cholesterol, good for bones); health logo/symbol (such as 'Good for you' or the sunflower 'Eat well' logo); allergy information; environmental impact (e.g., production, transport)".

2.4.4. Attitudes toward plant-based foods

Participants completed five items targeting behavioral and evaluative features of attitudes toward plant-based foods on a 7-point scale ranging from -strongly disagree (−3) to strongly agree (3): "Nowadays there are good plant-based options for many products; It's possible to have a satisfying diet eating mostly plant-based foods; It's becoming increasingly easy to have plant-based meals; I regularly purchase plant-based foods; People in my social circle regularly eat plant-based foods".

2.4.5. Demographics

At the end of the survey, participants indicated their age, gender, household income, and educational attainment, and categorized themselves as either omnivore, partial vegetarian, vegetarian, or vegan.

2.5. Results

2.5.1. Data analysis

Our cutoff for statistical significance for all tests was $p < 0.05$, except for the correlation analyses, which we set at $p < 0.001$ because of the large number of correlations. Skewness and kurtosis values for all variables used in the following analyses were within acceptable parameters (Kim, 2013). Internal reliability was excellent for both composite measures– information seeking ($\alpha = 0.85$) and attitudes toward plant-based foods ($\alpha = 0.85$). Product evaluations were recoded such that a positive value indicated a preference for the labeled product, and a negative value indicated a preference for the unlabeled product. An overview of means and standard deviations by product and label is provided in Table 2.

2.5.2. Impact of V-labels

As planned in the OSF registration, to test the main hypotheses regarding the impact of the V-Labels on participant evaluation of food products, we conducted a 3 (label) × 5 (product) mixed repeated-measures ANOVA for each of the six evaluative dimensions. We then followed up any significant interactions with tests of main effects. Finally, we tested if this relation (between the V-Labels and the six evaluative measures) was moderated by label information seeking and attitudes toward plant-based foods, using, again, a repeated-measures ANOVA. Both moderators were between-factors and were categorized in three levels – low (Mean – Standard Deviation), medium (mean) and high (Mean + Standard Deviation). As we did not set out to examine the main effect of product (e.g., whether cookies were seen to be tastier than pasta), we did not systematically compare each of the products to one another, but these means and standard deviations are presented in Table 2. For all ANOVAs in this study, Mauchly's test indicated that the assumption of sphericity had been violated ($p < 0.001$), so we used Greenhouse-Geisser corrections for within-subject effects.

2.5.2.1. Healthy. There was a significant effect of label, $F(2, 1145) = 8.46$, $p < 0.001$, and a significant effect of product, $F(3.81, 4366.95) = 67.94$, $p < 0.001$, but the interaction between label and product was not significant, $F(7.63, 4366.95) = 1.46$, $p = 0.171$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly healthier than both the vegan products ($p = 0.001$, $d = 0.29$), and the vegetarian products ($p = 0.019$, $d = 0.21$), but the difference between vegetarian and vegetarian products ($p = 0.404$, $d = 0.10$) was not significant. For an overview of product means and standard deviations, see Table 2. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 1.22$, $p = 0.302$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 0.31$, $p = 0.872$.

Table 2
US-American evaluations of "vegetarian", "vegan", and "plant-based" food products.

	Vegetarian		Vegan		Plant-based	
	$n = 371$		$n = 418$		$n = 359$	
	M	*SD*	*M*	*SD*	*M*	*SD*
Healthy	**0.82**	**0.97**	**0.72**	**1.11**	**1.03**	**1.05**
Sausages	1.22	1.33	1.06	1.50	1.36	1.41
Cheese	0.65	1.37	0.43	1.54	0.81	1.51
Cookies	0.85	1.16	0.90	1.33	1.07	1.32
Pasta	0.79	1.23	0.68	1.30	1.05	1.31
Chocolate	0.60	1.23	0.55	1.36	0.86	1.31
Tasty	**−0.75**	**1.20**	**−1.14**	**1.19**	**−0.63**	**1.25**
Sausages	−0.90	1.66	−1.17	1.59	−0.74	1.69
Cheese	−0.91	1.59	−1.47	1.53	−0.98	1.68
Cookies	−0.79	1.48	−1.12	1.49	−0.62	1.52
Pasta	−0.26	1.36	−0.66	1.31	−0.16	1.30
Chocolate	−0.87	1.56	−1.28	1.57	−0.65	1.51
Ethical	**0.61**	**0.94**	**0.61**	**1.11**	**0.86**	**1.05**
Sausages	0.91	1.34	1.03	1.54	1.09	1.38
Cheese	0.55	1.28	0.61	1.40	0.80	1.34
Cookies	0.57	1.09	0.57	1.23	0.84	1.31
Pasta	0.57	1.10	0.44	1.19	0.82	1.17
Chocolate	0.44	1.17	0.39	1.33	0.75	1.28
Pure	**0.52**	**1.06**	**0.41**	**1.11**	**0.70**	**1.20**
Sausages	0.68	1.40	0.70	1.52	0.89	1.55
Cheese	0.41	1.46	0.13	1.60	0.43	1.66
Cookies	0.61	1.24	0.50	1.28	0.81	1.39
Pasta	0.57	1.23	0.50	1.21	0.80	1.28
Chocolate	0.32	1.43	0.22	1.52	0.59	1.51
Environmentally-friendly	**0.78**	**1.02**	**0.72**	**1.09**	**1.05**	**1.08**
Sausages	0.99	1.35	1.03	1.38	1.29	1.32
Cheese	0.70	1.31	0.70	1.25	1.03	1.33
Cookies	0.82	1.20	0.70	1.23	1.03	1.25
Pasta	0.70	1.16	0.59	1.24	0.93	1.28
Chocolate	0.67	1.25	0.59	1.33	0.97	1.31
Purchasing Likelihood	**−0.41**	**1.56**	**−0.84**	**1.57**	**−0.11**	**1.58**
Sausages	−0.39	2.05	−0.79	1.97	−0.03	1.95
Cheese	−0.65	1.92	−1.19	1.92	−0.53	2.03
Cookies	−0.41	1.84	−0.84	1.84	−0.09	1.92
Pasta	0.02	1.76	−0.41	1.80	0.33	1.75
Chocolate	−0.63	1.90	−0.98	1.95	−0.23	1.93

Note. All values are compared to an otherwise visually identical, unlabeled product. Possible scores ranged from −3 (unlabeled product is much better) to 3 (labeled product is much better).

2.5.2.2. Tasty. There was a significant effect of label, $F(2,1145) = 19.16$, $p < 0.001$, and a significant effect of product, $F(3.90, 4462.20) = 87.59$, $p < 0.001$, but the interaction between label and product was not significant, $F(7.79, 4462.20) = 1.65$, $p = 0.107$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly tastier than the vegan products ($p < 0.001$, $d = 0.42$), and that the vegetarian products were seen as tastier than the vegan products ($p < 0.001$, $d = 0.33$), but the difference between vegetarian and plant-based products ($p = 0.390$, $d = 0.10$) was not significant. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 0.33$, $p = 0.858$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 1.34$, $p = 0.253$.

2.5.2.3. Ethical. There was a significant effect of label, $F(2,1145) = 7.17$, $p = 0.001$, and a significant effect of product, $F(3.82, 4377.46) = 54.70$, $p < 0.001$, as well as a significant interaction between label and product, $F(7.65, 4377.46) = 1.90$, $p = 0.011$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly more ethical than both the vegan products ($p = 0.003$, $d = 0.23$) and the vegetarian products ($p = 0.003$, $d = 0.25$), but the difference between vegan and vegetarian products ($p = 0.999$, $d = 0.00$) was not significant. Simple effects analyses run within each of the products indicated a significant effect of label for cheese ($p = 0.035$), cookies ($p = 0.002$), pasta ($p < 0.001$), and chocolate ($p < 0.001$), but the effect of label was not significant for sausages ($p = 0.217$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 1.92$, $p = 0.105$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 1.00$, $p = 0.408$.

2.5.2.4. Pure. There was a significant effect of label, $F(2, 1145) = 6.64$, $p = 0.001$, and a significant effect of product, $F(3.79, 4344.50) = 40.82$, $p < 0.001$, but the interaction between label and product was not significant, $F(7.59, 4344.50) = 1.70$, $p = 0.097$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly purer than the vegan products ($p = 0.001$, $d = 0.25$), but neither the difference between plant-based and the vegetarian products ($p = 0.069$, $d = 0.16$), nor the difference between vegan and vegetarian products ($p = 0.365$, $d = 0.10$) were significant. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 1.16$, $p = 0.326$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 1.67$, $p = 0.155$.

2.5.2.5. Environmentally friendly. There was a significant effect of label, $F(2, 1145) = 10.35$, $p < 0.001$, and a significant effect of product, $F(3.87, 4423.61) = 37.82$, $p < 0.001$, but the interaction between label and product was not significant, $F(7.73, 4423.61) = 0.91$, $p = 0.502$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly more environmentally friendly than both the vegan products ($p < 0.001$, $d = 0.30$) and the vegetarian products ($p = 0.001$, $d = 0.26$), but the difference between vegan and vegetarian products ($p = 0.741$, $d = 0.06$) was not significant. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 0.67$, $p = 0.611$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 0.13$, $p = 0.971$.

2.5.2.6. Likelihood of purchasing. There was a significant effect of label, $F(2, 1145) = 21.34$, $p < 0.001$, and a significant effect of product, $F(3.89, 4455.39) = 65.05$, $p < 0.001$, but the interaction between label and product was not significant, $F(7.78, 4455.39) = 0.80$, $p = 0.597$. Tukey post hoc analyses indicated that participants were significantly more likely to purchase the plant-based products than both the vegan products ($p < 0.001$, $d = 0.46$) and the vegetarian products ($p = 0.027$, $d = 0.19$), and also more likely to purchase the vegetarian than the vegan products ($p < 0.001$, $d = 0.27$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 1128) = 0.21$, $p = 0.933$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 1128) = 0.18$, $p = 0.950$.

2.5.3. Correlations between information seeking, plant-based food attitudes, and product evaluations

A full account of these correlations is provided in Table S1 in the Supplementary Materials (https://osf.io/me6h5/?view_only=1b4a1e31e94d4da3821dcdc782e986c6). Due to the large number of correlations, we focus on correlations that are $p < 0.001$.

We hypothesized that label information seeking would be positively associated with the difference between evaluations of the labeled and unlabeled products, and therefore correlated label information seeking with the absolute value of the product evaluation variables. Label information seeking was positively and significantly correlated with the absolute value of all healthy, ethical, pure, environmentally-friendly variables ($p < 0.001$, r ranging from 0.10 to 0.23), but was not significantly related to tasty ratings. As an additional (exploratory) analysis, we also correlated label information seeking scores with all product evaluation variables. All correlations were positive and significant at $p < 0.001$ (r ranging from 0.10 to 0.33).

Plant-based food attitudes scores were significantly and positively associated with all product evaluation variables at $p < 0.001$ (r ranging from 0.07 to 0.40), except for tasty ratings, where not all correlations reached the cutoff for statistical significance ($p < 0.05$, but not $p < 0.001$).

3. Study two

3.1. Participant recruitment

Participants were initially recruited through advertising on Facebook in June 2019, targeting people in the Germany who "liked" any of the big supermarkets in the country (e.g., Aldi, Edeka, Kaufland, Alnatura), to take part in an online study with the neutral title of "Wahrnehmungen von Lebensmitteln" (Perceptions of food products). Participants were given the opportunity to enter in a draw for one of several €80 Amazon gift cards. Participants who chose to enter the draw entered a contact email address via a separate link provided at the end of each study, to keep their responses anonymous. If recruitment via Facebook was unsuccessful, our original plan in the pre-registration was to recruit additional paid participants via Clickworker, an online platform from which one can recruit survey participants. As previously discussed, to have both American and German paid participants sourced from the same platform, we instead decided to recruit additional participants via Prolific in July 2019, who were paid a modest sum for their time.

3.2. Sample characteristics

A total of 536 participants began the survey (236 via Facebook, 300 via Prolific). After discarding those who failed the attention check (18 in the vegetarian label condition, 2 in the vegan label condition, and 25 in the plant-based label condition), the final sample size was 491 (218 via Facebook, 273 via Prolific).

The final sample consisted largely of women (64%). Participants ranged in age from 18 to 69 ($M_{age} = 31.16$, $SD_{age} = 10.88$). Most participants (60%) had a combined annual household income of less than €40,000. There was wide variation in educational attainment, with almost half the sample (45%) having completed at least some university. Most of the sample (73%) identified as omnivores, and many participants (59%) reported being the primary decision maker in purchasing groceries for their household (see Table 1 for more detailed demographics).

As we did not reach our target sample size of 1050 (as specified in Study 1), we conducted a sensitivity power analysis. Using G*Power 3.1.9.2 (Faul et al., 2009), we determined that a sample size of n = 491 would have 80% power to detect an effect size of $f = 0.14$ or higher at $\alpha = 0.05$ in a between-subjects ANOVA with three groups, which was close to our initial target of $f = 0.10$.

3.3. Procedure

The procedure used with the German sample was the same as for the USA sample.

3.4. Materials

The materials were initially developed in English for Study 1, then translated and back-translated by two English-German bilinguals for Study 2, with any discrepancies resolved via discussion. The final materials were double-checked by the chief investigator, who is also an English-German bilingual. Participants in Germany were given the questionnaire in German via Qualtrics, which contained the same materials as Study 1.

3.5. Results

3.5.1. Data analysis

The cutoff for statistical significance for all tests was $p < 0.05$, except for the correlation analyses, which we set at $p < 0.001$ because of the large number of correlations. Skewness and kurtosis values for all variables used in the following analyses were within acceptable parameters (Kim, 2013). Internal reliability was acceptable for information seeking ($\alpha = 0.74$) and excellent for attitudes toward plant-based foods ($\alpha = 0.82$). Our coding and analytic approach was identical to that of Study 1. As in Study 1, for all ANOVAs, Mauchly's test indicated that the assumption of sphericity had been violated ($p < 0.001$), so we used Greenhouse-Geisser corrections for within-subject effects. An overview

Table 3
German evaluations of "vegetarian", "vegan", and "plant-based" food products.

	Vegetarian		Vegan		Plant-based	
	$n = 158$		$n = 177$		$n = 156$	
	M	*SD*	*M*	*SD*	*M*	*SD*
Healthy	**0.26**	**0.89**	**0.10**	**0.93**	**0.32**	**0.88**
Sausages	0.36	1.60	0.29	1.61	0.58	1.59
Cheese	0.15	1.24	−0.24	1.47	0.17	1.35
Cookies	0.34	0.97	0.18	1.13	0.33	1.04
Pasta	0.25	0.99	0.08	1.02	0.23	0.95
Chocolate	0.20	0.80	0.18	1.09	0.28	0.97
Tasty	**−0.41**	**0.90**	**−0.64**	**1.17**	**−0.20**	**1.05**
Sausages	−0.90	1.76	−0.89	1.74	−0.38	1.73
Cheese	−0.33	1.27	−0.90	1.84	−0.40	1.56
Cookies	−0.33	1.07	−0.48	1.29	−0.03	1.19
Pasta	−0.12	0.93	−0.26	0.99	−0.04	0.94
Chocolate	−0.35	1.22	−0.65	1.53	−0.15	1.25
Ethical	**0.47**	**1.13**	**0.38**	**1.47**	**0.62**	**1.34**
Sausages	0.96	1.89	0.68	2.04	0.86	1.91
Cheese	0.50	1.39	0.31	1.78	0.65	1.55
Cookies	0.25	1.15	0.40	1.51	0.63	1.45
Pasta	0.30	1.14	0.15	1.29	0.36	1.29
Chocolate	0.34	1.10	0.34	1.53	0.58	1.42
Pure	**0.16**	**0.90**	**0.10**	**0.92**	**0.35**	**0.98**
Sausages	0.25	1.48	0.20	1.45	0.46	1.41
Cheese	0.13	1.21	−0.18	1.50	0.27	1.34
Cookies	0.14	0.93	0.21	1.00	0.46	1.08
Pasta	0.13	1.00	0.05	0.99	0.32	1.02
Chocolate	0.15	0.96	0.23	1.12	0.26	1.23
Environmentally-friendly	**0.43**	**1.02**	**0.36**	**1.25**	**0.56**	**1.24**
Sausages	0.82	1.72	0.66	1.76	0.74	1.70
Cheese	0.39	1.32	0.33	1.49	0.55	1.50
Cookies	0.32	1.14	0.36	1.35	0.57	1.35
Pasta	0.27	1.09	0.18	1.27	0.39	1.17
Chocolate	0.36	1.06	0.25	1.31	0.54	1.31
Purchasing Likelihood	**−0.22**	**1.51**	**−0.48**	**1.56**	**0.29**	**1.59**
Sausages	−0.52	2.27	−0.53	2.20	0.21	2.17
Cheese	−0.08	1.93	−0.85	2.09	0.09	2.00
Cookies	−0.23	1.69	−0.26	1.87	0.47	1.78
Pasta	0.03	1.65	−0.37	1.69	0.32	1.75
Chocolate	−0.28	1.80	−0.40	1.91	0.36	1.79

Note. All values are compared to an otherwise visually identical, unlabeled product. Possible scores ranged from −3 (unlabeled product is much better) to 3 (labeled product is much better).

of means and standard deviations by product and label is provided in Table 3.

3.5.2. Impact of V-labels

3.5.2.1. Healthy. There was a significant effect of product, $F(3.28, 1601.87) = 11.50$, $p < 0.001$, but neither the effect of label, $F(2, 488) = 2.72$, $p = 0.067$, nor the interaction between label and product were significant, $F(6.57, 1601.87) = 1.54$, $p = 0.155$. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 2.13$, $p = 0.076$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 1.25$, $p = 0.287$.

3.5.2.2. Tasty. There was a significant effect of label, $F(2, 488) = 7.12$, $p < 0.001$, a significant effect of product, $F(3.52, 1715.23) = 24.12$, $p < 0.001$, and a significant interaction between label and product, $F(7.03, 1715.23) = 3.55$, $p = 0.004$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly tastier than the vegan products ($p < 0.001$, $d = 0.40$), but the difference between the vegetarian and vegan products ($p = 0.114$, $d = 0.22$), and the difference between vegetarian and plant-based products ($p = 0.196$, $d = 0.21$) were not significant. Simple effects analyses run within each of the products revealed a significant effect of label for sausages ($p = 0.010$), cheese ($p = 0.001$), cookies ($p = 0.002$), and chocolate ($p = 0.003$), but not for pasta ($p = 0.113$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 1.49$, $p = 0.205$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 0.35$, $p = 0.844$.

3.5.2.3. Ethical. The effect of label was not significant, $F(2, 488) = 1.34$, $p = 0.252$, but there was a significant effect of both product, $F(3.15, 1535.98) = 30.14$, $p < 0.001$, and the interaction between label and product, $F(6.30, 1535.98) = 2.49$, $p = 0.019$. Simple effects analyses run within each of the products indicated a significant effect of label for cookies ($p = 0.048$), but not for cheese ($p = 0.143$), pasta ($p = 0.268$), chocolate ($p = 0.188$), or sausages ($p = 0.416$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 0.71$, $p = 0.583$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 1.98$, $p = 0.096$.

3.5.2.4. Pure. There was a significant effect of label, $F(2, 488) = 3.31$, $p = 0.037$, a significant effect of product, $F(3.45, 1688.91) = 2.04$, $p < 0.001$, and a significant interaction between label and product, $F(6.92, 1688.91) = 1.70$, $p = 0.048$. Tukey post hoc analyses indicated that the plant-based products were seen as significantly purer than the vegan products ($p = 0.035$, $d = 0.26$), but neither the difference between plant-based and the vegetarian products ($p = 0.155$, $d = 0.20$), nor the difference between vegan and vegetarian products ($p = 0.826$, $d = 0.07$) were significant. Simple effects analyses run within each of the products indicated a significant effect of label for cookies ($p = 0.014$), cheese ($p = 0.009$), and pasta ($p = 0.041$), but not for chocolate ($p = 0.664$) or sausages ($p = 0.219$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 0.50$, $p = 0.736$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 0.40$, $p = 0.808$.

3.5.2.5. Environmentally-friendly. There was a significant effect of product, $F(3.34, 1628.70) = 21.71$, $p < 0.001$, but neither the effect of label, $F(2, 488) = 1.23$, $p = 0.294$, nor the interaction between label and product was significant, $F(6.67, 1628.70) = 1.04$, $p = 0.403$. Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 0.85$, $p = 0.496$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 1.60$, $p = 0.173$.

3.5.2.6. Likelihood of purchasing. There was a significant effect of label, $F(2,488) = 10.40$, $p < 0.001$, a significant effect of product, $F(3.62, 1768.05) = 5.85$, $p < 0.001$, and a significant interaction between label and product, $F(7.25, 1768.05) = 3.18$, $p = 0.002$. Tukey post hoc analyses indicated that participants were significantly more likely to purchase the plant-based products than both the vegan products ($p < 0.001$, $d = 0.49$) and the vegetarian products ($p = 0.012$, $d = 0.33$), but the difference between the vegetarian and vegan products was not significant ($p = 0.262$, $d = 0.17$). Simple effects analyses run within each of the products indicated a significant effect of label for cookies ($p < 0.001$), cheese ($p < 0.001$), pasta ($p < 0.001$), chocolate ($p < 0.001$) and sausages ($p = 0.003$). Running the ANOVA with the inclusion of label information seeking level did not reveal a significant interaction between label and information seeking, $F(4, 482) = 1.52$, $p = 0.197$. Similarly, running the ANOVA with the inclusion of plant-based food attitudes level did not reveal a significant interaction between label and plant-based food attitudes, $F(4, 482) = 1.16$, $p = 0.330$.

3.5.2.7. Correlations between information seeking, plant-based food attitudes, and product evaluations. A full account of these correlations is provided in Table S2 in the Supplementary Materials.

Label information seeking was only significantly correlated with the absolute value of two product evaluation variables, Healthy: Cheese (+) and Tasty: Cookies (−). As an additional (exploratory) analysis, we also correlated label information seeking scores with all product evaluation variables. The only significant correlation was with Tasty: Cookies (+).

Plant-based food attitudes scores were significantly and positively associated with the tasty and purchasing likelihood variables for all products at $p < 0.001$ (r ranging from 0.15 to 0.30).

4. Discussion

The present work aimed to compare the effect of vegan, vegetarian, and plant-based labels on consumer appraisal and likelihood of purchasing a range of food products that are typically fully animal-based (cheese, sausages), or contain small to no amounts of animal-sourced ingredients (cookies, chocolate, pasta). The first study (US sample) yielded an overall coherent pattern of results, such that the plant-based label led to higher ratings in all product traits (healthy, tasty, ethical, pure, environmentally-friendly), compared to the vegan and/or vegetarian labels. This was also the case with the likelihood of purchasing the labeled food products (i.e., higher for the plant-based vs vegan and vegetarian labels). Contrary to our expectations, information seeking and attitudes toward plant-based foods did not moderate the effect of label type on consumer perceptions of food products. This means that the different nomenclatures affected consumer appraisals in similar ways, irrespective of consumer differences in these two variables. Nevertheless, we observed overall positive associations between information seeking, attitudes toward plant-based foods, and the appraisals of labeled products. This suggests that in the US sample, consumers who were more likely to notice labels when they are acquiring food products (e.g., checking logos/symbols in the package, looking for nutrition information, reading ingredients lists; Grunert et al., 2014) also tended to perceive (vegan, vegetarian, plant-based) labeled products as healthier,

tastier, more ethical, purer, and more sustainable. These consumers also showed higher scores in likelihood to purchase these products, and the same was observed in consumers with more favorable attitudes toward plant-based eating.

The findings with the German sample were similar but the differences between (vegan, vegetarian, plant-based) nomenclatures were smaller and less consistent. Most products with the plant-based label were seen as tastier, purer, and as more likely to be purchased, compared to the vegan and vegetarian labels. However, there were almost no differences between the three labels in the other product traits (healthy, ethical, environmentally-friendly). As in Study 1, no moderation effects of information seeking and attitudes toward plant-based foods emerged. We also found positive associations between attitudes toward plant-based eating and appraisals of labeled products, but only for tastiness and purchasing likelihood. Regarding information seeking, the associations were overall small and/or non-significant with all product traits.

Combining the two samples, the proportion of respondents who said they would definitely choose the V-labeled sausage varies from 4.6% among those who saw the vegetarian label to 6.1% among those who saw the plant-based label. Although this may seem like a small change, if it directly translated to consumer behavior, it would reflect a 33% increase in sales from just substituting the word "Vegetarian" with "Plant-based" on the label. For some consumers, the V-labels have a negative effect – 9.5% of the respondents who saw the vegan label (8.5% for the vegetarian label) said they would definitely choose the sausage with no label. This negative effect is much smaller for the plant-based label as only 4.9% of respondents said they would definitely choose the non-labeled sausage.

Taken as a whole, the findings from the two studies suggest that differences between the vegan, vegetarian, and plant-based nomenclatures used to label food products did not always matter – but when they did, the plant-based label appeared to gain some advantage. One possible interpretation for these findings can be drawn from recent theoretical propositions on Moralized Minority Practice Identities (MMPIs), which have been discussed regarding plant-based eating and other sustainable practices (Kurz et al., 2020). Food consumption practices often reflect general consumption orientations and convey social identities (Graça et al., 2019; Rosenfeld et al., 2020), and the MMPI model of social change proposes that sustainable practices are often connotated with social minorities and bounded in social identities. This may arguably make these practices unattractive to the members of the general public who do not want to identify with these minorities. The corollary is that efforts to make sustainable food practices the new norm (instead of an established niche) should focus mostly on providing context and infrastructure that enables widespread engagement with the practice, without people having to commit to a new social identity (see Kurz et al., 2020). Considering these propositions, one interpretation to our findings is that the vegan and vegetarian nomenclatures may have been seen as more exclusive and identity-prescriptive by the participants in our samples, whereas the products that were labeled as plant-based may have been seen as more inclusive and therefore more attractive. This is also consistent with recent findings that vegetarian dishes were less likely to be chosen when they were framed as vegetarian, compared to a pro-environmental frame, a social frame, and a neutral frame (i.e., vegetarian and non-vegetarian dishes mixed into the same section of the menu; Krpan & Houtsma, 2020, but see Parkin & Attwood, 2022; Rosenfeld et al., 2022). Available reports by the food industry also show that the sales of plant-based food products like meat analogues tend to increase when these products are placed and displayed in the same section or department as their animal-sourced counterparts (e.g., PBFA, 2020, 2022). Nevertheless, the vegan and vegetarian movements have been identified as pivotal in enabling normative contestation to meat-centric diets and supporting the emergence of a market for meat alternatives in industrialized western societies (Tziva et al., 2020). Thus, we reinforce previous calls for further research on immediate and longer-term trade-offs of emphasizing either practice-based or identity-based approaches for enabling plant-based eating and sustainable food consumption in general (Kurz et al., 2020).

Another relevant contribution of this work was to observe how (vegan, vegetarian, plant-based) labeled food products were perceived relative to their unlabeled counterparts. More specifically, we examined how a set of product traits (i.e., healthy, tasty, ethical, pure, and environment-friendly) accounted for variance in likelihood of purchasing labeled (vs unlabeled) products. This is useful because understanding how specific product traits shape the likelihood of purchasing labeled products may help inform strategies, frames, and materials for targeted communication of these products. Here, the overall pattern of findings was almost identical in both samples. Taste was identified as a strong and consistent predictor of purchasing likelihood in all labeled products in both the US sample and in the German sample. This was not surprising given that perceived hedonic value is known to be one of the most robust determinants of plant-based food choice (Caputo et al., 2023; Giacalone et al., 2022; Graça et al., 2019). This also reinforces the notion that perceived hedonic value (or lack thereof) plays an important role in how (vegan, vegetarian, plant-based) labeled products are perceived outside of plant-oriented consumer segments. Indeed, a recent consumer survey in 10 EU countries on perceptions of barriers to plant-based food consumption indicated that omnivores were particularly likely to be concerned that plant-based foods would not be as tasty and filling as they would like, and that they would not enjoy eating them (Perez-Cueto et al., 2022).

The traits ethical and pure also consistently accounted for unique variance in purchasing likelihood in both samples, which implies that these traits were also relevant and self-standing features in how consumers appraised labeled products vis-à-vis purchasing likelihood. This is in line with other studies showing that consumers tend to favor food products that are perceived as more natural (Roman et al., 2017; Siegrist & Hartmann, 2020) and suggests that a halo effect eventually triggered by the labels may have linked the traits pure and ethical with the likelihood of purchasing these products. These findings also suggest that the traits pure and ethical may be leveraged as potentially relevant selling points to frame and communicate (vegan, vegetarian, plant-based) labeled products.

Lastly, as for the traits environment-friendly and healthy, these were identified as relatively weak and less consistent predictors of purchasing likelihood when taken together with the other traits. Perceived healthfulness in particular was as unique (weak) predictor of this outcome variable in only two products in the US sample (sausages, chocolate), and one product in the German sample (cheese). On the one hand, this was surprising considering extensive evidence that health and environmental motives are among the main determinants of plant-based eating (Dagevos, 2021; Hopwood et al., 2020, 2021). On the other hand, this can perhaps be partly explained by the set of products that we used in both studies. We selected a set of five food products that covered diverse product categories – i.e., sausages, cheese, cookies, chocolate, and pasta. Coincidentally, all these products may to a certain extent be associated with 'comfort food', which may have activated a more hedonically oriented mindset when consumers were asked to appraise the products. The influence of health and environmental motives on purchasing likelihood may have been diminished in favor of other product traits that were possibly more salient – especially perceived tastiness, but also the traits ethical and pure. More research is necessary to expand on these possibilities and support (or disprove) this interpretation, which could have implications for how to frame and communicate (vegan, vegetarian, plant-based) labeled products across different product categories. In addition to including more food products, future studies testing the impact of labels and different label nomenclatures should favor field-experiments to increase the external and ecological validity of their findings. Although this study is not focused on a strict-cross cultural comparison of attitudes toward plant-based foods in the USA, future research in this domain, particularly that which utilizes

nationally representative samples, would be valuable.

As in other studies on this topic, one important limitation with the current work is that we did not use real food products to operationalize the labels, and instead developed the stimuli using images of food products from image banks. This allowed us to avoid potential confounders with brand-specific variables and previous experience with the products, as well as to standardize the stimuli across the two studies, but had the tradeoff of limiting the ecological validity of the study materials. It is also important to replicate our findings with samples from diverse cultural contexts and include other potentially relevant moderators in addition to information seeking and attitudes toward plant-based foods. Another limitation is that we did not clearly define what we meant when asking participants to report how "pure" they perceived the food products to be. This allowed participants to fill the concept with their own understanding of purity, which could mean, for example, being free of harmful additives or pesticides, non-GMO, or non-industrial.

Our sample in Germany has an overrepresentation of vegetarians and vegans (10% and 6%, respectively, compared to country-level estimates of 6% vegetarian and 1% vegan; Bundesministerium for Ernährung und Landwirtschaft, 2019), which may mean that attitudes toward plant-based foods are not quite as positive in the general population. However, because the proportion of people in Germany eating plant-based appears to be increasing every year (8% vegetarian and 2% vegan; Bundesministerium for Ernährung und Landwirtschaft, 2023a), it is possible that average attitudes toward plant-based foods continue to grow more positive. Although a recent review of the English-language literature indicated that consumers were much less aware than market stakeholders of the environmental consequences of a shift toward alternative proteins (Amato et al., 2023) it is possible that this awareness gap is less pronounced in Germany for both environmental and animal ethics consequences. In 2023, the German federal government introduced a mandatory animal husbandry label, which tells consumers whether an animal has been raised in one of five different conditions: indoor housing; indoor + space; indoor with fresh air; outdoor runs/pasture; and organic (Bundesministerium for Ernährung und Landwirtschaft, 2023b). It will be useful for researchers to investigate whether this translates into changes in consumer behavior.

To conclude, there have been calls for research on how to promote plant-based food products and practices in ways that appeal to increasingly larger numbers of consumers. This is important to help shift current market structures that still reinforce the excessive consumption of animal-sourced products, especially in industrialized western societies. The use of labels together with other interventions to reshape food consumption and acquisition settings has been proposed as a potentially promising approach, but there is still a lack of knowledge on how consumers may react to plant-based related labels and to different label terminologies. The current findings suggest that a 'plant-based' label may be more appealing to general audiences when compared to 'vegetarian' and a 'vegan' label, but information seeking (i.e., tendency to look for product-related details when acquiring food products) and attitudes toward plant-based food were positively related with more favorable product appraisals and purchase likelihood across the three conditions (i.e., vegan, vegetarian, and plant-based labels), especially in the US sample.

Ethical statement

This research project was approved by the La Trobe University Human Research Ethics Committee (approval #HEC18268). Participants gave informed consent before taking part.

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CRediT authorship contribution statement

Matthew B. Ruby: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **João Graça:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Eero Olli:** Writing – review & editing, Methodology, Formal analysis.

Declaration of competing interest

At the time of data collection, E.O. worked for ProVeg International. They had no influence on our analyses or on our decision to publish our research.

Data availability

Materials and data are available via the OSF (https://osf.io/me6h5/?view_only=1b4a1e31e94d4da3821dcdc782e986c6).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2024.107288.

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