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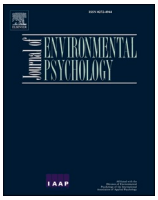

Don't say "vegan" or "plant-based": Food without meat and dairy is more likely to be chosen when labeled as "healthy" and "sustainable"

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ABSTRACT

Eating less meat and dairy is healthy and environmentally sustainable, but food labeled as "vegan" is relatively unpopular. Here, we examined the effect of different labels for promoting choices for food without meat and dairy, among a representative U.S. sample (N = 7341). Participants chose between one gourmet food gift basket without meat and dairy and another with meat and dairy that were available from an actual online store. They were randomly assigned to one of five conditions, in which the gourmet food gift basket without meat and dairy was labeled as "vegan", "plant-based," "healthy," "sustainable," or "healthy and sustainable." Ten participants were randomly selected to receive the gourmet food gift basket of their choice. Overall, the gourmet food gift basket without meat and dairy was less likely to be chosen when its label focused on its content (stating "vegan" or "plant-based") rather than on its benefits (stating "healthy", "sustainable" or both). Specifically, the "plant-based" label did only slightly better than the "vegan" label, leading, respectively, to 27% and 20% of participants choosing the gourmet food gift basket without meat and dairy. However, 42% of participants chose the gourmet food gift basket without meat and dairy when it was labeled "healthy," 43% when it was labeled "sustainable," and 44% when it was labeled "healthy and sustainable." This labeling effect was consistent across socio-demographics groups but was stronger among self-proclaimed red-meat eaters. Labels provide a low-cost intervention for promoting healthy and sustainable food choices.

1. Introduction

Limiting meat and dairy intake and eating more fruit and vegetables is better for people's health (Springmann et al., 2018; Willett et al., 2019), because it reduces the risk of cardiovascular diseases (Aune et al., 2017; Dauchet, Amouyel, Hercberg, & Dallongeville, 2006), type 2 diabetes (Cooper et al., 2012; P. Y. Wang, Fang, Gao, Zhang, & Xie, 2016) and cancer (Aune et al., 2017; Jansen et al., 2009). Diets with less meat and dairy are also more environmentally sustainable because they have lower impact on climate change, referred to as a smaller "carbon footprint" (Springmann et al., 2018; Willett et al., 2019). Indeed, meat and dairy products contribute 72%–78% of global food-related greenhouse-gas emissions (Gerber et al., 2013) and 14.5% of total global emissions (Gerber et al., 2013). Therefore, health recommendations from the Dietary Guidelines for Americans (CDC, 2021; USDA & HHS, 2020), American Heart Association (Lichtenstein et al., 2021), American Institute for Cancer Research (AICR, 2022), and sustainability recommendations from the International Panel for Climate Change (IPCC) (IPCC, 2019) encourage the urgent adoption of diets that include less meat and more fruit and vegetables (Clark et al., 2020; Kimani-Murage et al., 2021; D. R. Williams et al., 2020).

Yet, labeling food products or menu items as "vegan" may be considered off-putting: an online study of hypothetical food choices with Danish meat eaters found that adding the label "vegan" or "plant-based" to a dish without meat and dairy (vs. using no label) made it less likely to be selected from a menu that also included meat dishes (Hielkema & Lund, 2022). An Italian online study found greater self-reported willingness to buy food without meat and dairy when labels said

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"plant-based" rather than "vegan" (Demartini, Vecchiato, Finos, Mattavelli, & Gaviglio, 2022). Possibly, this relatively low appeal of the label "vegan" reflects the negative perceptions expressed in focus groups with American meat eaters, who said: "If I became a vegan, my family and friends would hate me" (Markowski & Roxburgh, 2019). An online study in Germany suggested that intentions to buy products labeled as "vegan" (vs. not) may be undermined by negative perceptions of taste, and increased by positive perceptions of health benefits (Stremmel, Elshiewy, Boztug, & Carneiro-Otto, 2022). Of course, one drawback of these labeling studies is that they reflect hypothetical food choices.

A study that examined actual rather than hypothetical sales in a University of California cafeteria found that dishes without meat and dairy accounted for 0.24% of all purchases when they were labeled as "vegan" and 0.19% of all purchases when they were labeled as "plant-based" (Rosenfeld, Bartolotto, & Tomiyama, 2022). Thus, these actual choices slightly favored the label "vegan" over "plant-based" (Rosenfeld et al., 2022) which contrasts the finding of the above-mentioned Italian online study with hypothetical choices (Demartini et al., 2022). It is possible that visitors of university cafeteria in California perceived the term "vegan" relatively less negatively as compared to Italian adults. It has also been suggested that the relative appeal of "vegan" over "plant-based" labels may reflect diners' confusion about what they are getting when choosing "plant-based" food (Storz, 2022; K. A. Williams & Patel, 2017). Some have defined "plant-based" diets as rich in fruit and vegetables while excluding all animal products (Freeman et al., 2017). In contrast, others have defined "plant-based" as including some dairy, fish, and poultry (Shikany et al., 2015).

Initial evidence suggests that food products without meat and dairy might be preferred if labels focus on the health benefits (Aschemann & Hamm, 2009; Ballco & Gracia, 2022; Fernandes et al., 2016; Lassen et al., 2014). As noted, an online study in Germany suggested that intentions to buy vegan products may be associated with positive perceptions of health benefits (Stremmel et al., 2022). A laboratory study in Germany found that food products with health labels were preferred over food products without health labels (Aschemann & Hamm, 2009). A review of research on actual food choices found that calorie labeling in itself had little to no effect on sales of healthy dishes (Bleich et al., 2017; Fernandes et al., 2016), but that using health labels to flag low-calorie dishes increased actual (Fernandes et al., 2016) and intended purchases of healthy food (Ballco & Gracia, 2022). For example, a study of actual food choices in Danish hospital cafeteria found that adding health labels in an intervention cafeteria increased choices of healthy food options as compared to a control cafeteria in which no health labels were added (Lassen et al., 2014).

There is also initial evidence that food without meat and dairy may be preferred if labels focus on the environmental benefits (Krpan & Houtsma, 2020; Visschers & Siegrist, 2015). An online study of hypothetical food choices with people in the United Kingdom found that vegetarian dishes were selected more often when they were labeled as "environmentally friendly main courses for a happy planet" rather than as "vegetarian main courses" (Krpan & Houtsma, 2020). Furthermore, a study of actual food choices in a Swiss university cafeteria found that adding "climate-friendly" labels to dishes with lower carbon footprints during an intervention period increased their purchases to 56%, from 46% in the no-label pre-intervention period (Visschers & Siegrist, 2015). However, a study in a Norwegian university cafeteria found no effect of similar labels (Slapø & Karevold, 2019).

One limitation of research on the effects of labels on choosing food without meat and dairy is that studies have mostly focused on hypothetical choices. Those studies that focused on actual choices have been conducted in university cafeteria that predominantly serve students. Individuals with a college degree tend to consume more fruit and vegetables as well as less red meat than individuals without a college degree (Tonsor, Lusk, & Schroeder, 2023; Y. Wang & Beydoun, 2009). Because red meat consumption in most middle- and high-income countries including the United States is much higher than is considered healthy or sustainable (Springmann et al., 2018; Willett et al., 2019), it is important to identify labeling interventions that are effective for people with different socio-demographic backgrounds as well as people with different eating identities, including meat eaters (Bryan, Tipton, & Yeager, 2021). Higher meat consumption and lower fruit and vegetable consumption are also found among individuals who self-report being men (vs. not), Black or African American (vs. White) (Tonsor et al., 2023; Y. Wang & Beydoun, 2009), younger (vs. older) (Daniel, Cross, Koebnick, & Sinha, 2011) and having conservative (vs. liberal) in their political views (Kannan & Veazie, 2018; Nezlek & Forestell, 2020). Eating identities also play a role in food choices: Individuals who identify as meat eaters (vs. not) tend to report eating more meat (Sleboda, Bruine de Bruin, Arangua, & Gutsche, 2022), and express less interest in limiting red meat consumption (Carfora, Caso, & Conner, 2017; Wolstenholme, Carfora, Catellani, Poortinga, & Whitmarsh, 2021). Additionally, individuals who identify as healthy eaters (vs. not) tend to eat less meat (Sleboda et al., 2022) and tend to be more responsive to nutritional interventions (Kendzierski, 2007).

Building on the reviewed literature, we present a national food choice experiment that examined labeling strategies for promoting choices of food without meat and dairy. Specifically, we aimed to address limitations of previous research by asking participants from a large representative U.S. sample to choose between a gourmet food gift basket without or with meat and dairy, available from an actual online store. They were randomly assigned to different labels associated with the gourmet food gift basket without meat and dairy. Specifically, we compared labels that stated the "vegan" or "plant-based" content with labels that state the benefits of being "healthy" and "sustainable." We randomly selected 10 participants to receive the food basket of their choice.

Specifically, we examined:

1 Are people more likely to choose a gourmet food gift basket without meat and dairy (over a gourmet food gift basket without meat and dairy) when it is labeled as "vegan", "plant-based", "healthy", "sustainable", or "healthy and sustainable"?
2 Do labeling effects vary across socio-demographic groups and political affiliations?
3 Do labeling effects vary across self-proclaimed eating identities?

2. Materials and methods

2.1. Participants

Our study was conducted as part of the Understanding America Study (UAS), which is a probability-based Internet panel with about 10,000 individuals 18 and older (Alattar, Messel, & Rogofsky, 2018). UAS members were recruited through random address-based sampling and are representative of the national U.S. population (Alattar et al., 2018). They received a tablet and broadband Internet if needed (Alattar et al., 2018). On average, UAS members participants complete two online surveys a month. Surveys are typically administrated in English and Spanish. Respondents receive about $20 for every 30 min of survey time.

In total, 10,090 UAS members were invited to participate in our study. Of those, 7577 (75%) completed the measures relevant to our study. The demographic characteristics of our sample are in line with the demographic characteristics of the US population as estimated by the US Census 2020, before and after applying poststratification weights (Table S1). These poststratification weights were created through a raking algorithm that aligned sample statistics with U.S. population statistics in terms of gender, race and ethnicity, age, education, and geographic location (Alattar et al., 2018).

2.2. Procedure

In a national food choice experiment, participants were asked to

choose between two gourmet food gift baskets as a thank-you for their participation in the Understanding America Study (Fig. 1). Participants were told that ten participants would be randomly selected to receive the gourmet food gift basket of their choice. Participants received no information about their chances of receiving the gourmet food gift basket of their choice, or about the number of people that would be invited to our study.

The two gourmet food gift baskets we presented were taken from an actual online store (Fig. S1 and Fig. S2). One gourmet food gift basket contained no meat and dairy while the other did contain meat and dairy. The two gourmet food gift baskets were presented in counterbalanced order. To examine labeling effects, we randomly varied the label of the gourmet food gift basket without meat and dairy to state that it was: (1) "vegan", (2) "plant-based", (3) "healthy", (4) "sustainable", or (5) "healthy and sustainable". In the actual online store, the gourmet food gift basket without meat and dairy was labeled as "healthy" with a more detailed description stating that its content was "vegan." In addition to the randomly varied label, all participants received a brief description of the items included in each gourmet food gift basket, taken from the online store (Figs. S1–2). The gourmet food gift basket without meat and dairy was described as including "sweet and savory snacks, dried fruits, olives, and hummus spread." The gourmet food gift basket with meat and dairy included "sweet and savory snacks, salami, brie cheese, and pepper-feta spread."

Our comparison of the items in the two gourmet food gift baskets suggested that the content of the gourmet food gift basket without meat and dairy was indeed healthier, in terms of containing fewer calories and carbs, more fiber, less fat, less saturated fat, less cholesterol, and less sodium – though it did have less protein than the gourmet food gift basket with meat and dairy. The gourmet food gift basket without meat and dairy was also more sustainable, in terms of having a lower carbon footprint, overall and per 1000 calories, as computed with two separate online carbon footprint calculators (Tables S4–S5). Participants in each condition were told that the two gourmet food gift baskets were "worth about the same." In the online store, the gourmet food gift basket without meat and dairy sold for $95.95 at the time of our study, while the gourmet food gift basket with meat and dairy sold for $86.95.

To assess whether labeling effects varied by eating identity, we asked

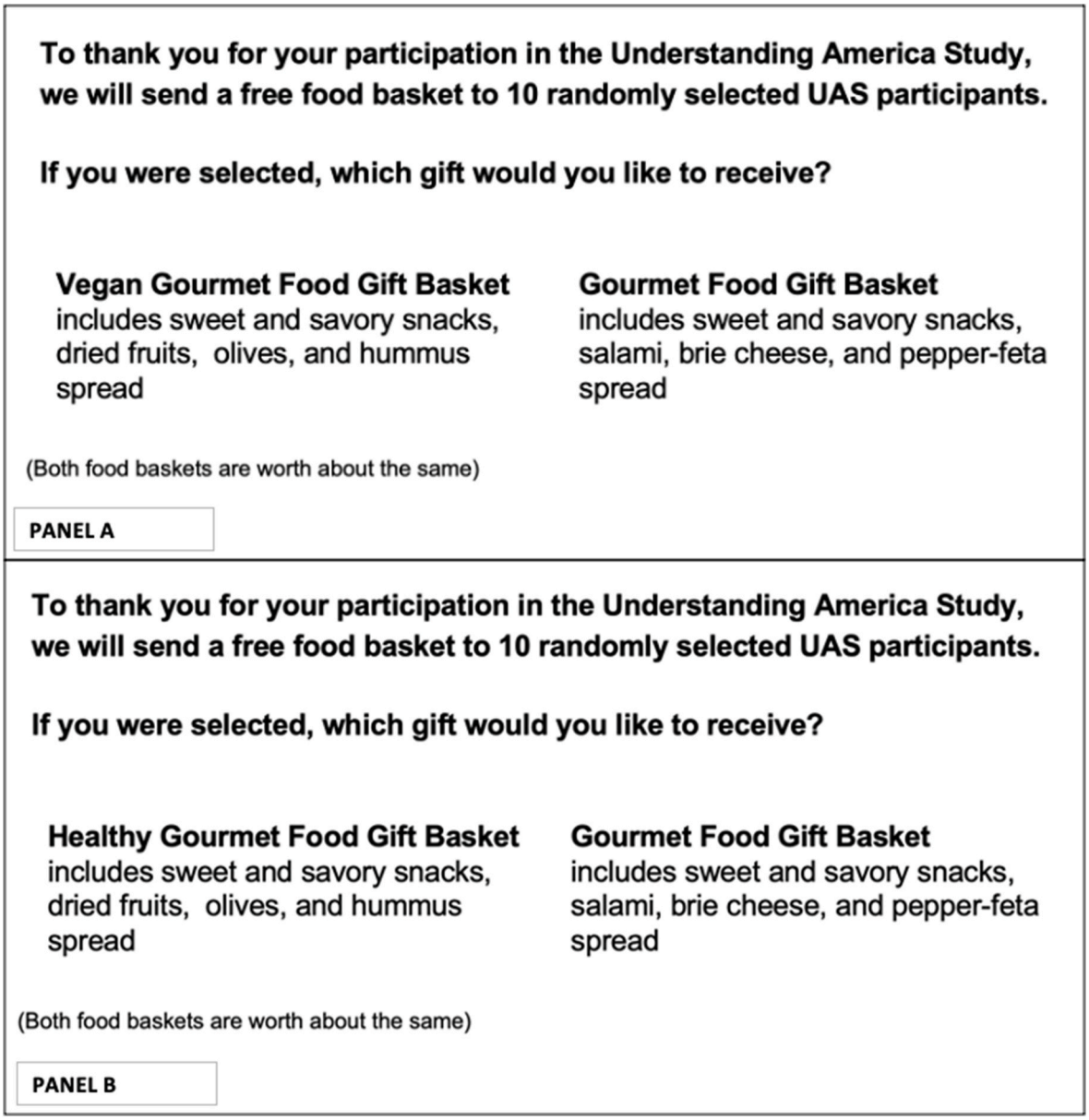

Fig. 1. Food choice presented to participants in the condition in which the gourmet food gift basket was labeled as "vegan" (PANEL A) and "healthy" (PANEL B).

participants to indicate their agreement with the following statements: (1) I am someone who eats red meat; (2) I am a healthy eater; and (3) I am someone who eats vegan. To each of these items, participants could respond Yes, No or Don't know. All responses were dichotomized to represent answering yes (coded as 1) or no or don't know (coded as 0). Other related eating identities were assessed but were excluded from our analyses to avoid multicollinearity (Table S1). Overall, 86% (in both weighted and unweighted analyses) of participants in our sample identified as a red-meat eater, 59% (in weighted and 62% in unweighted analyses) as a healthy eater and 7% (in both weighted and unweighted analyses) as a vegan eater.

2.3. Data analysis

Our first research question asked: Are people more likely to choose a gourmet food gift basket without meat and dairy (over a gourmet food gift basket without meat and dairy) when it is labeled as "vegan", "plant-based", "healthy", "sustainable", or "healthy and sustainable"? To answer this research question, we conducted logistic regression models predicting whether or not participants chose the gourmet food gift basket without meat and dairy, using its randomly assigned label as the main predictor (Table 1). Specifically, we examined whether the gourmet food gift basket without meat and dairy was more likely to be chosen when the label said "plant-based", "healthy", "sustainable", or "healthy and sustainable" (vs. "vegan"). Thus, the "vegan" label was used as the reference category. The model controlled for demographics including gender (male vs. not), age (treated as a continuous variable), ethnicity (either non-Hispanic Black, Hispanic, Asian, or non-Hispanic other vs. non-Hispanic White), education (no college degree vs. college degree), income (below-median vs. above-median), and political affiliation (Biden-voters, Trump-voters vs. Independent or non-voters) as well as red-meat (vs. not) eating identity, healthy (vs. not) eating identity, and vegan (vs. not) eating identity.

Our second research question asked whether labeling effects vary across socio-demographic groups and political affiliations, and our third research question asked whether labeling effects vary self-proclaimed eating identities. To examine these research questions, we added interactions to the regression model in Table 1, for each label (vs. vegan) by gender, age, race/ethnicity, college degree, political affiliation, and eating identities (Table 2).

All presented analyses used poststratification weights. As noted, poststratification weights were created through a raking algorithm that aligned sample statistics with U.S. population statistics in terms of gender, race and ethnicity, age, education, and geographic location (Alattar et al., 2018). Because there is a debate in the literature about the usefulness of using weights in regression analyses (Bollen, Biemer, Karr, Tueller, & Berzofsky, 2016; F. Wang, Wang, & Yan, 2023), all analysis were also performed with unweighted data. Unweighted analyses are presented in the Supplementary Material. Statistical significance was defined as $p < 0.05$. All analyses were conducted using SPSS version 28.

Table 1
Logistic regressions modeling effects of labels on participants' likelihood of choosing the gourmet food gift basket without meat and dairy.

Predictor	B	*SE* (B)	Wald test	Odds ratio	95% Cl for Odds Ratio	*p*-value
Plant-based label (vs. vegan)	0.45	0.09	22.81	1.56	1.30, 1.87	<.001
Healthy label (vs. vegan)	1.11	0.09	154.15	3.04	2.55, 3.63	<.001
Sustainable label (vs. vegan)	1.16	0.09	169.65	3.20	2.68, 3.81	<.001
Healthy and sustainable label (vs. vegan)	1.25	0.09	193.60	3.50	2.93, 4.18	<.001
Model summary	Nagelkerke $R^2 = 0.16$; $\chi 2\ (2) = 920.46$; $p < 0.001$					

Note: B = log odds, SE(B) = standard error, Odds Ratio = Exp (B). CI=Confidence Interval. Poststratification weights were used (weighted N = 7341). This model controlled for eating identities and demographics. For full model, see Table S3. For unweighted analysis see Table S4.

3. Results

Are people more likely to choose a gourmet food gift basket without meat and dairy (over a gourmet food gift basked without meat and dairy) when it is labeled as "vegan", "plant-based", "healthy", "sustainable", or "healthy and sustainable"?

We found that the gourmet food gift basket without meat and dairy was much less likely to be chosen over the one with meat and dairy if its label focused on its content ("vegan" or "plant-based") rather than its benefits ("healthy", "sustainable", or both) (Fig. 2). Only 20% of participants chose the gourmet food gift basket without meat and dairy when it was labeled as "vegan." The percent of participants choosing the same gourmet food gift basket without meat and dairy increased significantly to 27% when it was labeled as "plant-based." The percent of participants choosing the gourmet food gift basket without meat and dairy was 42% when it was labeled as "healthy," 43% when it was labeled as "sustainable," and 44% when it was labeled as "healthy and sustainable" – thus nearly double as compared to the "vegan" label (Fig. 2). After accounting for socio-demographic variables, political affiliations, and eating identities, the gourmet food gift basket without meat and dairy had 1.6 times the odds of being chosen if it was labeled "plant-based" rather than "vegan", 3.04 times the odds of being chosen if it was labeled "healthy" or "sustainable" rather than "vegan", and 3.5 times the odds of being chosen if it was labeled "healthy and sustainable" rather than "vegan" (Table 1). In the unweighted analysis, the main effects of labels held at $p < 0.05$ and yielded similar conclusions (Fig. S3 and Table S4).

3.1. Does the labeling effect vary across socio-demographic groups and political affiliation?

Independent of gender, age, race/ethnicity, education, and political affiliation, the gourmet food gift basket without meat and dairy was consistently the least popular when labeled as "vegan" and consistently the most popular when labeled as "healthy", "sustainable" or "healthy and sustainable" (Fig. 3, Panels A–E). Although the labeling effect occurred in all demographic groups, we did observe some heterogeneity (Table 2). Individuals who self-identified as male (vs. not) were relatively more likely to choose the gourmet food gift basket without meat and dairy if it was labeled as "healthy" rather than "vegan" (Fig. 3, Panel A). Younger (vs. older) participants were relatively more likely to choose the gourmet food gift basket without meat and dairy if it was labeled as "sustainable" rather than "vegan" (Fig. 3, Panel B) Non-Hispanic Black (vs. non-Hispanic White) participants were relatively more likely to choose the gourmet food gift basket if it was labeled as "plant-based" rather than "vegan" (Fig. 3, Panel C). Individuals without (vs. with) a college degree were relatively more likely to choose the gourmet food gift basket if it was labeled as "plant-based" or "sustainable" rather than "vegan" (Fig. 3, Panel D). However, these demographic differences were relatively small. Additionally, the labeling effect did not vary by political affiliation (Fig. 4).

The unweighted analysis yielded similar conclusions (Figs. S4–S5 and Table S6).

All interactions of the labeling effects with demographics remained significant in the unweighted analyses, except for the interaction of male (vs. not) with the healthy label (vs. vegan label), the interaction of age with the sustainable label (vs. vegan label), the interaction of non-Hispanic Black (vs. non-Hispanic White) with the plant-based label (vs. vegan label), while the interaction of non-Hispanic Mixed or other

Table 2
Logistic regressions modeling effects of labels by socio-demographic characteristics and eating identities on participants' likelihood of choosing the gourmet food gift basket without meat and dairy with the interaction between label type with socio-demographic characteristics and eating identities.

	B	*SE* (B)	Wald test	Odds ratio	95% Cl for Odds Ratio	*p*-value
Interactions with Male (vs. Not)						
Plant-based label (vs. vegan) * Male (vs. Not)	0.22	0.20	1.17	1.24	0.84, 1.85	0.28
Healthy label (vs. vegan) * Male (vs. Not)	0.47	0.19	6.08	1.61	1.10, 2.34	0.01
Sustainable label (vs. vegan) * Male (vs. Not)	0.35	0.19	3.28	1.41	0.97, 2.05	0.07
Healthy and sustainable label (vs. vegan) * Male (vs. Not)	0.35	0.19	3.24	1.42	0.97, 2.08	0.07
Interactions with Age (continuous variable)						
Plant-based label (vs. vegan) * Age	0.00	0.01	0.04	1.00	0.99, 1.01	0.83
Healthy label (vs. vegan) * Age	−0.01	0.01	1.81	0.99	0.98, 1.00	0.18
Sustainable label (vs. vegan) * Age	−0.02	0.01	6.75	0.99	0.97, 1.00	0.01
Healthy and sustainable label (vs. vegan) * Age	−0.01	0.01	2.28	0.99	0.98, 1.00	0.13
Interactions with Non-Hispanic Black (vs. non-Hispanic White)						
Plant-based label (vs. vegan) * Non-Hispanic Black (vs. non-Hispanic White)	0.64	0.31	4.23	1.89	1.03, 3.46	0.04
Healthy label (vs. vegan) * Non-Hispanic Black (vs. non-Hispanic White)	0.02	0.30	0.00	1.02	0.56, 1.84	0.95
Sustainable label (vs. vegan) * Non-Hispanic Black (vs. non-Hispanic White)	0.44	0.31	2.04	1.55	0.85, 2.82	0.15
Healthy and sustainable label (vs. vegan) * Non-Hispanic Black (vs. non-Hispanic White)	−0.33	0.31	1.16	0.72	0.40, 1.31	0.28
Interactions with Hispanic (vs. non-Hispanic White)						
Plant-based label (vs. vegan) * Hispanic (vs. non-Hispanic White)	−0.43	0.27	2.55	0.65	0.38, 1.10	0.11
Healthy label (vs. vegan) * Hispanic (vs. non-Hispanic White)	−0.42	0.25	2.83	0.66	0.41, 1.07	0.09
Sustainable label (vs. vegan) * Hispanic (vs. non-Hispanic White)	−0.41	0.25	2.76	0.67	0.41, 1.08	0.10
Healthy and sustainable label (vs. vegan) * Hispanic (vs. non-Hispanic White)	0.09	0.26	0.11	1.09	0.66, 1.80	0.74
Interactions with Asian (vs. non-Hispanic White)						
Plant-based label (vs. vegan) * Asian (vs. non-Hispanic White)	0.19	0.41	0.20	1.20	0.54, 2.70	0.65
Healthy label (vs. vegan) * Asian (vs. non-Hispanic White)	−0.09	0.43	0.04	0.92	0.40, 2.12	0.84
Sustainable label (vs. vegan) * Asian (vs. non-Hispanic White)	0.24	0.39	0.37	1.27	0.59, 2.73	0.54
Healthy and sustainable label (vs. vegan) * Asian (vs. non-Hispanic White)	−0.02	0.41	0.00	0.98	0.44, 2.17	0.97
	B	*SE* (B)	Wald test	Odds ratio	95% Cl for Odds Ratio	*p*-value
Interactions with Mixed or other (vs. non-Hispanic White)						
Plant-based label (vs. vegan) * Mixed or other (vs. non-Hispanic White)	0.48	0.61	0.62	1.61	0.49, 5.32	0.43
Healthy label (vs. vegan) * Mixed or other (vs. non-Hispanic White)	0.37	0.57	0.42	1.45	0.47, 4.43	0.52
Sustainable label (vs. vegan) * Mixed or other (vs. non-Hispanic White)	0.45	0.57	0.63	1.57	0.51, 4.83	0.43
Healthy and sustainable label (vs. vegan) * Mixed or other (vs. non-Hispanic White)	0.64	0.58	1.21	1.89	0.61, 5.89	0.27
Interactions with no College degree (vs. College degree)						
Plant-based label (vs. vegan) * no College degree (vs. College degree)	0.46	0.22	4.63	1.59	1.04, 2.43	0.03
Healthy label (vs. vegan) * no College degree (vs. College degree)	0.30	0.20	2.18	1.35	0.91, 2.00	0.14
Sustainable label (vs. vegan) * no College degree (vs. College degree)	0.73	0.20	13.15	2.07	1.40, 3.06	<.001
Healthy and sustainable label (vs. vegan) * no College degree (vs. College degree)	0.26	0.20	1.62	1.30	0.87, 1.93	0.20
Interactions with Political Affiliation: Biden voters (vs. Independent or non-voters)						
Plant-based label (vs. vegan) * Biden voters (vs. Independent or non-voters)	−0.03	0.26	0.02	0.97	0.59, 1.60	0.90
Healthy label (vs. vegan) * Biden voters (vs. Independent or non-voters)	−0.15	0.24	0.41	0.86	0.54, 1.37	0.52
Sustainable label (vs. vegan) * Biden voters (vs. Independent or non-voters)	0.24	0.24	0.99	1.27	0.80, 2.01	0.32
Healthy and sustainable label (vs. vegan) * Biden voters (vs. Independent or non-voters)	0.13	0.24	0.31	1.14	0.71, 1.83	0.58
Interactions with Political Affiliation: Trump voters (vs. Independent or non-voters)						
Plant-based label (vs. vegan) * Trump voters (vs. Independent or non-voters)	0.48	0.29	2.80	1.62	0.92, 2.86	0.09
Healthy label (vs. vegan) * Trump voters (vs. Independent or non-voters)	0.41	0.28	2.14	1.50	0.87, 2.59	0.14
Sustainable label (vs. vegan) * Trump voters (vs. Independent or non-voters)	0.40	0.27	2.09	1.49	0.87, 2.54	0.15
Healthy and sustainable label (vs. vegan) * Trump voters (vs. Independent or non-voters)	0.31	0.28	1.23	1.36	0.79, 2.33	0.27
Interactions with Eating Identities: Red-meat eaters (vs. not)						
Plant-based label (vs. vegan) * Red-meat eaters (vs. not)	0.01	0.01	0.01	1.07	0.65, 1.78	0.79
Healthy label (vs. vegan) * Red-meat eaters (vs. not)	0.02	0.02	0.02	2.10	1.30, 3.38	0.00
Sustainable label (vs. vegan) * Red-meat eaters (vs. not)	0.01	0.01	0.01	3.40	2.11, 5.48	<.001
Healthy and sustainable label (vs. vegan) * Red-meat eaters (vs. not)	0.01	0.01	0.01	1.88	1.13, 3.13	0.02
	B	*SE* (B)	Wald test	Odds ratio	95% Cl for Odds Ratio	*p*-value
Interactions with Eating Identities: Healthy eaters (vs. not)						
Plant-based label (vs. vegan) * Healthy eaters (vs. not)	0.51	0.21	6.16	1.67	1.11, 2.51	0.01
Healthy label (vs. vegan) * Healthy eaters (vs. not)	0.44	0.20	5.05	1.55	1.06, 2.28	0.03
Sustainable label (vs. vegan) * Healthy eaters (vs. not)	0.56	0.20	8.13	1.75	1.19, 2.57	0.00
Healthy and sustainable label (vs. vegan) * Healthy eaters (vs. not)	0.59	0.20	8.79	1.80	1.22, 2.64	0.00
Interactions with Eating Identities: Vegan eaters (vs. not)						
Plant-based label (vs. vegan) * Vegan eaters (vs. not)	−0.84	0.32	6.94	0.43	0.23, 0.81	0.01
Healthy label (vs. vegan) * Vegan eaters (vs. not)	−0.79	0.34	5.37	0.45	0.23, 0.89	0.02
Sustainable label (vs. vegan) * Vegan eaters (vs. not)	−0.95	0.33	8.00	0.39	0.20, 0.75	0.01
Healthy and sustainable label (vs. vegan) * Vegan eaters (vs. not)	−0.87	0.34	6.44	0.42	0.22, 0.82	0.01
Model summary	Nagelkerke $R^2 = 0.18$; $\chi 2\ (2) = 1048.44$; $p < 0.001$					

Note: B = log odds, SE(B) = standard error, Odds Ratio = Exp (B). CI=Confidence Interval. Poststratification weights were used (weighted N = 7341). This model controlled for main effects of labels, eating identities and demographics (not shown). For full model, see Table S5. For unweighted analysis see Table S6.

race (vs. Non-Hispanic White) with the sustainable label (vs. vegan label) became significant. Yet, all interactions remained small and in the same direction as the weighted analyses.

Does the labeling effect vary across self-proclaimed eating identities?

The labeling effect was most pronounced for individuals who identified as red-meat eaters (Table 2; Fig. 5, Panel A). Participants who identified as red-meat eaters (vs. not) were more likely to choose the gourmet food gift basket without meat and dairy if it was labeled

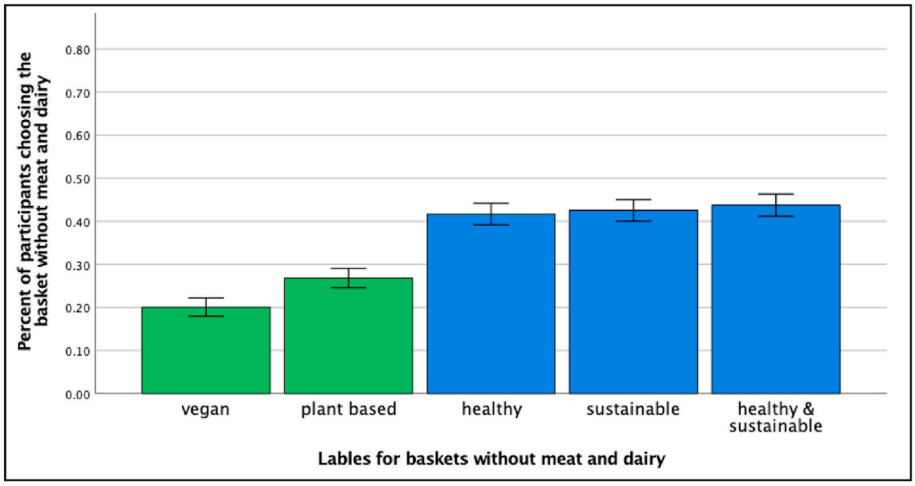

Fig. 2. Percent of participants choosing the gourmet food gift basket without meat and dairy by label.
Note: Poststratification weights were used (weighted $N = 7341$). Error bars reflect 95% Confidence Intervals.

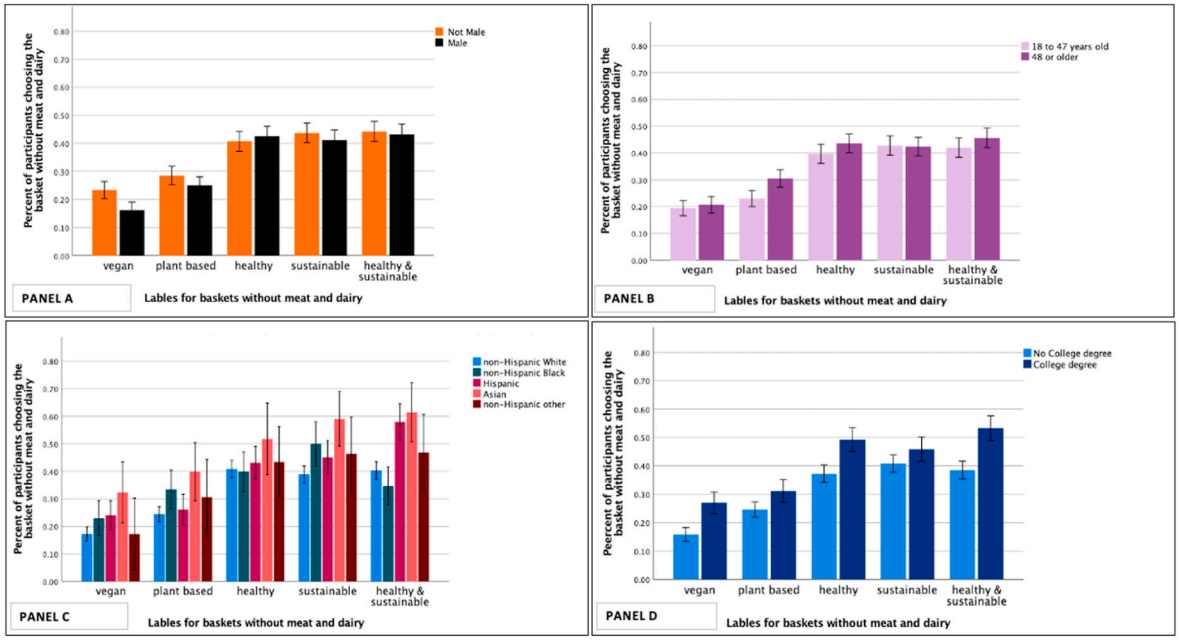

Fig. 3. Percent of participants choosing the gourmet food gift basket without meat and dairy by label and gender (PANEL A), by label and age groups (PANEL B), by label and race/ethnicity (PANEL C), and by label and college degree (PANEL E).
Note: Poststratification weights were used (weighted $N = 7341$). Error bars reflect 95% Confidence Intervals.

"healthy," "sustainable" or "healthy and sustainable" rather than "vegan" (Table 2; Fig. 5, Panel A). Participants who identified as healthy eaters (vs. not) also showed this pattern (Table 2; Fig. 5, Panel B). In addition, participants who identified as healthy eaters also preferred the gourmet food gift basket without meat and dairy when it was labeled as "plant-based" rather than "vegan" (Table 2; Fig. 5, Panel B). In contrast, the labeling effect was less pronounced among participants who identified as vegan (vs. not): Those who identified as vegan (vs. not) were consistently more likely to choose the gourmet food gift basket without meat and dairy if it was labeled as "vegan" as compared to any other label (Table 2; Fig. 5, Panel C).

The unweighted analysis yielded similar conclusions (Table S6 and Fig. S6). All interactions of the labeling effects with eating identities remained significant except for the interaction of the healthy eating identity (vs. not) with the healthy label (vs. vegan label), the interaction of the vegan eating identity (vs. not) with the healthy label (vs. vegan label), and the interaction of vegan eating identity (vs. not) with the sustainable label (vs vegan label). Yet, all interactions remained in the same direction as in the weighted analysis (Table S6 and Fig. S6).

4. Discussion

Eating less meat and dairy is a key component of a healthy and sustainable diet (Clark et al., 2020; D. R. Williams et al., 2020). In a national food choice experiment in which participants chose between actual food gift baskets, we found that food without meat and dairy was twice as popular when labeled as "healthy", "sustainable", or both than when labeled as "vegan". Such labels may be effective because many people are unaware of health and environmental benefits of eating less meat and dairy (Hartmann & Siegrist, 2017; Tobler, Visschers, & Siegrist, 2011; Truelove & Parks, 2012) and other food choices (Perkovic, Otterbring, Schärli, & Pachur, 2022; Siegrist, Bearth, & Hartmann,

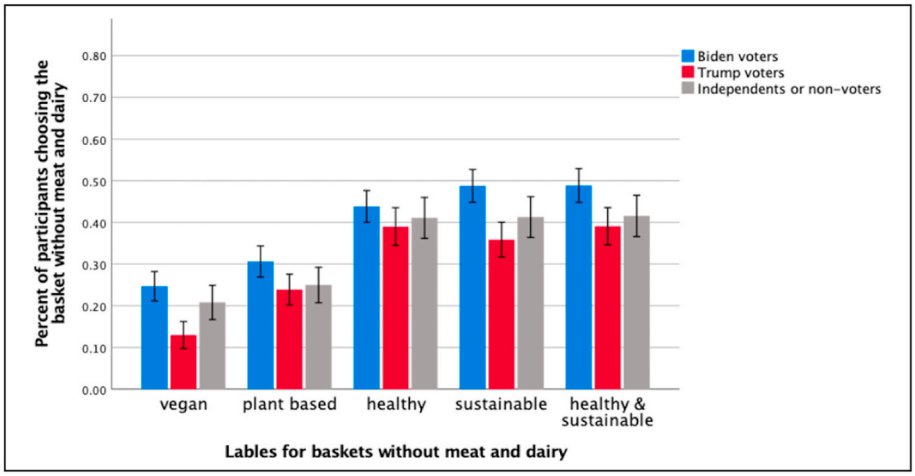

Fig. 4. Percent of participants choosing the gourmet food gift basket without meat and dairy by label and political affiliation.
Note: Poststratification weights were used (weighted $N = 7341$). Error bars reflect 95% Confidence Intervals.

2022). This finding suggests that food without meat and dairy may be promoted through labels that focus on health and environmental benefits.

Overall, the gourmet food basket without meat and dairy was the most popular when labeled as "healthy", "sustainable", or both "healthy and sustainable." Although the gourmet food basket without meat and dairy was much less popular when it was labeled as "plant-based" or "vegan," it was relatively more likely to be chosen when it was labeled as "plant-based" rather than "vegan". This result is in line with findings reported in a hypothetical online study among Italians who expressed greater willingness to buy food without meat and dairy when labels said "plant-based" rather than "vegan" (Demartini et al., 2022). However, opposite findings were obtained in a study of actual food choices at a university cafeteria in California, where food without meat and dairy was more favored when the labeled as "vegan" rather than "plant-based" (Rosenfeld et al., 2022). Possibly, the term "vegan" has fewer negative connotations among visitors of university cafeteria in California as compared to the national U.S. adult population. Additionally, the relative appeal of "vegan" over "plant-based" labels may occur when people feel confused about what they might get if they order "plant-based" food (Storz, 2022; K. A. Williams & Patel, 2017). However, the content of our gourmet food gift baskets was clearly described, which may have helped to resolve confusion about what "plant-based" means.

The labeling effect was consistent across socio-demographic groups. That is, independent of gender, age, race/ethnicity, education, and political affiliation, being presented with labels that emphasized health, sustainability or both increased the likelihood that participants chose the gourmet food gift basket without meat and dairy. Labelling effects were slightly stronger among men, younger individuals, individuals who identified as non-Hispanic Black and individuals without a college degree –who tend to eat more meat and less fruit and vegetables (Kannan & Veazie, 2018; Nezlek & Forestell, 2020; Tonsor et al., 2023; Y. Wang & Beydoun, 2009) and may have been least aware of the health or environmental benefits of reducing meat and dairy consumption (Hartmann & Siegrist, 2017; Tobler et al., 2011; Truelove & Parks, 2012).

The labeling effect was most pronounced among individuals who identified as red meat eaters. Specifically, we found that especially people who identified as red-meat eaters (vs. not) were more likely to choose the gourmet food gift basket without meat and dairy when it was labeled as "healthy", "sustainable", or both, rather than "vegan". In light of prior work suggesting that many meat eaters see no reason to limit their meat consumption (de Boer, Schösler, & Aiking, 2017), are unwilling to limit their meat consumption (Wolstenholme et al., 2021), and dislike the idea of going vegan (Markowski & Roxburgh, 2019), these results suggest a promising strategy for promoting dietary change among red meat eaters.

Additionally, individuals who identified as healthy eaters (vs. not) were also more likely to choose the gourmet food gift basket without meat and dairy when it was labeled as "healthy", "sustainable", "healthy and sustainable" rather than "vegan". Healthy eaters more frequently chose the gourmet food gift basket without meat and dairy when it was labeled as "plant-based" rather than "vegan". This result is in line with prior work suggesting that individuals who identify as healthy eaters (vs. not) tend to be more responsive to nutritional interventions (Kendzierski, 2007). Because self-proclaimed healthy eaters care more about their health and are more environmentally conscious (Dutta & Youn, 1999), they may pay more attention to labels such as "healthy," "sustainable" or "plant-based".

The labeling effect was least pronounced among individuals who identified as vegan (vs. not), possibly because vegans were relatively more responsive to the "vegan" label. Yet, even among vegans, the gourmet food gift basket without meat and dairy was relatively more likely to be chosen when the label focused on the benefits ("healthy," "sustainable" or "healthy and sustainable") rather than content ("vegan" or "plant-based").

Our study has several strengths. While the promise of using labels to reduce meat consumption has been emphasized (Clark et al., 2020; D. R. Williams et al., 2020), most studies have focused on hypothetical choices or on actual choices in university cafeteria that serve predominantly students. Our study reported on food choices between actual gourmet food gift baskets, as made by a representative sample of Americans. Adding labels that emphasize the health and environmental benefits of food without meat and dairy could be an effective, low-cost, and easy-to-scale intervention for diverse groups of people across the United States.

Naturally, our study also has several limitations. First, only ten of our participants received the gourmet food gift basket they chose, which might have made their choices feel less real. However, research in behavioral economics suggests that the choices participants make in experiments are unaffected by whether all or only some participants will be provided with their decision outcome (Charness, Gneezy, & Halladaya, 2016). Second, the study took place online and results may only generalize to the online shopping context. However, online shopping is highly popular (Chetty, Friedman, Stepner, & The Opportunity Insights Team, 2020). Third, we did not vary the labels on the gourmet food gift basket without meat and dairy because it would have required using negative labels such as "unhealthy" or "unsustainable." It has been suggested that flagging both healthy vs. unhealthy or sustainable vs. unsustainable food items with a traffic-light system may increase healthy and sustainable food choices (Slapø & Karevold, 2019;

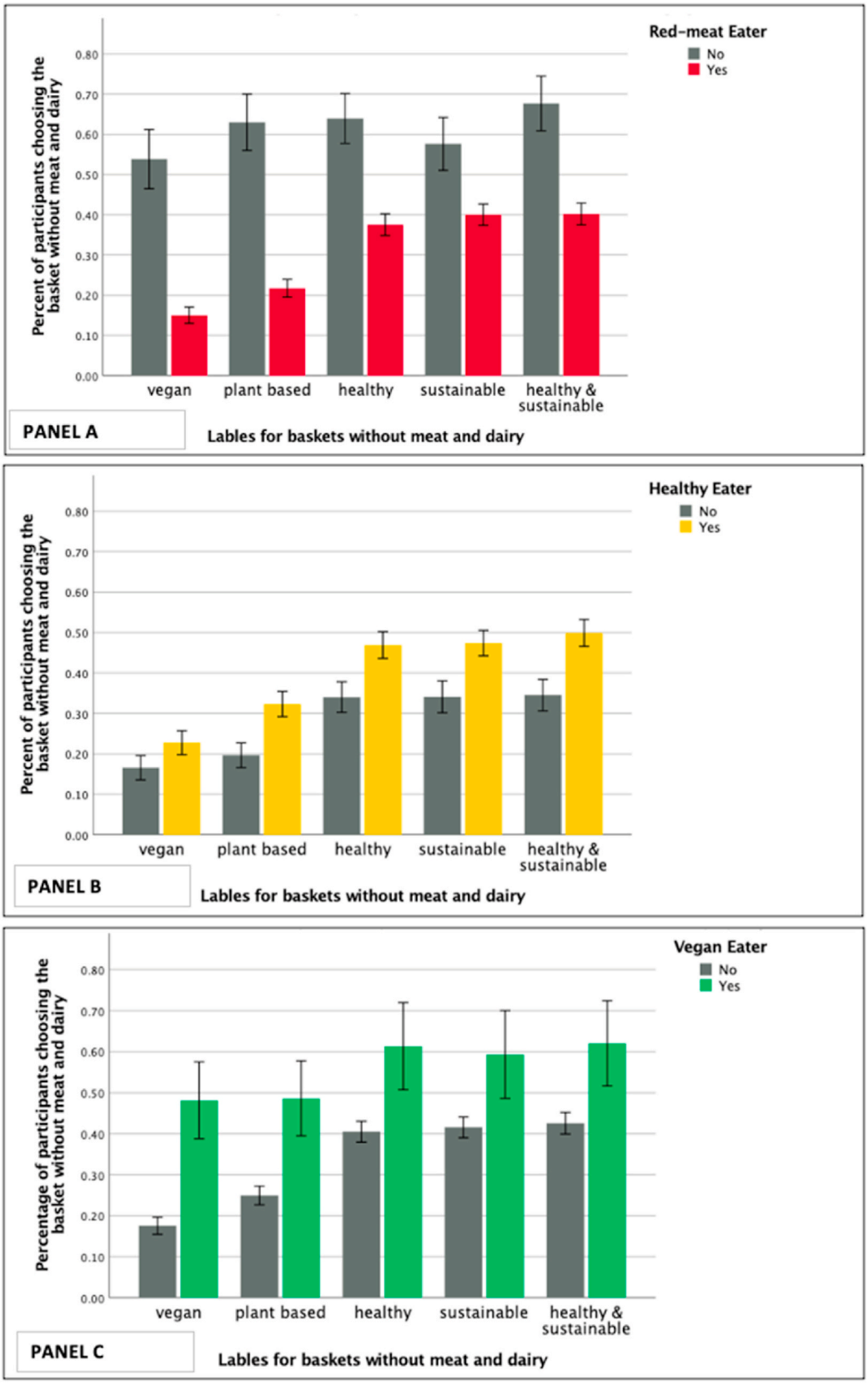

Fig. 5. Percent of participants choosing the gourmet food gift basket without meat and dairy by label and red-meat eating identity (PANEL A), and by label and healthy eating identity (PANEL B) and by label and vegan eating identity (PANEL C). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Note: Poststratification weights were used in these analyses (weighted $N = 7341$). Error bars reflect 95% Confidence Intervals.

Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012). Fourth, we did not test alternative labels that might have been more effective, such as "delicious" (Bacon & Krpan, 2018; Gavrieli et al., 2020; Turnwald, Boles, & Crum, 2017, 2019) or subtle health labels such as an image of a red heart with a white check mark (Wagner, Howland, & Mann, 2015). Finally, we presented participants with only two gourmet food gift baskets.

Changing the labels of vegan food to focus on health and environmental benefits may promote dietary changes recommended by public health and environmental experts. If our findings generalize to online shopping environments and real-world settings such as cafeterias, restaurants, groceries, supermarkets, labels may prove to be a cost-effective strategy for promoting healthy and sustainable food choices.

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Author contributions

Conceptualization: PS, WBdB, Methodology: PS, WBdB., TG, JA, Data analyses: PS, Writing – original draft: PS, Writing – review & editing: PS, WBdB., TG, JA.

Data statement

All data are publicly available from the Understanding America Study (survey number 500), https://uasdata.usc.edu.

Declaration of competing interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2023.102217.

References

AICR. (2022). *Ovarian cancer - American Institute for cancer research*. https://www.aicr.org/research/the-continuous-update-project/ovarian-cancer/.

Alattar, L., Messel, M., & Rogofsky, D. (2018). An introduction to the understanding America study Internet panel. *Social Security Bulletin, 78*.

Aschemann, J., & Hamm, U. (2009). Preferences for food with nutrition and health claims in a close-to-realistic choice context. In A. L. McGill, & S. Shavitt (Eds.), *North America - Advances in consumer research*, 819–819.

Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N. N., Norat, T., et al. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality—a systematic review and dose-response meta-analysis of prospective studies. *International Journal of Epidemiology, 46*(3), 1029–1056. https://doi.org/10.1093/IJE/DYW319

Bacon, L., & Krpan, D. (2018). (Not) Eating for the environment: The impact of restaurant menu design on vegetarian food choice. *Appetite, 125*(March), 190–200. https://doi.org/10.1016/j.appet.2018.02.006

Ballco, P., & Gracia, A. (2022). Tackling nutritional and health claims to disentangle their effects on consumer food choices and behaviour: A systematic review. *Food Quality and Preference, 101*.

Bleich, S. N., Economos, C. D., Spiker, M. L., Vercammen, K., VanEpps, E. M., Block, J. P., et al. (2017). A systematic review of calorie labeling and modified calorie labeling interventions: Impact on consumer and restaurant behavior. *Obesity, 25*(12). https://doi.org/10.1002/OBY.21940, 2018.

de Boer, J., Schösler, H., & Aiking, H. (2017). Towards a reduced meat diet: Mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite, 113*, 387–397. https://doi.org/10.1016/J.APPET.2017.03.007

Bollen, K. A., Biemer, P. P., Karr, A. F., Tueller, S., & Berzofsky, M. E. (2016). Are survey weights needed? A review of diagnostic tests in regression analysis. *Annual Review of Statistics and Its Application, 3*, 375–392.

Bryan, C. J., Tipton, E., & Yeager, D. S. (2021). Behavioural science is unlikely to change the world without a heterogeneity revolution. *Nature Human Behaviour, 5*, 980–989.

Carfora, V., Caso, D., & Conner, M. (2017). Correlational study and randomised controlled trial for understanding and changing red meat consumption: The role of eating identities. *Social Science & Medicine, 175*, 244–252. https://doi.org/10.1016/j.socscimed.2017.01.005

CDC. (2021). *Healthy eating for a healthy weight*. Center for Disease Control and Prevention. https://www.cdc.gov/healthyweight/healthy_eating/.

Census. (2020). *Census*, 2020 https://data.census.gov/cedsci/profile?g=0500000US06037.

Charness, G., Gneezy, U., & Halladaya, B. (2016). Experimental methods: Pay one or pay all. *Journal of Economic Behavior & Organization, 131*, 141–150.

Chetty, R., Friedman, J. N., Stepner, M., & The Opportunity Insights Team. (2020). *The economic impacts of COVID-19: Evidence from a new public database built using private sector data*.

Clark, M. A., Domingo, N. G. G., Colgan, K., Thakrar, S. K., Tilman, D., Lynch, J., et al. (2020). Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets. *Science (New York, N.Y.), 370*(6517), 705–708. https://doi.org/10.1126/SCIENCE.ABA7357

Cooper, A. J., Khaw, K. T., Sharp, S. J., Wareham, N. J., Lentjes, M. A. H., Forouhi, N. G., et al. (2012). A prospective study of the association between quantity and variety of fruit and vegetable intake and incident type 2 diabetes. *Diabetes Care, 35*(6), 1293–1300. https://doi.org/10.2337/DC11-2388

Daniel, C. R., Cross, A. J., Koebnick, C., & Sinha, R. (2011). Trends in meat consumption in the USA. *Public Health Nutrition, 14*(4), 575–583. https://doi.org/10.1017/S1368980010002077

Dauchet, L., Amouyel, P., Hercberg, S., & Dallongeville, J. (2006). Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. *The Journal of Nutrition, 136*(10), 2588–2593. https://doi.org/10.1093/JN/136.10.2588

Demartini, E., Vecchiato, D., Finos, L., Mattavelli, S., & Gaviglio, A. (2022). Would you buy vegan meatballs? The policy issues around vegan and meat-sounding labelling of plant-based meat alternatives. *Food Policy, 111*, Article 102310. https://doi.org/10.1016/J.FOODPOL.2022.102310

Dutta, M. J., & Youn, S. (1999). Profiling healthy eating consumers: A psychographic approach to social marketing. *Social Marketing Quarterly, 5*(4), 4–21. https://doi.org/10.1080/15245004.1999.9961078

Fernandes, A. C., Oliveira, R. C., Proenca, R. P. C., Curioni, C. C., Rodrigues, V. M., & Fiates, G. M. R. (2016). Influence of menu labeling on food choices in real-life settings: A systematic review. *Nutrition Reviews, 74*(8), 534–548. https://doi.org/10.1093/NUTRIT/NUW013

Freeman, A. M., Morris, P. B., Barnard, N., Esselstyn, C. B., Ros, E., Agatston, A., et al. (2017). Trending cardiovascular nutrition controversies. *Journal of the American College of Cardiology, 69*(9), 1172–1187. https://doi.org/10.1016/J.JACC.2016.10.086

Gavrieli, A., Attwood, S., Stillman, P., Putnam-Farr, E., Wise, J., Upritchard, J., et al. (2020). The impact of appealing dish names on plant-based food choices in corporate cafes: A field study. *Current Developments in Nutrition, 4*(Supplement_2). https://doi.org/10.1093/CDN/NZAA059_019, 1302–1302.

Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., et al. (2013). *Tackling climate change through livestock - a globAl Assessment of emissions and mitigation opportunities*. Food and Agriculture Organization of the United Nations (FAO).

Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology, 61*, 11–25. https://doi.org/10.1016/J.TIFS.2016.12.006

Hielkema, M. H., & Lund, T. B. (2022). A "vegetarian curry stew" or just a "curry stew"? - the effect of neutral labeling of vegetarian dishes on food choice among meat-reducers and non-reducers. *Journal of Environmental Psychology, 84*, Article 101877. https://doi.org/10.1016/J.JENVP.2022.101877

IPCC. (2019). *Special report on climate change and land — IPCC site*. https://www.ipcc.ch/srccl/.

Jansen, M. C. J. F., Bas Bueno-De-Mesquita, H., Feskens, E. J. M., Streppel, M. T., Kok, F. J., & Kromhout, D. (2009). Reports: Quantity and variety of fruit and vegetable consumption and cancer risk. *Nutrition and Cancer, 48*(2), 142–148. https://doi.org/10.1207/S15327914NC4802_3

Kannan, V. D., & Veazie, P. J. (2018). Political orientation, political environment, and health behaviors in the United States. *Preventive Medicine, 114*, 95–101. https://doi.org/10.1016/J.YPMED.2018.06.011

Kendzierski, D. (2007). A self-schema approach to healthy eating. *Journal of the American Psychiatric Nurses Association, 12*(6), 350–357. https://doi.org/10.1177/1078390306298983

Kimani-Murage, E., Gaupp, F., Lal, R., Hansson, H., Tang, T., Chaudhary, A., et al. (2021). An optimal diet for planet and people. *One Earth, 4*(9), 1189–1192. https://doi.org/10.1016/J.ONEEAR.2021.08.017

Krpan, D., & Houtsma, N. (2020). To veg or not to veg? The impact of framing on vegetarian food choice. *Journal of Environmental Psychology, 67*, Article 101391. https://doi.org/10.1016/J.JENVP.2020.101391

Lassen, A. D., Beck, A., Leedo, E., Andersen, E. W., Christensen, T., Mejborn, H., et al. (2014). Effectiveness of offering healthy labelled meals in improving the nutritional quality of lunch meals eaten in a worksite canteen. *Appetite, 75*(1), 128–134.

Lichtenstein, A. H., Appel, L. J., Vadiveloo, M., Hu, F. B., Kris-Etherton, P. M., Rebholz, C. M., et al. (2021). 2021 dietary guidance to improve cardiovascular health: A scientific statement from the American heart association. *Circulation, 144* (23), e472–e487. https://doi.org/10.1161/CIR.0000000000001031

Markowski, K. L., & Roxburgh, S. (2019). "If I became a vegan, my family and friends would hate me:" Anticipating vegan stigma as a barrier to plant-based diets. *Appetite, 135*, 1–9. https://doi.org/10.1016/j.appet.2018.12.040. December 2018.

Nezlek, J. B., & Forestell, C. A. (2020). Vegetarianism as a social identity. *Current Opinion in Food Science, 33*, 45–51. https://doi.org/10.1016/J.COFS.2019.12.005

Perkovic, S., Otterbring, T., Schärli, C., & Pachur, T. (2022). The perception of food products in adolescents, lay adults, and experts: A psychometric approach. *Journal of Experimental Psychology: Applied, 28*(3), 555. https://doi.org/10.1037/XAP0000384

Rosenfeld, D. L., Bartolotto, C., & Tomiyama, A. J. (2022). Promoting plant-based food choices: Findings from a field experiment with over 150,000 consumer decisions. *Journal of Environmental Psychology, 81*, Article 101825. https://doi.org/10.1016/J.JENVP.2022.101825

Shikany, J. M., Safford, M. M., Newby, P. K., Durant, R. W., Brown, T. M., & Judd, S. E. (2015). Southern dietary pattern is associated with hazard of acute coronary heart disease in the reasons for geographic and racial differences in stroke (REGARDS) study. *Circulation, 132*(9), 804–814. https://doi.org/10.1161/CIRCULATIONAHA.114.014421

Siegrist, M., Bearth, A., & Hartmann, C. (2022). The impacts of diet-related health consciousness, food disgust, nutrition knowledge, and the Big Five personality traits on perceived risks in the food domain. *Food Quality and Preference, 96*, Article 104441. https://doi.org/10.1016/J.FOODQUAL.2021.104441

Slapø, H. B., & Karevold, K. I. (2019). Simple eco-labels to nudge customers toward the most environmentally friendly warm dishes: An empirical study in a cafeteria setting. *Frontiers in Sustainable Food Systems, 3*, 40. https://doi.org/10.3389/FSUFS.2019.00040/BIBTEX

Sleboda, P., Bruine de Bruin, W., Arangua, L., & Gutsche, T. (2022). Associations of eating identities with self-reported dietary behaviors and body mass index. *Frontiers in Nutrition*. https://doi.org/10.3389/fnut.2022.894557

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., et al. (2018). Options for keeping the food system within environmental limits, 2018 *Nature, 562*, 7728. https://doi.org/10.1038/s41586-018-0594-0, 562(7728), 519–525.

Storz, M. A. (2022). What makes a plant-based diet? A review of current concepts and proposal for a standardized plant-based dietary intervention checklist. *European Journal of Clinical Nutrition, 76*(6), 789–800. https://doi.org/10.1038/S41430-021-01023-Z

Stremmel, G., Elshiewy, O., Boztug, Y., & Carneiro-Otto, F. (2022). Vegan labeling for what is already vegan: Product perceptions and consumption intentions. *Appetite, 175*. https://doi.org/10.1016/J.APPET.2022.106048

Thorndike, A. N., Sonnenberg, L., Riis, J., Barraclough, S., & Levy, D. E. (2012). A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices. *American Journal of Public Health, 102*(3), 527–533. https://doi.org/10.2105/AJPH.2011.300391

Tobler, C., Visschers, V. H. M., & Siegrist, M. (2011). Eating green. Consumers' willingness to adopt ecological food consumption behaviors. *Appetite, 57*(3), 674–682. https://doi.org/10.1016/j.appet.2011.08.010

Tonsor, G. T., Lusk, J. L., & Schroeder, T. C. (2023). Market potential of new plant-based protein alternatives: Insights from four US consumer experiments. *Applied Economic Perspectives and Policy, 45*(1), 164–181. https://doi.org/10.1002/AEPP.13253

Truelove, H. B., & Parks, C. (2012). Perceptions of behaviors that cause and mitigate global warming and intentions to perform these behaviors. *Journal of Environmental Psychology, 32*(3), 246–259. https://doi.org/10.1016/J.JENVP.2012.04.002

Turnwald, B. P., Bertoldo, J. D., Perry, M. A., Policastro, P., Timmons, M., Bosso, C., et al. (2019). Increasing vegetable intake by emphasizing tasty and enjoyable attributes: A randomized controlled multisite intervention for taste-focused labeling. *Psychological Science, 30*(11), 1603–1615. https://doi.org/10.1177/0956797619872191

Turnwald, B. P., Boles, D. Z., & Crum, A. J. (2017). Association between indulgent descriptions and vegetable consumption: Twisted carrots and dynamite beets. *JAMA Internal Medicine, 177*(8), 1216. https://doi.org/10.1001/JAMAINTERNMED.2017.1637

USDA, & HHS. (2020). *Dietary Guidelines for Americans, 2020-2025*. U.S. Department of Agriculture and U.S. Department of Health and Human Services. DietaryGuidelines.gov.

Visschers, V. H. M., & Siegrist, M. (2015). Does better for the environment mean less tasty? Offering more climate-friendly meals is good for the environment and customer satisfaction. *Appetite, 95*, 475–483. https://doi.org/10.1016/J.APPET.2015.08.013

Wagner, H., Howland, M., & Mann, T. (2015). Brief report: Effects of subtle and explicit health messages on food choice. *Health Psychology, 34*(1), 79–82.

Wang, Y., & Beydoun, M. A. (2009). Meat consumption is associated with obesity and central obesity among US adults, 2009 *International Journal of Obesity, 33*(6), 621–628. https://doi.org/10.1038/ijo.2009.45, 33(6).

Wang, P. Y., Fang, J. C., Gao, Z. H., Zhang, C., & Xie, S. Y. (2016). Higher intake of fruits, vegetables or their fiber reduces the risk of type 2 diabetes: A meta-analysis. *Journal of Diabetes Investigation, 7*(1), 56–69. https://doi.org/10.1111/JDI.12376

Wang, F., Wang, H., & Yan, J. (2023). Diagnostic tests for the necessity of weight in regression with survey data. *International Statistical Review, 91*(1), 55–71.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., et al. (2019). Food in the anthropocene: The EAT-lancet commission on healthy diets from sustainable food systems. *Lancet (London, England), 393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Williams, D. R., Clark, M., Buchanan, G. M., Ficetola, G. F., Rondinini, C., & Tilman, D. (2020). Proactive conservation to prevent habitat losses to agricultural expansion. *Nature Sustainability, 4*(4), 314–322. https://doi.org/10.1038/s41893-020-00656-5, 2020 4:4.

Williams, K. A., & Patel, H. (2017). Healthy plant-based diet: What does it really mean? *Journal of the American College of Cardiology, 70*(4), 423–425. https://doi.org/10.1016/J.JACC.2017.06.006

Wolstenholme, E., Carfora, V., Catellani, P., Poortinga, W., & Whitmarsh, L. (2021). Explaining intention to reduce red and processed meat in the UK and Italy using the theory of planned behaviour, meat-eater identity, and the Transtheoretical model. *Appetite, 166*, Article 105467. https://doi.org/10.1016/J.APPET.2021.105467

Further reading

Igielnik, R., Keeter, S., & Hartig, H. (2021, June 30). *Behind Biden's 2020 Victory a n examination of the 2020 electorate, based on validated voters*. Pew Research Center. https://www.pewresearch.org/politics/2021/06/30/behind-bidens-2020-victory.

My Emmission. Free food carbon footprint calculator (n.d.). Retrieved March 1, 2023, from https://myemissions.green/food-carbon-footprint-calculator/.

Zero Food-print. (n.d.). FOODPRINT CALCULATOR. Retrieved March 1, 2023, from https://dazzling-inferno-125.firebaseapp.com/#/.