Agricultural and Resource Economics Review (2024), **53**, 20–44
doi:10.1017/age.2023.28

RESEARCH ARTICLE

Aligning values to labels: A best-worst analysis of food labels

Alexandria McLeod[1], Wei Yang[2], Di Fang[3] and Rodolfo M. Nayga Jr.[4]

[1]Department of Agricultural & Resource Economics, University of Connecticut, Storrs, CT, USA, [2]Agricultural Economics and Agribusiness Department, University of Arkansas, Fayetteville, AR, USA, [3]Food and Resource Economics Department, University of Florida, Gainesville, FL, USA and [4]Department of Agricultural Economics, Texas A&M University, College Station, TX, USA
Corresponding author: Di Fang; Email: difang@ufl.edu

(Received 16 January 2023; revised 18 May 2023; accepted 18 May 2023; first published online 17 August 2023)

Abstract
Consumer misperception and misinterpretation of food labels can lead to consumers not buying a product or purchasing products that do not align with their environmental or sustainability interests. Consumer purchasing behavior can be explained by looking at consumer food values or food quality attributes. This study aimed to (a) determine the effect label information has on consumer preference shares for selected sustainability-related food labels and (b) if correlations exist between food labels and food values. To the best of our knowledge, this is the first study to examine the comprehension of 12 different labels and identify how food labels relate to food value preferences. Responses from the best-worst scaling experiment of food value and environmental food label choice sets were analyzed using the random parameter logit model. Results reveal preference shares changed for each label as more information was provided to the respondents about the various labels included in the study. These findings should support food policy efforts requiring strict, clear label standards. Food labels should represent the food's core food values to increase consumer preference for the product. These findings also further support the need for efforts to increase consumer knowledge and understanding of the labels on food packaging.

Keywords: best-worst scaling; consumer perception; ecolabels; food values; sustainability

JEL Classifications: Q18; Q13; D12

Introduction

Using information-based labels to inform consumers can help consumers make better choices (Roe and Sheldon 2007; Bonroy and Constantatos 2014; Lusk and McCluskey 2018). However, the lack of knowledge regarding certification standards can reduce the informativeness (Harbaugh et al. 2011). For example, the United States Department of Agriculture (USDA) provides the definition for *natural* meat products as those that do not contain artificial ingredients, added colors, and is minimally processed (Fortin 2016), but more than 60% of consumers wrongly believed meat labeled as 'natural' was raised without antibiotics, growth hormones, and genetically modified organisms during production (Syrengelas et al. 2018). For this reason, there has been a push among consumer groups and other organizations to have more transparent and stricter food labeling rules.

Existing research highlights consumers' misperception and confusion surrounding food labels (Zepeda et al. 2013; Garcia and de-Magistris 2016; Brécard 2017; Ellison et al. 2017; Syrengelas et al. 2018; Lim et al. 2020). Consumers tend to overinterpret the quality that a label represents or struggle to understand one (Brécard 2017; McFadden and Lusk 2018; Bernard et al. 2019; Asioli et al. 2020). For example, people believe that the grass-fed label means superior food safety (Lim et al. 2020). If consumers are expecting unsupported food safety benefits from such labels, then it is necessary to adjust the distortion created by the misperception. On the other hand, having strict labeling rules could weaken firms' incentives to provide quality. Scott and Sesmerro (2022) find that misperception about labels can in fact benefit consumers and enhance efficiency due to firms' strategic reactions to it. However, the relationship between misperception and welfare hinges upon the direction of misperception.

Given this, it is necessary to investigate whether adding additional clarification and certification could reduce misperception. We define misperception as the alignment between the labels and the values they represent. We focused on sustainability-related food labels because they are among the most frequently misinterpreted labels on the market. This study was conducted as an online survey with three information treatments: (1) label only; (2) label and description; or (3) label, description, and certification statement. Using a best-worst scaling (BWS) approach, we first sought to understand if preference shares would change based on information. We then calculated the correlation between food labels and food values to examine whether additional information could improve the alignment and reduce misperception. The rest of the paper is structured as follows: a review of selected label and claims, methodology and econometric models, survey and data, results, and conclusions.

Review of labels and food values

Consumer Reports conducted extensive market research on what consumers expect from a food label claim or seal. Consumers see claims as "words or phrases printed on the label such as 'humanely raised' or 'no GMOs'"; and seals as "graphics combining a logo or an image with a short claim, such as the USDA organic seal" (Consumer Reports 2019, 1). We selected nine seals mentioned in the Consumer Reports (2019) and Ecolabel Index (2022). The nine seals are American Grassfed, Animal Welfare Approved, Non-GMO Project Verified, USDA Organic, Certified Humane Raised and Handled, American Humane Certified, One Health Certified,[1] Certified B Corporation, and Food Alliance Certified. The three claims included in this study were "All Natural or Natural," "No Antibiotics," and "Non-GMO." Each seal or claim has different criteria for obtaining certification. The top four seals on the market with clear rules and rigorous verification include American Grassfed, Animal Welfare Approved, USDA Organic, and Non-GMO Project Verified. See Table A1 in the Appendix for a summary of the prior literature on the seals or claims included in this study.

[1]One Health Certified is a seal developed by meat and poultry industry experts. It is not part of the One Health initiative. See Table A1 in the Appendix for more information on the seals and claims included in the study.

Table 1. Food values presented in the best-worst scaling survey

Value category	Value	Description
Credence	Naturalness	Made without modern food technologies like genetic engineering, hormone treatment, and food irradiation
	Safety	Eating the food will not make you sick
	Environmental impact	Effects of food production on the environment
	Origin	Whether the food is produced locally, in USA, or abroad
	Animal welfare	Well-being of farm animals
	Fairness	Farmers, processors, and retailers get a fair share of the price
	Nutrition	Amount and type of fat, protein, etc.
Experience	Taste	Flavor of the food in your mouth
	Appearance	Food looks appealing and appetizing
	Convenience	How easy and fast the food is to cook and eat
	Novelty	Food is something new that you have not tried before
Price	Price	Price you pay for the food

Note. Reprinted from Cerroni et al. (2021, 8).

Consumer Reports (2019) also conducted research on labeling by focusing on the aspects of food production highlighted on food labels that cause the most confusion. These aspects include reducing pesticides, reducing the use of drugs in farm animals, what farm animals eat, animal welfare, and reducing the use of genetically modified organisms.

Food values

Researchers have determined that consumer purchasing decisions are influenced by their preferred food values or food quality attributes. For example, Bazzani et al. (2018) identified 12 food values to capture the main food quality attributes consumers focus on when making purchasing decisions. The food values were naturalness, safety, environmental impact, origin, animal welfare, fairness, nutrition, taste, appearance, convenience, novelty, and price. The study conducted by Bazzani et al. (2018) was then replicated by Cerroni et al. (2021) to observe the malleability of food values. Our study expands upon Bazzani et al. (2018) and Cerroni et al. (2021) by identifying if food value preference shares align with consumer preferences for 12 labels. Our study also expands on Cerroni et al. (2021) by identifying if food values were malleable based on the amount of information provided with the labels. Bazzani et al. (2018) explained that food values are categorized into credence, experience, and price attributes. Credence attributes are characteristics that consumers cannot decipher by looking at the product, for example, sustainability and ethical issues (Fortin 2016; Bazzani et al. 2018). Experience attributes are characteristics that consumers can personally experience, for example, taste and convenience (Bazzani et al. 2018). Cerroni et al. (2021) created a table to visually represent the 12 food values in Table 1.

Using the label definitions shown to participants during the study, the background research pertaining to each label, and the definitions for the food values (or attributes) as defined in the study, it was determined that the labels represented five of the 12 food values, as shown in Table A2 in the Appendix. For this study, the food value *Naturalness* was represented by American Grassfed, Non-GMO project verified, and USDA Organic. *Safety* was represented by USDA Organic. *Environmental impact* was represented by USDA Organic, One Health Certified, and Certified B Corporation. *Animal Welfare* was represented by Food Alliance Certified, Animal Welfare Approved, Certified Humane Raised & Handled, and American Humane Certified. *Fairness* was represented by Certified B Corporation and Food Alliance Certified.

Methodology

Best-Worst Scaling (BWS)

The BWS approach uses a series of choice sets made up of a subset of statements, attributes, or items to identify preference shares for the items in the subset. Respondents are asked to choose their most important (or preferred) and least important (or preferred) attribute, statement, or item among the choice set. The BWS approach was made popular by Finn and Louviere (1992) and has been used by researchers from many research disciplines (e.g., Auger et al. 2007; Flynn et al. 2007; Lusk and Briggeman 2009). The BWS approach allows researchers to identify preference shares for each issue under consideration and conduct accurate comparisons of the preference shares. Following Bazzani et al. (2018), this study uses the Case 1 mechanism of the BWS approach, where respondents are asked to select their most important and least important item among each choice set.

Treatment design and research objectives

Respondents were randomly assigned to one of three groups to determine the effect different types of information have on preference shares for different labels. The first group is the control group, where in the food label best-worst choice sets they only see a picture of the label. The second group is treatment one (T1), where in the food label best-worst choice sets they see a picture of the label and a description of what the label means. The third group is treatment two (T2), where in the food label best-worst choice sets they see a picture of the label, a description of what the label means, and a statement explaining if the label is verified. Table A3 includes each food label image, description, and verification statement included in the study. All three groups were asked the same food value questions, environmental questions, and a variation of the food sustainability label questions based on which group they were assigned to. See Figure A1 in Appendix for an example of a food label choice set shown to participants.

Survey design

In our study, the BWS is employed to evaluate food value and environmental labels applied on food products in the market. Twelve food values related to the main issues of food consumption are used: appearance, price, nutrition, novelty, convenience, origin, taste, naturalness, fairness, safety, animal welfare, and environmental impact (Bazzani et al. 2018; Cerroni et al. 2021). The approach of partially balanced incomplete design (BIBD) is used to generate a design with an equal number of items, where each item is repeated the same number of times across the choice tasks. The same approach generates the experimental design for evaluating environmental food labels. The 12 environmental food labels commonly used in the United States were selected from the food label database, Ecolabel Index (2022), the largest global online directory of ecolabels, and were separated into 12 choice tasks.

The questionnaire is composed of four sections. The first section was comprised of 12 food label choice sets. Four labels were presented in each choice set, and each label was displayed four times in the first section. The order of choice sets was randomized across respondents to control for position bias (Campbell and Erdem 2015). The second section comprised 12 food attribute (also called food value) choice sets. Four food attributes were presented in each choice set, and each attribute was displayed four times in the second section. The order of the first and second sections was randomized across respondents to control for order bias. The label choice options and the food attribute chose options within each choice set were also randomized to control for position bias to help prevent respondents from selecting only the higher positioned items in a choice set. The third section comprised the 15 revised New Ecological Paradigm (NEP) scale statements measuring a population's environmental worldview (Anderson 2012). The NEP Scale questions cover five factors of the relationship between humans and the environment: balance, limits, anti-anthropocentrism, anti-exceptionalism, and eco-crisis (Dunlap et al. 2000). Respondents were asked to indicate their level of agreement or disagreement with each statement using a 5-point Likert-type scale format with 1 = *strongly agree* to 5 = *strongly disagree*. The final section of the survey included sociodemographic questions and food purchase behavior questions.

We targeted our sample from the general US population by using two screening questions: 1) Are you 18-year-old or older? 2) Have you purchased chicken in the last 6 months? Only participants who responded "Yes" to both questions were considered valid respondents. Purchasing chicken was chosen as a screening variable because it was reported as the most consumed type of meat in the US, which would encompass a diverse participant pool (Shahbandeh 2021). At the beginning of our survey, we asked each individual to complete an online consent form and asked them to promise to read all questions and information carefully and provide their best answers. A text "cheap talk" was provided to every respondent before starting choice tasks to reduce the hypothesis bias (Tonsor and Shupp 2011; Ellis et al. 2021). In order to control for order effect, we randomized the order of food value BWS and environmental food label BWS choice tasks. Attention check questions, including instructed response attention check questions, were included in the survey to ensure all respondents included in the analysis were attentive throughout the survey (Gummer et al. 2021).

Econometric model

Responses from the BWS of food value and environmental food label are analyzed using a random parameter logit (RPL) model following Lusk and Briggeman (2009) and Cerroni et al. (2021). In the model, we assume that there are J items presented in each choice task set t, then the number of possible pairs of items is $J(J-1)$. We define the observable level of importance of the item j as λ_j, and then the unobservable level of importance is $I_{ij} = \lambda_j + \varepsilon_{ij}$, where i stands for respondent i and ε_{ij} is a random error.

All the models in our study are consistent with random utility theory (McFadden 1974). The idiosyncratic error ε_{ij} is independent and identically distributed extreme value type 1. The probability of respondent i selects item j as the most important and item k as the least important in choice task t compared to other $M = J(J-1)-1$ possible pairs can be presented by:

$$P_{ijkt} = \exp\left(\lambda_{ijt} - \lambda_{ikt}\right) / \sum_{l=1}^{J} \sum_{m=1}^{J} \exp(\lambda_{ilt} - \lambda_{imt}) - J$$

Our models allow heterogeneity in preferences for the various food labels and food values, and assume that estimated parameters $\lambda_j$are following a multinormal distribution. The RPL models are estimated using the gmnl package in R version 1.3.1073 (Sarrias and Daziano 2017). The share of preference for each value or label, the predicted probability of that value or label selected as the most important one, is calculated by:

$$PS_j = \frac{e^{\widehat{\lambda_j}}}{\sum_{k=1}^{j} e^{\widehat{\lambda_l}}}$$

where $\widehat{\beta}$ is the mean of estimated individual parameter. The total of the share of preferences must be one.

Data

The questionnaire was administered online between October 21, 2021, and November 1, 2021, via Dynata. Our sample consists of 1,200 US consumers. Ninety percent of respondents were able to complete the survey in under 24.2 minutes with the average time being 14 minutes. Respondents who spent less than 5 minutes or more than 60 minutes on the survey were excluded from the analysis. Participants who spent less than 5 minutes on the survey may not have thoroughly read the questions or provided sincere responses, given that the survey typically took around 14 minutes to complete. On the other hand, respondents who spent more than 60 minutes might also have been less likely to provide accurate answers due to the long period taken to finish the survey. Respondents who did not answer the attention check questions correctly were also removed. The final analysis sample contained 1,158 surveys. Demographic and socioeconomic characteristics of our sample and the US population are shown in Table 2. Overall, our sample is representative of the US population. However, the percentage of Hispanic or Latino individuals in the population (18%) is higher than our sample (7.5%). The distribution of gender, place of residence, and education was fairly similar in both the sample and US population. Approximately 67% of the sample had an annual income equal or below the US median income of $69,717.

Table 3 provides the balance test across treatment groups. Out of the sample of 1,158 US consumers, the majority were female (52%), white (62%), married (48%), earned a 4-year college degree (25%), and had a gross household income of less than $69,717 (67%). The political views identified by respondents included democrat (41%), followed by independent (30%), republican (26%), and other (3%), respectively. A χ^2 is performed between the control group and treatment groups to detect any significant difference. *P* values higher than 5% indicate that the sample is well balanced.

Results

Identify consumer preference ranking for the 12 food labels

Results from the RPL model and preference share estimates for food labels are reported in Table 4. The most selected least important label, *B corporation*, was used as the baseline for the food labels. See Table A4 in the Appendix for a summary table of the percentage

Table 2. Demographic and socioeconomic distribution

Variable	Definition	Sample %	US population %
Race			
	White	62.2	61.2
	Black	14.5	12.1
	Hispanic or Latino	7.5	18.8
	Asian	6.2	5.8
	American Indian or Alaskan Native	1.8	1
	Native Hawaiian or Pacific Islander	0.3	0.2
	Other	7.5	–
Gender			
	Female	51.7	50.5
	Male	47.7	49.5
Place of residence			
	Not Rural (2,500 or more inhabitants)	84.5	80
	Rural (less than 2,500 inhabitants)	15.5	19.3
Marital status			
	Married	47.9	48
	Unmarried	31.2	34.2
	Separated/Divorced	10.5	12.3
	Widow/Widower	2.2	5.5
	Cohabitant	8.2	NA
Education			
	Less than high school	2.6	10.6
	High school/GED	23.1	26.3
	Some college	22.8	19.3
	2-year college degree (Associate)	10.7	8.8
	4-year college degree (BA, BS)	24.8	21.2
	Graduate or Professional degree	16.0	13.8
Gross annual income			Median income $69,717
	Less than $15,000	12.6	
	$15,000–29,000	15.8	
	$30,000–44,000	15.3	
	$45,000–59,000	13.7	
	$60,000–74,000	9.6	

(*Continued*)

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 2. (*Continued*)

Variable	Definition	Sample %	US population %
	$75,000–89,000	8.3	
	$90,000–119,000	8.4	
	$120,000–149,000	7.6	
	$150,000 or more	8.7	

Note. US population data were extracted from the United States Census Bureau (United States Census Bureau 2021).

breakdown of labels chosen as most important and least important by group and for the full sample. The ranking of food labels across treatment groups was dissimilar as expected. The top three labels for the control group were "No antibiotics," "Natural," and Non-GMO Project Verified. For groups T1 and T2, the USDA Organic label was ranked first, followed by One Health Certified. T1 ranked American Grassfed third, while T2 ranked Non-GMO Project Verified third. Figure 1 provides a graphical representation of the preference shares attributed to the food labels by treatment group.

As shown in Fig. 1, the food labels with the most preference shares from the control group included two claims, "no antibiotics" and "Natural", and two seals USDA Organic and Non-GMO Project Verified. The 95% confidence intervals are calculated by using Bootstrap. Among these four labels, the preference share of "Natural" was not significantly different from others at the 0.05 level. However, "no antibiotics" was significantly different from the two seals at the 0.05 level. Treatment 1 respondents, who were shown the label picture and description, attributed the most preference shares to four seals, USDA Organic, One Health Certified, American Grassfed, and Food Alliance Certified, respectively. There was no significant difference in preference shares between USDA Organic and One Health Certified at the 0.05 level. But both of them were significantly different from American Grassfed and Alliance Certified. The food labels with the most preference shares from the Treatment 2 group were USDA Organic, Non-GMO Project Verified, One Health Certified, and Food Alliance Certified. In the Treatment 2 group, the preference share of USDA Organic was significantly different from the other 3 most preference shares. The B Corporation seal and "Non-GMO" claim were ranked among the lowest across all treatment groups. The control group ranked American Grassfed much lower than the other two groups, while T1 and T2 ranked "Natural" much lower than the control group.

Determine if consumer preference ranking changes by providing more information with the labels, including descriptions and verification statements

As shown in Table 5, significant changes in preference shares were observed for different food labels across treatment groups (see appendix Table A5 for preference shares by treatment group). Interest in the Food Alliance Certified and American Grassfed labels increased as more information was provided. When compared to the control group, consumers in the T1 group increased interest in the Food Alliance Certified label ($\Delta S = 0.055$; $p < 0.01$), as did consumers in the T2 group ($\Delta S = 0.057$; $p < 0.01$). When compared to the control group, consumers in the T1 group increased interest in the American Grassfed label ($\Delta S = 0.079$; $p < 0.01$), as did consumers in the T2 group ($\Delta S = 0.060$; $p < 0.01$). Four labels lost importance as more information was provided, three of which were the claims included in the study. First, the claim "No Antibiotics" lost

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 3. Balance test across treatment groups

Variable	Definition	Control = Label picture only	T1 = Label picture and description	T2 = Label picture, description, and verification	*p*-value
Race					0.461
	American Indian or Alaskan Native	11	3	7	
	Asian	28	22	22	
	Black	51	69	48	
	Hispanic or Latino	29	27	31	
	Native Hawaiian or Pacific Islander	1	1	1	
	Other	26	36	25	
	White	252	239	229	
Gender					0.729
	Male	193	188	171	
	Female	204	205	190	
	Gender variant/non-conforming	1	4	2	
Place of residence					0.343
	Rural (less than 2,500 inhabitants)	70	56	53	
	Not Rural (2,500 or more inhabitants)	328	341	310	
Marital status					0.261
	Married	187	189	179	
	Cohabitant	27	30	38	
	Unmarried	134	127	100	
	Separated/Divorced	44	44	34	
	Widow/Widower	6	7	12	

(*Continued*)

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 3. (*Continued*)

Variable	Definition	Control = Label picture only	T1 = Label picture and description	T2 = Label picture, description, and verification	*p*-value
Education					0.848
	Less than high school	10	11	9	
	High school/GED	95	99	73	
	Some college	92	86	86	
	2-year college degree (Associate)	43	44	37	
	4-year college degree (BA, BS)	93	94	100	
	Master's Degree	6	2	4	
	Doctoral Degree	49	52	50	
	Professional Degree	10	9	4	
Political view					0.541
	Republican	104	105	89	
	Democrat	154	166	158	
	Independent	125	119	108	
	Other	15	7	8	
Gross annual income					0.640
	Less than $15,000	52	46	48	
	$15,000–29,000	74	60	49	
	$30,000–44,000	62	60	55	
	$45,000–59,000	54	55	50	
	$60,000–74,000	28	43	40	
	$75,000–89,000	37	25	34	
	$90,000–119,000	28	37	32	
	$120,000–149,000	31	32	25	
	$150,000 or more	32	39	30	

importance in the T2 group ($\Delta S = -0.102$; $p < 0.01$). Second, "Natural" lost importance significantly in the T1 group ($\Delta S = -0.110$; $p < 0.01$) and the T2 group ($\Delta S = -0.085$; $p < 0.01$). Finally, the claim "Non-GMO" lost importance significantly in the T1 group ($\Delta S = -0.033$; $p < 0.01$) and the T2 group ($\Delta S = -0.026$; $p < 0.05$). We observed that

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 4. Random parameter logit models for labels by treatment group[a]

Dep. Var: choice	Control	T1	T2
Mean values	Coefficient	Coefficient	Coefficient
Seals			
Food Alliance	1.148** (0.075)	1.509** (0.079)	1.453** (0.079)
Animal Welfare Approved	1.530** (0.076)	1.373** (0.076)	1.236** (0.076)
Certified Humane Raised & Handled	1.779** (0.079)	1.412** (0.078)	1.282** (0.077)
American Humane Certified	1.478** (0.075)	1.413** (0.078)	1.086** (0.077)
American Grassfed	0.978** (0.076)	1.669** (0.081)	1.403** (0.078)
Non-GMO Project	1.796** (0.080)	1.307** (0.080)	1.503** (0.081)
USDA Organic	1.602** (0.082)	1.789** (0.085)	1.736** (0.084)
One Health Certified	1.749** (0.080)	1.757** (0.080)	1.503** (0.078)
Claims			
No Antibiotics	2.204** (0.085)	0.615** (0.075)	0.434** (0.076)
Natural	2.042** (0.082)	−0.673** (0.082)	0.308** (0.075)
Non-GMO	1.023** (0.077)	−0.372** (0.076)	−0.115 (0.076)
Observations	4,776	4,764	4,356
Participants	398	397	363
Log Likelihood	−9,677.10	−9,605.10	−9,129.00
AIC	19,508.15	19,364.29	18,412.09
BIC	20,006.45	19,862.39	18,903.29

Note. Although a lower AIC or BIC value is preferred, they are not absolute measures of model goodness-of-fit, but rather relative measures of model fit. The same goes for log-likelihood values. Since we do not compare model fit across different groups, we do not focus on these measures and their interpretations.

**$p < 0.01$, * $p < 0.05$.

[a]Standard error in brackets.

when all the information was provided about a label, T2 had less interest in "No Antibiotics," American Humane Certified, and American Grassfed labels compared to T1.

Identify consumer preference ranking for the food attributes or values

Results from the RPL model and preference share estimates for food values are reported in Table 6. Fig. 2 provides a graphical representation of the food value preference shares by treatment group. The least important food value selected by most respondents, *Novelty*, was used as the baseline. All groups ranked *Safety* and *Taste* the highest compared to the other food values. *Environmental impact* is ranked slightly lower than convenience in T2. The ranking for all other food values was similar across treatment groups.

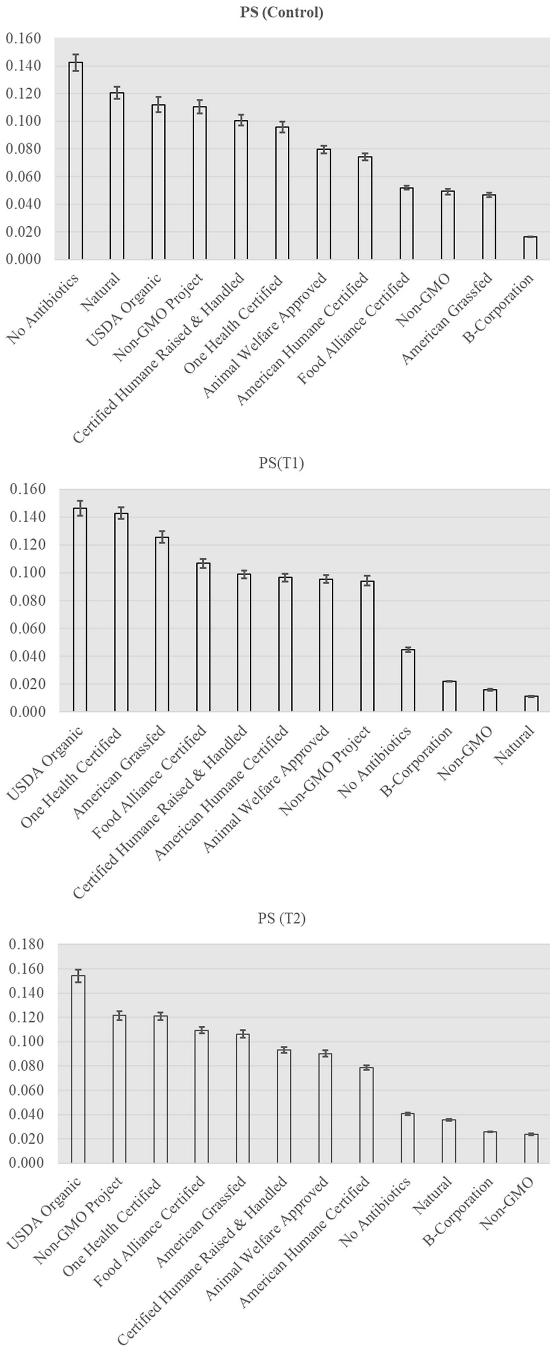

Figure 1. Preference shares for food labels with 95% confidence interval by treatment group.

Table 5. Change in preference shares (ΔS) for food labels across treatment groups[a]

Food label	T1 – Control ΔS	T2 – Control ΔS	T2 – T1 ΔS
Seals			
Food Alliance	0.055**	0.057**	0.002
Animal Welfare Approved	0.016	0.011	−0.005
Certified Humane Raised & Handled	−0.002	−0.007	−0.006
American Humane Certified	0.022	0.004	−0.018
American Grassfed	0.079**	0.060**	−0.019*
Non-GMO Project	−0.016	0.011	0.027
USDA Organic	0.035*	0.042	0.008*
One Health Certified	0.047	0.025	−0.021
B Corporation	0.005**	0.010**	0.004**
Claims			
No Antibiotics	−0.098	−0.102**	−0.004*
Natural	−0.110**	−0.085**	0.025*
Non-GMO	−0.033**	−0.026*	0.008*

**$p < 0.01$, * $p < 0.05$.
[a]Statistical significance levels are related to the results from Bootstrap and the Poe test (Poe et al. 2005).

As shown in Fig. 2, the three food values with the most preference shares across the groups include *Safety*, *Taste,* and *Nutrition.* The food values with the lowest preference shares across treatment groups were *Convenience* and *Novelty.*

Determine if there is a connection between food labels and food attributes

The correlation values between each food label and food attribute by treatment group are displayed in Table 7. The food attributes represented by the food labels were identified using the label and attribute definitions and the background research for the label (see Appendix Table A2 for more information). Overall, there were correlations among all three groups between USDA Organic and *Naturalness*; B Corporation and *Fairness*; and Animal Welfare Approved and *Animal Welfare.* Highly significant correlations were found between six food labels and food attributes within the control group ($p < 0.01$). Highly significant correlations were found between seven food labels and food attributes within the T1 group, followed by only two significant correlations in the T2 group ($p < 0.01$). Participants in the T1 and T2 groups were influenced by the information provided about the label. However, the certification statement shown to the T2 group shows that it will sometimes prove harmful to the perception of the label because consumers want to make their own decision. These correlations proved that information provided to the consumers could be beneficial, but too much information is unnecessary, as shown in the correlations between some labels in which the correlation coefficients

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 6. Random parameter logit models for food values by treatment group[a]

Dep. Var: Choice	Control	T1	T2
Mean values	Coefficient	Coefficient	Coefficient
Appearance	2.119** (0.084)	2.154** (0.086)	2.311** (0.090)
Fairness	1.287** (0.078)	1.391** (0.077)	1.349** (0.087)
Origin	1.318** (0.082)	1.639** (0.079)	1.541** (0.090)
Convenience	1.028** (0.073)	1.009** (0.070)	1.437** (0.084)
Taste	2.842** (0.092)	2.742** (0.088)	3.279** (0.100)
Animal Welfare	1.989** (0.087)	1.859** (0.082)	1.850** (0.091)
Naturalness	2.201** (0.083)	2.291** (0.082)	2.323** (0.094)
Nutrition	2.567** (0.088)	2.365** (0.086)	2.563** (0.094)
Price	2.243** (0.089)	2.297** (0.087)	2.699** (0.100)
Safety	3.642** (0.103)	3.611** (0.100)	3.842** (0.111)
Environmental Impact	1.366** (0.082)	1.447** (0.080)	1.249** (0.088)
Observations	4,776	4,764	4,356
Participants	398	397	363
Log Likelihood	−9,214.00	−9,424.20	−8,413.50
AIC	18,581.96	19,002.42	16,980.92
BIC	19,080.25	19,500.52	17,472.13

Note. Although a lower AIC or BIC value is preferred, they are not absolute measures of model goodness-of-fit, but rather relative measures of model fit. The same goes for log-likelihood values. Since we do not compare model fit across different groups, we do not focus on these measures and their interpretations.
**$p < 0.01$, * $p < 0.05$.
[a]Standard error in brackets.

decreased as more information was provided for the label. The labels and attributes with no significant correlation were: American Grassfed and *Naturalness;* USDA Organic and *Environment;* and, One Health Certified and *Environment.*

Heterogeneity in treatment effects

Two tests were used to determine if there was heterogeneity in treatment effects by looking at NEP scores and shopping frequency. The first test determined if preference shares were influenced by NEP scores (see Fig. 3). We separated the sample into two NEP categories: Low NEP group, in which their total scores of NEP items were less than the median of total scores in the whole sample; otherwise, they were classified in the High NEP group (Dsouza et al., 2023; Zheng et al., 2023). The food labels with the most preference shares from the control group with low NEP scores included two claims ("No antibiotics" and "Natural") and two seals (USDA Organic and Non-GMO Project Verified). The same was found in the control group using the pooled data set. However, the two seals with the most preference shares from the control group with high NEP scores were Certified Humane Raised & Handled and One Health Certified instead of USDA Organic and Non-GMO

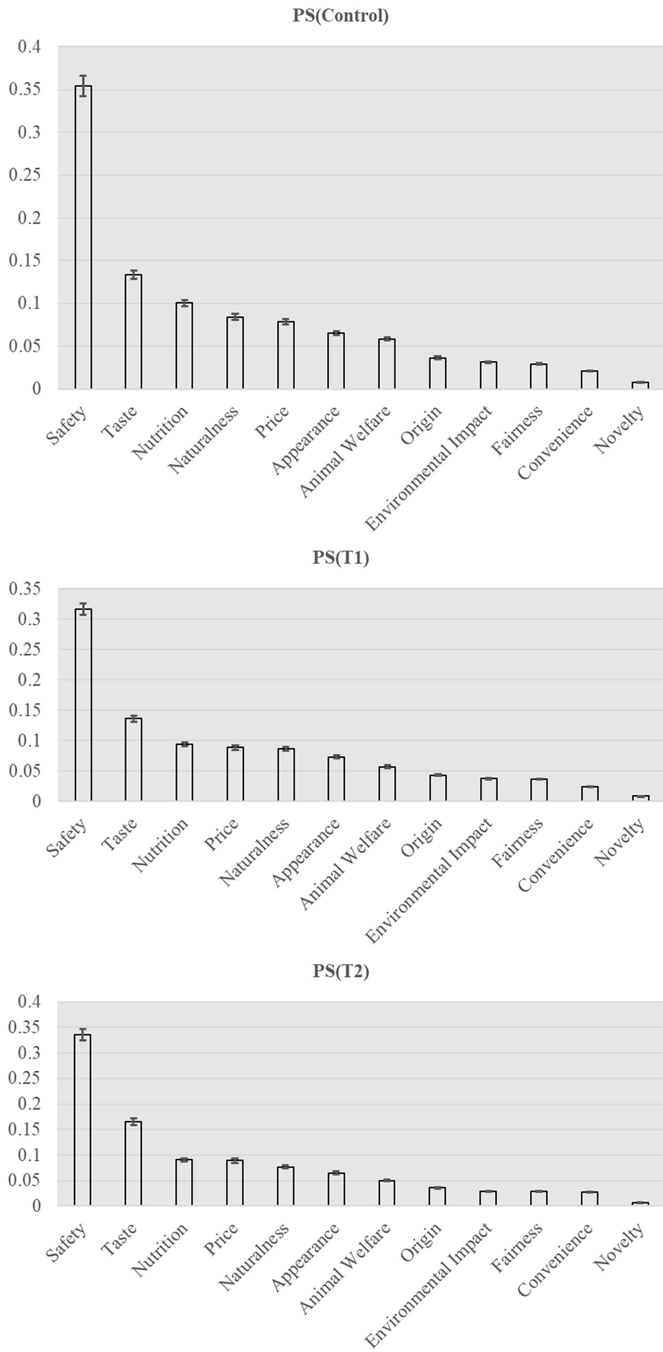

Figure 2. Preference shares for food values by treatment group.

Table 7. Correlation between food labels and food attributes by treatment group

Variables		Correlation coefficients			
Food label	Food attribute	Control	T1	T2	Full data set
American Grassfed	Naturalness	−0.059	0.067	0.068	0.038
Non-GMO Project Verified	Naturalness	0.052	0.132**	0.009	0.053
USDA Organic	Naturalness	0.146**	0.093	0.102	0.142**
USDA Organic	Safety	−0.046	0.152**	0.141**	0.052
USDA Organic	Environment	−0.020	−0.074	−0.013	0.007
One Health Certified	Environment	0.072	−0.049	0.028	0.047
B Corporation	Environment	0.020	0.161**	0.045	0.077**
B Corporation	Fairness	0.144**	0.196**	0.152**	0.187**
Food Alliance Certified	Environment	0.117*	0.029	0.035	0.109**
Food Alliance Certified	Animal Welfare	−0.027	0.127*	0.131*	0.083**
Food Alliance Certified	Fairness	0.263**	0.019	0.109*	0.120**
Animal Welfare Approved	Animal Welfare	0.390**	0.147**	0.107*	0.239**
Certified Humane Raised and Handled	Animal Welfare	0.371**	0.131**	0.054	0.213**
American Humane Certified	Animal Welfare	0.343**	0.145**	0.084	0.197**

Note. Food label and food attribute combinations are based on the food attribute represented by the food label. For more information on these combinations see Table A2 in the Appendix.
$^{**}p < 0.01$, $^{*}p < 0.05$.

Project Verified. The respondents with high NEP scores from the T1 group had the same most preferred labels compared to all respondents from T1, such as One Health Certified, American Grassfed, USDA Organic, and Food Alliance Certified. There was a slight difference for respondents with low NEP scores from T1. The Food Alliance Certified seal had a slightly lower preference share among respondents with low NEP scores compared to all respondents from T1, which removed Food Alliance Certified from the top four labels. Similar results also were found in the T2 group. Respondents with high and low NEP scores from T2 had the same top four food labels compared to the whole sample from treatment 2: USDA Organic, One Health Certified, Non-GMO Project, and Food Alliance Certified. The preference shares for the claims "No antibiotics" and "Natural" in the control group were higher than in the other two groups regardless of low NEP and high NEP scores. This result was the same as what we found in the control group by using the pooled data set. The respondents in the control group with high NEP scores and low NEP scores had a higher preference share for the Non-GMO Project Verified seal than the respondents in treatment 1, who were provided a label description. There was no significant difference between the control group and treatment 2, who were provided label information and verification.

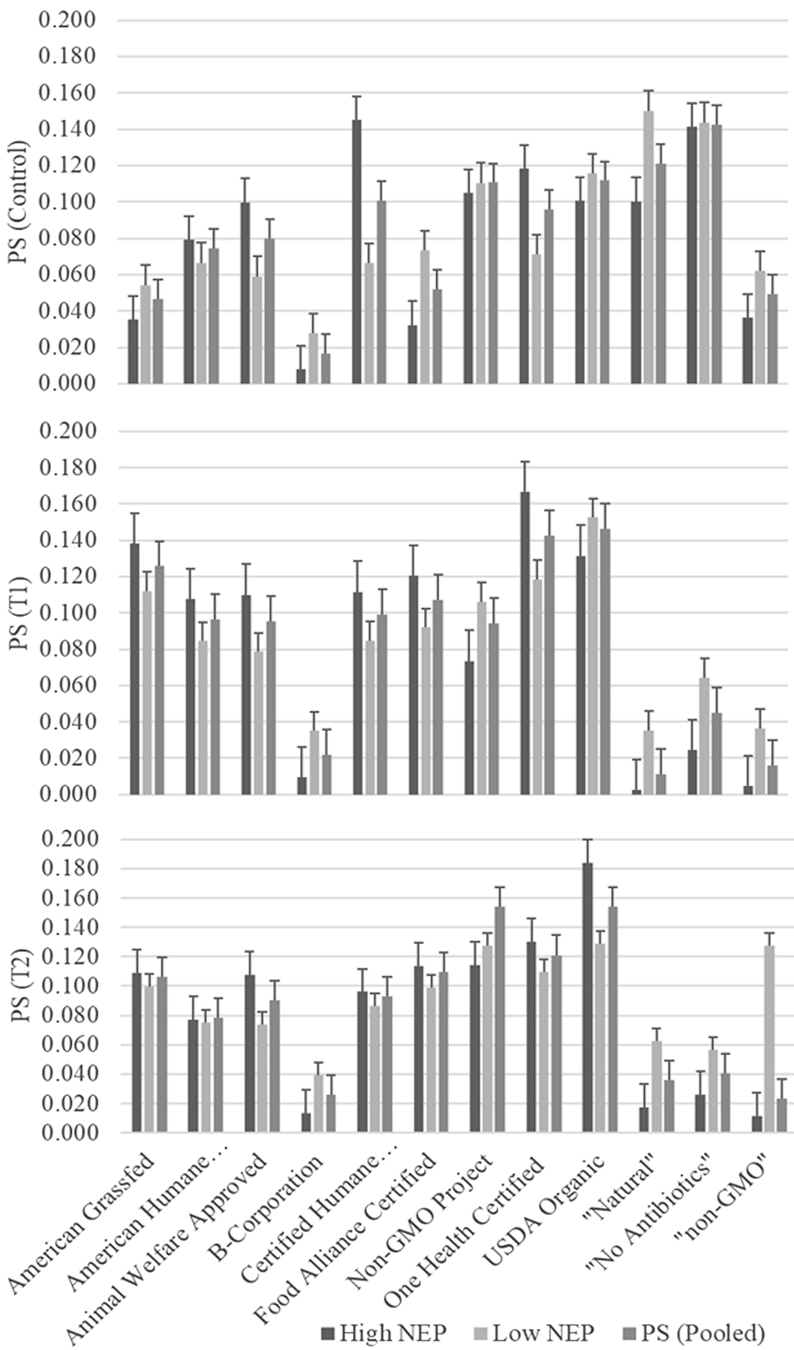

Figure 3. Preference shares for food labels by treatment group based on high vs. low NEP scores.

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

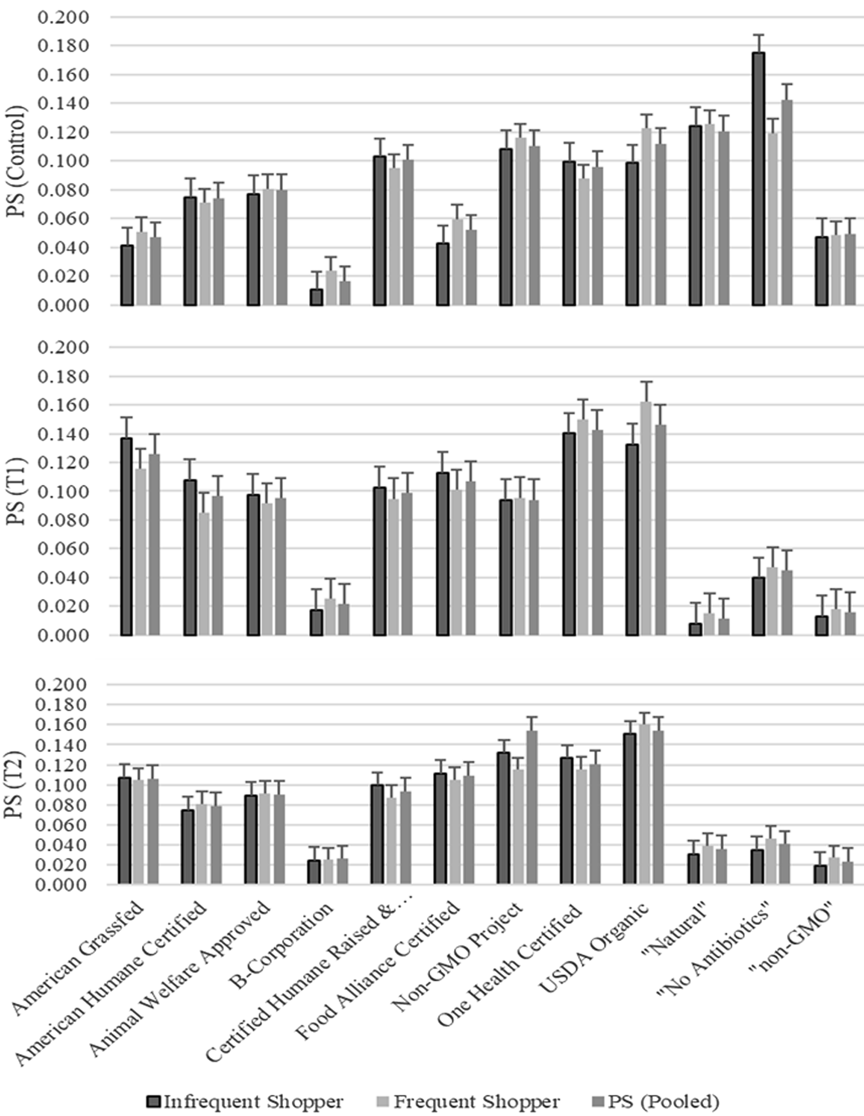

Figure 4. Preference shares for food labels by treatment group based on shopping frequency.

We also examined if there is heterogeneity in treatment effects across shopping frequency. Participants who indicated shopping for groceries more than once a week were considered frequent shoppers; otherwise, they were considered as infrequent shoppers. As shown in Fig. 4, the frequency of shopping had minimal effect on the preference shares by treatment group when compared to the pooled preference shares for each group. B Corporation had a significant difference in preference shares between infrequent and frequent shoppers for participants in the control and T1 groups (Table 8, preference shares see Table A6 in appendix). The T2 group had the most labels with significant changes in

https://doi.org/10.1017/age.2023.28 Published online by Cambridge University Press

Table 8. Change in preference shares (ΔS) for food labels based on infrequent vs. frequent shopping by treatment groups[a]

	Control	T1	T2
	Frequent – Infrequent	Frequent – Infrequent	Frequent – Infrequent
Food label	ΔS	ΔS	ΔS
Seals			
Food Alliance	0.017	−0.012	−0.006*
Animal Welfare Approved	0.004	−0.006*	0.002
Certified Humane Raised & Handled	−0.008	−0.008	−0.012
American Humane Certified	−0.004	−0.023	0.007
American Grassfed	0.010	−0.021	−0.003*
Non-GMO Project	0.008	0.002	−0.017*
USDA Organic	0.024	0.030	0.010
One Health Certified	−0.012	0.009	−0.011
B Corporation	0.013**	0.008**	0.001*
Claims			
No Antibiotics	−0.055	0.008	0.012
Natural	0.001	0.007	0.009*
Non-GMO	0.001	0.005	0.008

**$p < 0.01$, * $p < 0.05$.
[a]Statistical significance levels are related to the results from the Poe test (Poe et al. 2005).

preference shares ($p < 0.05$), including the labels Food Alliance Certified, American Grassfed, Non-GMO Project Verified, B Corporation, and the "Natural" claim. When compared to the pooled preference shares attributed to the labels by each treatment group, the most preferred labels were similar even when taking shopping frequency into account. The control group's top four labels for frequent shoppers were the same as the control group's pooled label ranking. The top four labels for infrequent shoppers within the control group were similar, but organic was removed from the top four and replaced with Certified Humane Raised and Handled. The top four labels for frequent and infrequent shoppers in the T1 and T2 groups were the same as their groups pooled label ranking.

In summation, the heterogeneity checks revealed variation in preference for the labels based on high and low NEP scores. However, shopping frequency was found to have minimal influence on preference share by treatment group when compared to the pooled preferences.

Conclusions

The goal of the study was to identify consumer preference shares for 12 sustainability-related food labels and 12 food values (or attributes). Participants were separated into three groups to identify the effect of more information on food label preference shares. A BWS approach was applied to identify consumer preferences for food labels and food values. The other goal of the study was to identify if a correlation exists between food labels and food values.

The labels included in this study are popular in the U.S. market, and most have been studied as the labels contributing to consumer misperception. Our results imply that consumers do not fully understand the standards or verification process of a label by simply seeing the logo or image. As more information was provided for the T1 and T2 groups, the preference shares changed for each label (seal or claim). The claims "Natural" and "No Antibiotics" are among the most misinterpreted labels on the market. The results of this study provide further support for that statement by showing the extent to which importance decreased for those claims as more information was provided to groups T1 and T2. The USDA Organic label received the most preference shares across our participant pool. This finding does not align with Ellison et al. (2017), where the 'Product is certified organic' claim received the least preference shares, which highlighted consumer confusion surrounding the standards required for that claim. This finding could be attributed to the USDA doing a better job over the last 6 years of explaining the meaning of their label and the criteria for obtaining the label. Based on the observed change in preference shares, Food Alliance Certified, American Grassfed, and B Corporation should increase efforts focusing on consumer literacy for their labels to increase consumer interest.

As indicated by consumers in this study, the most important food values were *Safety* and *Taste*. These findings align with previous research on food values which determined that *Safety* and *Taste* are among the most important attributes for consumers when purchasing products (Lusk and Briggeman 2009; Bazzani et al. 2018; Cerroni et al. 2021). The food attributes with the lowest preference shares across treatment groups were *Convenience* and *Novelty*.

The correlation values between food values and food labels within groups determined that perceived authoritative certification statements can harm the perception of the label because consumers want to make their own decisions based on the label image and description. The correlation values supported the idea that more information is useful as shown by the increase in preference share for labels when the definition of the label was added. Too much information, on the other hand, is unnecessary and can have an adverse effect on consumer perception of the label, consistent with the findings of Jacoby et al. (1977), Lusk and Marette (2012), McCluskey and Swinnen (2004), Salaün and Flores (2001), Verbeke (2005). The researchers believe that consumer fatigue related to the number of certified labels displaying too much information can be overwhelming for consumers and will not positively affect their food value preferences.

This study was the first of its kind to determine consumer preferences for a large number of environmental food labels. This study should guide further research on the connection between food labels and food values. Future studies should test the robustness of our findings in other contexts (e.g., other countries).

Policy implications

This study further supports the notion that consumers could benefit from clear label standards to make informed purchasing decisions. Food policy efforts should require strict, clear label standards. Promoting clear labeling standards for sustainability-related ecolabels will benefit the environment and influence companies to adopt better practices. Companies will be more likely to adopt new standards if the certification will increase consumer preference for their product. Developing clear labeling standards could encourage companies to adopt sustainable practices because the consumers would be more likely to understand the standards needed to receive certification for a specific label.

Enhancing consumer understanding of food labels offers benefits to consumers, retailers, and producers alike. When consumers demonstrate a preference or comprehension of a label, companies are more likely to pursue certification as it distinguishes their products in the market. As evidenced in this study, consumer preferences can shift with the provision of additional information for certain labels. However, it is important to strike a balance, as excessive information may overwhelm consumers. Thus, labels should provide clear descriptions of certification requirements to enhance consumer knowledge. Transparent and effective communication about these requirements can also foster consumer trust in a company or brand (Smith, 2019). Pierce and Hartt (2019) suggest that certifications should be regarded as a strategic investment in marketing rather than solely driving sales, as they enable companies to better target specific consumer segments. The authors further highlight that certifications establish trust by signaling the "presence or absence of qualities that consumers seek or avoid" (Pierce and Hartt 2019, 23–24).

Consumer fatigue related to food labeling is a concern (Fang et al. 2019). Increasingly, more media outlets are citing the conflicting label and nutrition messages as the source of stress and fatigue on the consumer (Badaracco 2012; Loria 2017; Nunes 2017; and Visser 2019). Consumer fatigue has also been linked to causing voters to avoid labeling initiatives (Gunlock 2015).

The Food and Drug Administration (FDA) has recently proposed a new definition and regulations for labeling products as "healthy," indicating their commitment to addressing consumer confusion and misperception of food labels (Reiley 2022). However, policy makers should not limit their efforts to redefining terms solely for front-of-package labels. It is crucial to design labels with the underlying food values in mind. Our study findings reveal that consumers perceive a label as less significant when it fails to align with their core food values. Therefore, policy makers should consider this aspect when developing guidelines to mitigate consumer misperception and misinterpretation of labels, including seals and claims.

Food labeling alone is no longer sufficient to drive lasting consumer behavior change towards sustainable and healthy foods, primarily due to the growing consumer fatigue and skepticism surrounding food labels. To foster lasting behavior change, food labeling can be complemented by other interventions, such as taxes and subsidies, community-based initiatives, and targeted interventions tailored to individual lifestyles, in order to avoid relying on a one-size-fits-all approach (Osman and Jenkins 2021, 44). Another effective strategy for influencing consumer behavior is to raise awareness about the potential risks associated with certain products. For instance, Chile implemented a black stop sign as a front-of-package label on unhealthy foods in 2016 to discourage their consumption or purchase (Correa et al. 2022). When designing labels to alert consumers to product risks, it is crucial to provide clear explanations of the risk levels to prevent individuals from either becoming overly cautious or disregarding the warnings entirely, as recommended by Robinson et al. (2016). One approach to indicate varying levels of risk is by using traffic light labeling, which employs a color-coded system (e.g., green, yellow, and red) to convey low, medium, and high levels of potential harm to individuals or the environment (e.g., sugar or sodium content, carbon emissions). This method helps differentiate and communicate different levels of risk effectively.

Limitations

This study has a limitation in that it does not allow for the calculation of the extent to which preference is attributed solely to the picture (logo) compared to the accompanying text description included in the logo. Future research could address this limitation by incorporating a control group that includes text descriptors in the design. It would be valuable to explore how preference shares are influenced by various logo design elements, such as color, esthetic, and the specific text used in the logo. Another potential limitation of the study is related to survey length, which could contribute to survey fatigue. Since the average completion time is approximately 14 minutes, it is unlikely that our survey had a negative impact on some participants' responses due to fatigue.

Supplementary material. The supplementary material for this article can be found at [https://doi.org/10.1017/age.2023.28].

Data availability statement. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funding statement. This work is supported by AFRI Sustainable Agricultural Systems Coordinated Agricultural Project (SAS-CAP) grant no. 2021-68012-35917 from the USDA National Institute of Food and Agriculture.

Competing interests. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Anderson, M.W. 2012. "New Ecological Paradigm (NEP) Scale." *Berkshire Encyclopedia of Sustainability* **6**: 260–262.

Asioli, D., J. Aschermann-Witzel, and R.M. Nayga Jr. 2020. "Sustainability-Related Food Labels." *Annual Review of Resource Economics*: 1–15. https://doi.org/10.1146/annurev-resource-100518-094103

Auger, P., T.M. Devinney, and J.J. Louviere. 2007. "Using Best-Worst Scaling Methodology to Investigate Consumer Ethical Beliefs across Countries." *Journal of Business Ethics* **70**: 299–326. https://doi.org/10.1007/s10551-006-9112-7

Badaracco, S. 2012. "The Sustainability Playground: Consumer Fatigue." *FastCasual*. https://www.fastcasual.com/blogs/the-sustainability-playground-consumer-fatigue/

Bazzani, C., G.W. Gustavsen, R.M. Nayga Jr., and K. Rickertsen. 2018. "A Comparative Study of Food Values between the United States and Norway." *European Review of Agricultural Economics* **45**(2): 239–272. https://doi.org/10.1093/erae/jbx033

B Corporation. 2021. *Certified B Corporation*: B Corporation. https://usca.bcorporation.net/certification

Bernard, J.C., J.M. Duke, and S.E. Albrecht. 2019. "Do Labels that Convey Minimal, Redundant, or No Information Affect Consumer Perceptions and Willingness to Pay?" *Food Quality and Preference* **71**: 149–157.

Bonroy, O., and C. Constantatos. 2014. "On the economics of labels: How their introduction affects the functioning of markets and the welfare of all participants." *American Journal of Agricultural Economics* **71**(1): 239–259. https://doi.org/10.1093/ajae/aau088

Brécard, D. 2017. "Consumer Misperception of Ecolabels, Green Market Structure and Welfare." *Journal of Regulatory Economics* **51**(3): 340–364. https://doi.org/10.1007/s11149-017-9328-8

Campbell, D., and S. Erdem. 2015. "Position Bias in Best-Worst Scaling Surveys: A Case Study on Trust in Institutions." *American Journal of Agricultural Economics* **97**(2): 526–545. https://doi.org/10.1093/ajae/aau112

Cerroni, S., R.M. Nayga Jr., G. Pappalardo, and W. Yang. 2021. "Malleability of Food Values Amid the COVID-19 Pandemic." *European Review of Agricultural Economics*: 1–27. https://doi.org/10.1093/erae/jbab025

Consumer Reports. 2019a. *Claim: Natural*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/natural

Consumer Reports. 2019b. *Claim: No Antibiotics*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/no-antibiotics

Consumer Reports. 2019c. *Claim: Non-GMO*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/non-gmo

Consumer Reports. 2019d. *Seal: American Grassfed*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/american-grassfed

Consumer Reports. 2019e. *Seal: American Humane Certified*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/american-humane-certified

Consumer Reports. 2019f. *Seal: Animal Welfare Approved*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/animal-welfare-approved

Consumer Reports. 2019g. *Seal: Certified Humane Raised & Handled*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/certified-humane

Consumer Reports. 2019h. *Seal: Non-GMO Project Verified*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/non-gmo-project-verified

Consumer Reports. 2019i. *Seal: One Health Certified*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/one-health-certified

Consumer Reports. 2019j. *Seal: USDA Organic*. Consumer Reports, Inc. https://www.consumerreports.org/food-labels/seals-and-claims/usda-organic

Consumer Reports. 2019. *Understanding CR's Ratings for Food-Label Seals & Claims*. Consumer Reports, Inc., Yonkers, NY. https://www.consumerreports.org/food-labels/how-we-rate

Correa, T., C. Fierro, M. Reyes, L. Taillie, F. Carpentier, and C. Corvalán. 2022. "Why Don't You [Government] Help us Make Healthier Foods More Affordable Instead of Bombarding us with Labels? Maternal Knowledge, Perceptions, and Practices after Full Implementation of the Chilean Food Labelling Law." *International Journal of Environmental Research and Public Health* **19**. https://doi.org/10.3390/ijerph19084547

Dsouza, A., D. Fang, W. Yang, N. Kemper, and R.M. Nayga Jr. 2023. "Consumers' Valuation for a Novel Food Waste Reducing Technology: The Case of Natural Coating." *Journal of the Agricultural & Applied Economics Association*. In press. https://doi.org/10.1002/jaa2.47

Dunlap, R.E., K.D. Van Liere, A.G. Mertig, and R.E. Jones. 2000. "Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale." *Journal of Social Issues* **56**(3): 425–442.

Ecolabel Index. 2021a. *B Corporation*: Ecolabel Index. https://www.ecolabelindex.com/ecolabel/b-corporation

Ecolabel Index. 2021b. *Food Alliance*: Ecolabel Index. https://www.ecolabelindex.com/ecolabel/food-alliance-certified

Ecolabel Index. 2022. *Ecolabel Index*. https://www.ecolabelindex.com/

Ellis, J., K.L. Delong, K.L. Jensen, and A.P. Griffith. 2021. "The Impact of a Visual Cheap Talk Script in an Online Choice Experiment." *International Journal on Food System Dynamics* **12**(1): 19–36. http://doi.org/10.18461/ijfsd.v10i5.28

Ellison, B., K. Brooks, and T. Mieno. 2017. "Which Livestock Production Claims Matter Most to Consumers?" *Agriculture Humane Values* **34**: 819–831. https://doi.org/10.1007/s10460-017-9777-9

Fang, D., R.M. Nayga, H.A. Snell, G.H. West, and C. Bazzani. 2019. "Evaluating USA's New Nutrition and Supplement Facts Label: Evidence from a Non-Hypothetical Choice Experiment." *Journal of Consumer Policy* **42**(4): 545–562.

Finn, A., and J.J. Louviere. 1992. "Determining the Appropriate Response to Evidence of Public Concern: The Case of Food Safety." *Journal of Public Policy and Marketing* **11**(2): 12–25.

Flynn, T.N., J.J. Louviere, T.J. Peters, and J. Coast. 2007. "Best-Worst Scaling: What It Can Do for Health Care Research and How to Do It." *Journal of Health Economics* **26**: 171–189. https://doi.org/10.1016/j.jhealeco.2006.04.002

Food Alliance. 2016a. *General FAQs*: Food Alliance. https://foodalliance.org/faqs

Food Alliance. 2016b. *Livestock Producers*: Food Alliance. http://foodalliance.org/livestock-producers/

Fortin, N. 2016. *Food Regulation: Law, Science, Policy, and Practice*: Wiley. https://doi.org/10.1002/9781119341178

Gracia, A., and T. de-Magistris. 2016. "Consumer Preferences for Food Labeling: What Ranks First?" *Food Control* **61**: 39–46. https://doi.org/10.1016/j.foodcont.2015.09.023

Gummer, T., J. Roßmann, and H. Silber. 2021. "Using Instructed Response Items as Attention Checks in Web Surveys: Properties and Implementation." *Sociological Methods & Research* **50**(1): 238–264. https://doi.org/10.1177/0049124118769083

Gunlock, J. 2015. "Food Labeling Fatigue." *HuffPost*. https://www.huffpost.com/entry/food-labeling-fatigue_b_6215052

Harbaugh, R., J.W. Maxwell, and B. Roussillon. 2011. Label Confusion: The Groucho Effect of Uncertain Standards." *Management Science* **57**(9): 1512–1527. https://doi.org/10.1287/mnsc.1110.1412

Jacoby, J., C. Berning, and T. Dietvorst. 1977. "What about disposition?" *Journal of Marketing* **41**(2): 22–28. https://doi.org/10.1177/002224297704100212

Lim, K. H., W. Hu, and R.M. Nayga. 2020. "Consumer Preference for Grass-Fed Beef: A Case of Food Safety Halo Effect." *Journal of Agricultural and Resource Economics*: 1–18. http://doi.org/10.22004/ag.econ.307458

Loria, K. 2017. "Too Many Labels Cause Information Overload for Consumers." *Food Dive*. https://www.fooddive.com/news/too-many-labels-cause-information-overload-for-consumers/442972/

Lusk, J.L., and S. Marette. 2012. "Can labeling and information policies harm consumers?" *Journal of Agricultural and Food Industrial Organization* **10**(1): 1–15. https://doi.org/10.1515/1542-0485.1373

Lusk, J.L., and J. McCluskey. 2018. "Understanding the impacts of food consumer choice and food policy outcomes." *Applied Economic Perspectives and Policy* **40**(1): 5–21. https://doi.org/10.1093/aepp/ppx054

Lusk, J.L., and B.C. Briggeman. 2009. "Food Values." *American Journal of Agricultural Economics* **91**(1): 184–196. https://doi.org/10.1111/j.1467-8276.2008.01175.x

McCluskey, J., and J. Swinnen. 2004. "Political economy of the media and consumer perceptions of biotechnology." *American Journal of Agricultural Economics* **86**(5): 1230–1237. https://doi.org/10.1111/j.0002-9092.2004.00670.x

McFadden, B.R., and J.L. Lusk. 2018. "Effects of the National Bioengineered Food Disclosure Standard: Willingness to Pay for Labels That Communicate the Presence or Absence of Genetic Modification." *Applied Economic Perspectives and Policy* **40**(2): 259–275.

McFadden, D. 1974. "Conditional Logit Analysis of Qualitative Choice Behavior." *Frontiers in Econometrics*: 105–142. Academic Press, NY, USA.

Nunes, K. 2017. "Information overload causing consumers to doubt food choices." *Food Business News*. https://www.foodbusinessnews.net/articles/9346-information-overload-causing-consumers-to-doubt-food-choices

Osman, M., and S. Jenkins. 2021. *Consumer Responses to Food Labelling: A Rapid Evidence Review*: Food Standards Agency. https://doi.org//10.46756/sci.fsa.aiw861

Pierce, E., and A. Hartt. 2019. *Certifications: What Role Should They Play in Your Marketing Strategy?*: NEXT Consulting. https://www.whatsnextinnatural.com/wp-content/uploads/2019/11/ssw19_next_certifications_092319.pdf

Poe, G.L., K.L. Giraud, and J.B. Loomis. 2005. "Computational methods for measuring the difference of empirical distributions." *American Journal of Agricultural Economics* **87**(2): 353–365. http://www.jstor.org/stable/3697850

Reiley, L. 2022. "The FDA Announces a New Definition of What's 'Healthy'." *The Washington Post*. https://www.washingtonpost.com/business/2022/09/28/white-house-conference-food-labels-healthy/

Robinson, L., W. Viscusi, and R. Zeckhauser. 2016. "Consumer Warning Labels Aren't Working." *Harvard Business Review*. https://hbr.org/2016/11/consumer-warning-labels-arent-working

Roe, B., and L. Sheldon. 2007. "Credence good labeling: The efficiency and distributional implications of several policy approaches." *American Journal of Agricultural Economics* **89**(4): 1020–1033. https://doi.org/10.1111/j.1467-8276.2007.01024.x

Salaün, Y., and K. Flores. 2001. "Information quality: Meeting the needs of the consumer." *International Journal of Information Management* **21**(1): 21–37. https://doi.org/10.1016/S0268-4012(00)00048-7

Sarrias, M., and R. Daziano. 2017. "Multinomial Logit Models with Continuous and Discrete Individual Heterogeneity in R: The gmnl Package." *Journal of Statistical Software* **79**(2): 1–46. https://doi.org/10.18637/jss.v079.i02

Scott, F., and J.P. Sesmero. 2022 "Market and Welfare Effects of Quality Misperception in Food Labels." *American Journal of Agricultural Economics* **104**(5): 1747–1769. https://doi.org/10.1111/ajae.12287

Shahbandeh, M. 2021. "U.S. Per Capita Meat Consumption 2020 and 2030 By Type." *Statista*. https://www.statista.com/statistics/189222/average-meat-consumption-in-the-us-by-sort/

Smith, A. 2019. "Do Consumers Have Certification Fatigue?" *New Hope Network*. https://www.newhope.com/market-data-and-analysis/do-consumers-have-certification-fatigue

Syrengelas, K.G., K.L. DeLong, C. Grebitus, and R.M. Nayga. 2018. "Is the Natural Label Misleading? Examining Consumer Preferences for Natural Beef." *Applied Economic Perspectives and Policy* **40**(3): 445–460. https://doi.org/10.1093/aepp/ppx042

Tonsor, G.T., and R.S. Shupp. 2011. "Cheap Talk Scripts and Online Choice Experiments: 'Looking Beyond the Mean'." *American Journal of Agricultural Economics* **93**(4): 1015–1031. https://doi.org/10.1093/ajae/aar036

United States Census Bureau. 2021. "2021 American Community Survey 1-Year Estimates." U.S. Department of Commerce. https://data.census.gov/table?q=2021populationdemographic&tid=ACSDP1Y2021.DP05

Verbeke, W. 2005. "Consumer acceptance of functional foods: Socio-Demographic, cognitive and attitudinal determinants." *Food Quality and Preference* **16**(1): 45–57. https://doi.org/10.1016/j.foodqual.2004.01.001

Visser, K. 2019. "Food Label Fatigue." *Iowa Food & Family Project*. https://www.iowafoodandfamily.com/blog/food-label-fatigue

Zepeda, L., L. Sirieix, A. Pizarro, F. Corderre, and F. Rodier. 2013. "A Conceptual Framework for Analyzing Consumers' Food Label Preferences: An Exploratory Study of Sustainability Labels in France, Quebec, Spain and the US." *International Journal of Consumer Studies* **37**: 605–616. http://doi.org/10.1111/ijcs.12041

Zheng, Q., R.M. Nayga Jr., W. Yang, and K. Tokunaga. 2023. "Do US Consumers Value Genetically Modified Farmed Salmon?" *Food Quality and Preference* **107**, 104841. https://doi.org/10.1016/j.foodqual.2023.104841.

Cite this article: McLeod, A., W., Yang, D., Fang, and R. M., Jr. Nayga (2024). "Aligning values to labels: A best-worst analysis of food labels." *Agricultural and Resource Economics Review* **53**, 20–44. https://doi.org/10.1017/age.2023.28