Aligning Values to Labels: A Best-Worst Analysis of Food Labels

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Abstract

Consumer misperception and confusion surrounding food labels have been a topic of interest worldwide. Misinterpretation of the labels can lead to consumers not buying a product or purchasing products that do not align with their environmental or sustainability interests. Researchers have identified a way to explain consumer purchasing behavior by looking at their 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 (seal or claim) 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: Ecolabels; Food Values; Consumer perception

1. Introduction

Consumer misperception and confusion surrounding food labels have been a topic of interest around the world (Bazzani et al., 2018; Brécard, 2017; Ellison et al., 2017; Garcia & de-Magistris, 2016; Lim et al., 2021; Syrengelas et al., 2018; Zepeda et al., 2013). One reason for the confusion and misperception is the increased number of food labels worldwide. For instance, the Ecolabel Index (2022) has tracked around 455 ecolabels in 199 countries and 25 industry sectors. The increased number of labels in the market has caused labels to lose their meaning and has increased consumer misinterpretation of the labels (Asioli et al., 2020; Brécard, 2017; Sundar et al., 2021). Consumer misinterpretation of labels can lead to consumers not buying a product or purchasing products that do not align with their environmental or sustainability interests. Consumers tend to overinterpret labels and have struggled to separate verified ecolabels from unverified ones (Asioli et al., 2020; Brécard, 2017). Hence, for a label to be effective, consumers must trust the authenticity and credibility of the food label (Asioli et al., 2020).

With the increased number of labels coupled with uncertainty surrounding the standards required for the label, consumer confusion is well documented in the literature. For example, many consumers are unaware of which standards are difficult for firms to meet when applying for certification. The lack of knowledge regarding certification standards can reduce the informativeness of labeling and reduce the incentive to be certified (Harbaugh et al., 2011). Consumers also frequently misinterpret “natural,” grass-fed, and certified organic labels (Ellison et al., 2017; Lim et al., 2020; Syrengelas et al., 2018). First, “Natural” is the most frequently used product label, appearing on 8.4% of all new food products (Syrengelas et al., 2018, p. 445). However, despite its popularity, the U.S. Food and Drug Administration does not have a formal definition for the term or its derivatives (Syrengelas et al., 2018, p. 445). As for the grass-fed

label, since it is known as an ecolabel, it could bias consumers' perceptions or create a halo effect (Lim et al. 2020). This halo effect can lead people to believe that eco-labeled products are of higher quality (Lim et al., 2020; Sundar et al., 2021). For example, people believe that the grass-fed label means superior food safety by minimizing the risk of various food-borne illnesses when no scientific evidence supports this belief (Lim et al., 2020). "...if consumers are generally expecting unsupported food safety benefits from ecolabels, then policy intervention may be necessary to adjust the distortion created by the misperception" (Lim et al., 2020, p. 14).

The certified organic claim is also frequently misinterpreted. Ellison et al. (2017) found that the 'Product is certified organic' claim had the lowest preference shares among the seven claims studied even though USDA Organic standards encompass many of the claims ranked as more important than organic, such as 'animals were not administered growth hormones,' 'no genetically-modified organisms used in production' and 'animals were humanely raised' (p. 826).

The differentiation between products regulated by the USDA and FDA can also contribute to consumer uncertainty toward labeling standards. The USDA reviews and regulates meat products, poultry products, egg products, and catfish, while the FDA reviews about 80% of the foods on the market, including dairy, seafood, produce, packaged foods, bottled water, and whole eggs. Unlike the FDA, the USDA provides a definition for *natural* meat products, highlighting that a product can be labeled natural if it does not contain artificial ingredients, added colors, and is minimally processed (Fortin, 2016; Syrengelas et al., 2018). Consumer Reports petitioned the USDA to ban the use of *natural* labeling because more than 60% of consumers wrongly believed meat labeled as 'natural' was raised without antibiotics, growth hormones, and genetically modified (GM) organisms in the production (Syrengelas et al., 2018).

There has been a push among consumer groups and other organizations, including Consumer Reports, to have more transparent food labeling laws. In particular, the FDA is more relaxed on their certifications as most producers are given recommended guidelines. However, "companies are not legally bound to follow any recommendations in the guidance" (Consumer Reports, 2019, Non-GMO Plant Foods section).

The well-documented consumer confusion and misinterpretation of labels highlight a need for further investigation. This study contributes to the literature by identifying consumer preferences for 12 sustainability-related food labels and 12 food values. We focused on sustainability-related food labels because it is a rising topic of interest for consumers. Sustainability-related labels are among the most frequently misinterpreted labels on the market, as shown in the examples above. Food values are the food quality attributes that influence consumers purchasing decisions which are categorized into credence (e.g., sustainability and ethical issues), experience (e.g., taste and convenience), and price attributes (Bazzani et al., 2018; Fortin, 2016). 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. We also sought to identify if label preference shares would change by providing more information about the label using the Best-Worst Scaling approach and dividing the participants among treatment groups. Respondents were assigned to one of three groups and were shown: (1) food label picture only; (2) picture and description of the seal/claim; or (3) picture, description, plus certification statement. We further determine whether consumers' food values align with their preferred labels. If there is a disconnect between their chosen labels and their food values, a case can be made to evaluate the discrepancy further. Companies need to know if the labels displayed on a product's packaging mislead consumers. Identifying the impact label information has on preference shares can help companies understand how consumers

interpret the labels included on the product's packaging. Determining the impact can also support policy changes to increase consumer knowledge and understanding of food labels and policy efforts requiring strict, clear label standards.

The rest of the paper is structured as follows: Seals and Claims, Food Values, Methodology, Econometric Model, Data, Results, Robustness Checks, Conclusions, and Policy Implications. The Seals and Claims section consists of a description of the difference between food label seals and claims, followed by an explanation of the nine seals and three claims included in the study. The Food Values section explains the background for the food values and which food values were represented by the food labels included in the study.

1.1. Labels: Seals and Claims

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, p. 1). Consumer Reports (2019) conducted the 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 (Consumer Reports, 2019).

This study focuses on nine seals mentioned in the Consumer Report (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, 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.

Labels are meant to educate consumers on important characteristics of the food they are buying and to convince them to purchase one product over the other. However, with so many labels not having a clear meaning and companies being able to create their own labels, we might reach a point where labels are meaningless. By creating strict regulations and definitions for different seals or claims, consumers can make informed purchases that align with the issues that are most important to them.

1.2. Food Values

Researchers have identified a way to explain consumer purchasing behavior by looking at their food values or food quality attributes (Bazzani et al., 2018; Cerroni et al., 2021; Lusk & Briggeman, 2009). Bazzani et al. (2018) identified 12 food values to capture the main food quality attributes consumers use 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 replicated by Cerroni et al. (2021) to observe the malleability of food values. This study expands upon the work done by Bazzani et al. (2018) and Cerroni et al. (2021) by identifying if food

value preference shares align with consumer preferences for 12 labels. This study expanded on the work done by 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, e.g., sustainability and ethical issues (Bazzani et al., 2018; Fortin, 2016). Experience attributes are characteristics that consumers can personally experience, e.g., taste and convenience (Bazzani et al., 2018). Cerroni et al. (2021) created a table to visually represent the 12 food values in Table 1.

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), p.8.

Using the label definitions shown to participants during the study 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 the purpose of 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.

2. Methodology

2.1. Best-Worst Scaling (BWS)

The Best-Worst Scaling (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 & Briggeman, 2009). Bazzani et al. (2018) explained that the BWS approach allows researchers to identify preference shares for each issue under consideration and conduct accurate comparisons of the preference shares. 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 (Bazzani et al., 2018).

2.2. Treatment design and research objectives

Respondents were 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, wherein the food label best-worst choice sets they only see a picture of the label. The second group is treatment one (T1), wherein 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), wherein 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.

2.3. Survey design

In our study, the Best Worst scaling approach (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 & 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 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 2= *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 ask each individual to complete an online consent form and ask them to promise to read all questions and information carefully and provide their best answers. A text "cheap talk" is provided to every respondent before starting choice tasks to reduce the hypothesis bias (Ellis et al., 2021; Tonsor & Shupp, 2011). In order to control for order effect, we randomize 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).

3. Econometric model

Responses from the BWS of food value and environmental food label are analyzed using the Random Parameter Logit model (RPL) (Revelt & Train, 1998), also known as the mixed logit model, a widely used model in choice experiment modeling. All the models of the choice experiment are consistent with random utility theory (McFadden, 1974), which can be presented by:

$$U_{ijt} = \beta_i' x_{ijt} + \epsilon_{ijt}$$

Where i = 1, … , I, is the number of respondents; j = 1, … , J, is the number of terms in choice task; t = 1, …, T is the number of choice tasks; β_i is the estimated parameter vectors for each i; x_{ijt} is a vector of items of food value or food labels; the idiosyncratic error ϵ_{ijt} is independent and identically distributed extreme value type 1.

In RPL, β_i allows randomly varying across individuals in the population by assuming its following certain continuous heterogeneity distribution (McFadden & Train, 2000; Train, 2009). We assume β_i following multivariate normal distribution, $\beta_i \sim MNV(\beta, \Sigma)$, and it is presented by:

$$\beta_i = \beta + L\eta_i$$

Where L is the lower-triangular Clolesky decomposition; η_i follows N(0,I), and is a vector of average coefficient of items of food value or food labels.

The unconditional probability of the sequence of choice terms selected by a respondent I is the integral of the product overall values of β:

$$P_i = \int \prod_t^T \frac{e^{\beta_i' x_{ijt}}}{\sum_k^J e^{\beta_i' x_{ikt}}} f(\beta_i) d\beta_i$$

The RPL models are estimated using the gmnl package in R version 1.3.1073 (Sarrias & 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:

$$PS_j = \frac{e^{\widehat{\beta_j}}}{\sum_{n=1}^J e^{\widehat{\beta_n}}}$$

4. Data

The questionnaire was administered online between October 21, 2021, and November 1, 2021, via Dynata. Our sample consists of 1,200 US consumers. Respondents who spent less than 5 minutes or more than 60 minutes on the survey were removed. Respondents who did not answer the attention check questions correctly were also removed. The final analysis sample contained 1,158 surveys.

Table 2 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 $59,000 (57%). 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 lower than 5% indicate that the sample is well balanced.

Table 2

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	
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	

5. Results

5.1. 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 3. Figure 1 provides a graphical representation of the preference shares attributed to the food labels by treatment group. The most selected least important label, *B corporation*, was used as the baseline for the food labels. 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. The "non-GMO" claim was ranked among the lowest for all three groups.

Table 3

Random Parameter Logit Models for Labels by Treatment Group[a]

	Control	**T1**	**T2**
Dep. Var: Choice			
Mean values	**Coefficient**	**Coefficient**	**Coefficient**
Seals			
Food Alliance	1.148**	1.509**	1.453**
	(0.075)	(0.079)	(0.079)
Animal Welfare Approved	1.530**	1.373**	1.236**
	(0.076)	(0.076)	(0.076)
Certified Humane Raised & Handled	1.779**	1.412**	1.282**
	(0.079)	(0.078)	(0.077)
American Humane Certified	1.478**	1.413**	1.086**
	(0.075)	(0.078)	(0.077)
American Grassfed	0.978**	1.669**	1.403**
	(0.076)	(0.081)	(0.078)
Non-GMO Project	1.796**	1.307**	1.503**
	(0.080)	(0.080)	(0.081)
USDA Organic	1.602**	1.789**	1.736**
	(0.082)	(0.085)	(0.084)
One Health Certified	1.749**	1.757**	1.503**
	(0.080)	(0.080)	(0.078)
Claims			
No Antibiotics	2.204**	0.615**	0.434**
	(0.085)	(0.075)	(0.076)
Natural	2.042**	-0.673**	0.308**
	(0.082)	(0.082)	(0.075)
Non-GMO	1.023**	-0.372**	-0.115
	(0.077)	(0.076)	(0.076)
Observations	4,776.00	4,764.00	4,356.00
LogLikelihood	-9,677.10	-9,605.10	-9,129.00
AIC	19,508.15	19,364.29	18,412.09

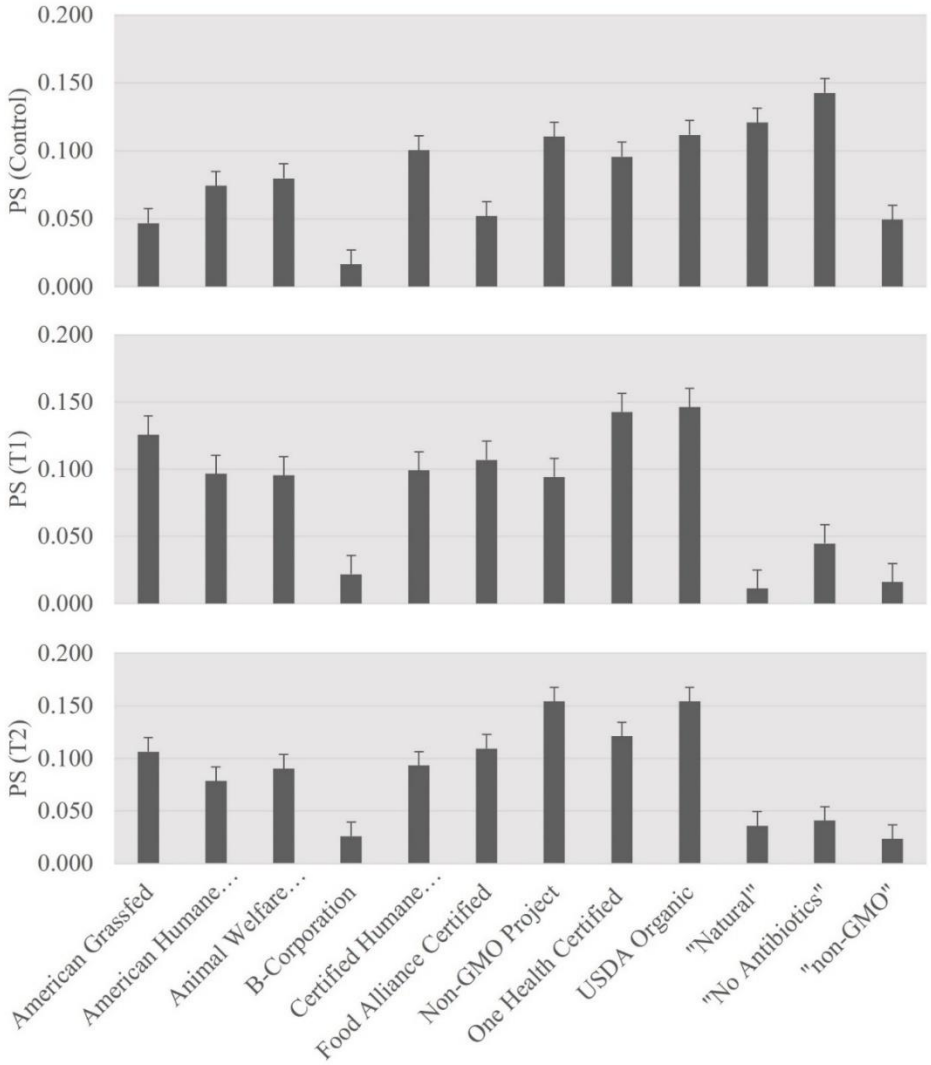
BIC	20,006.45	19,862.39	18,903.29

**p<0.01, *p<0.05
[a] Standard error in brackets

As shown in Figure 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. 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. 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. The B Corporation seal and “Non-GMO” claim were ranked amongst 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.

Figure 1

Preference Shares for Food Labels by Treatment Group



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

As shown in Table 4, significant changes in preference shares were observed for different food labels across treatment groups. 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 (ΔS = 0.055; $p < 0.01$), as did consumers in the T2 group (ΔS = 0.057; $p < 0.01$). When compared to the control group, consumers in the T1 group increased interest in the American Grassfed label (ΔS = 0.079; $p < 0.01$), as did consumers in the T2 group (ΔS = 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 importance in the T2 group (ΔS = -0.102; $p < 0.01$). Second, "Natural" lost importance significantly in the T1 group (ΔS = -0.110; $p < 0.01$) and the T2 group (ΔS = -0.085; $p < 0.01$). Finally, the claim "non-GMO" lost importance significantly in the T1 group (ΔS = -0.033; $p < 0.01$) and the T2 group (ΔS = -0.026; $p < 0.05$). We observed that 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.

Table 4

Change in Preference Shares (ΔS) for Food Labels across Treatment Groups [a]

	Control vs. T1	**Control vs. T2**	**T1 vs. T2**
Food Label	ΔS	ΔS	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 the Poe test (Poe et al., 2005).

5.2. 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 5. Figure 2 provides a graphic 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.

Table 5

Random Parameter Logit Models for Food Values by Treatment Group [a]

	Control	**T1**	**T2**
Dep. Var: Choice			
Mean values	**Coefficient**	**Coefficient**	**Coefficient**
	2.119**	2.154**	2.311**
Appearance	(0.084)	(0.086)	(0.090)
	1.287**	1.391**	1.349**
Fairness	(0.078)	(0.077)	(0.087)
	1.318**	1.639**	1.541**
Origin	(0.082)	(0.079)	(0.090)
	1.028**	1.009**	1.437**
Convenience	(0.073)	(0.070)	(0.084)
	2.842**	2.742**	3.279**
Taste	(0.092)	(0.088)	(0.100)
	1.989**	1.859**	1.850**
Animal Welfare	(0.087)	(0.082)	(0.091)
	2.201**	2.291**	2.323**
Naturalness	(0.083)	(0.082)	(0.094)
	2.567**	2.365**	2.563**
Nutrition	(0.088)	(0.086)	(0.094)
	2.243**	2.297**	2.699**
Price	(0.089)	(0.087)	(0.100)
	3.642**	3.611**	3.842**
Safety	(0.103)	(0.100)	(0.111)
	1.366**	1.447**	1.249**
Environmental Impact	(0.082)	(0.080)	(0.088)
Observations	4,776.00	4,764.00	4,356.00
LogLikelihood	-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

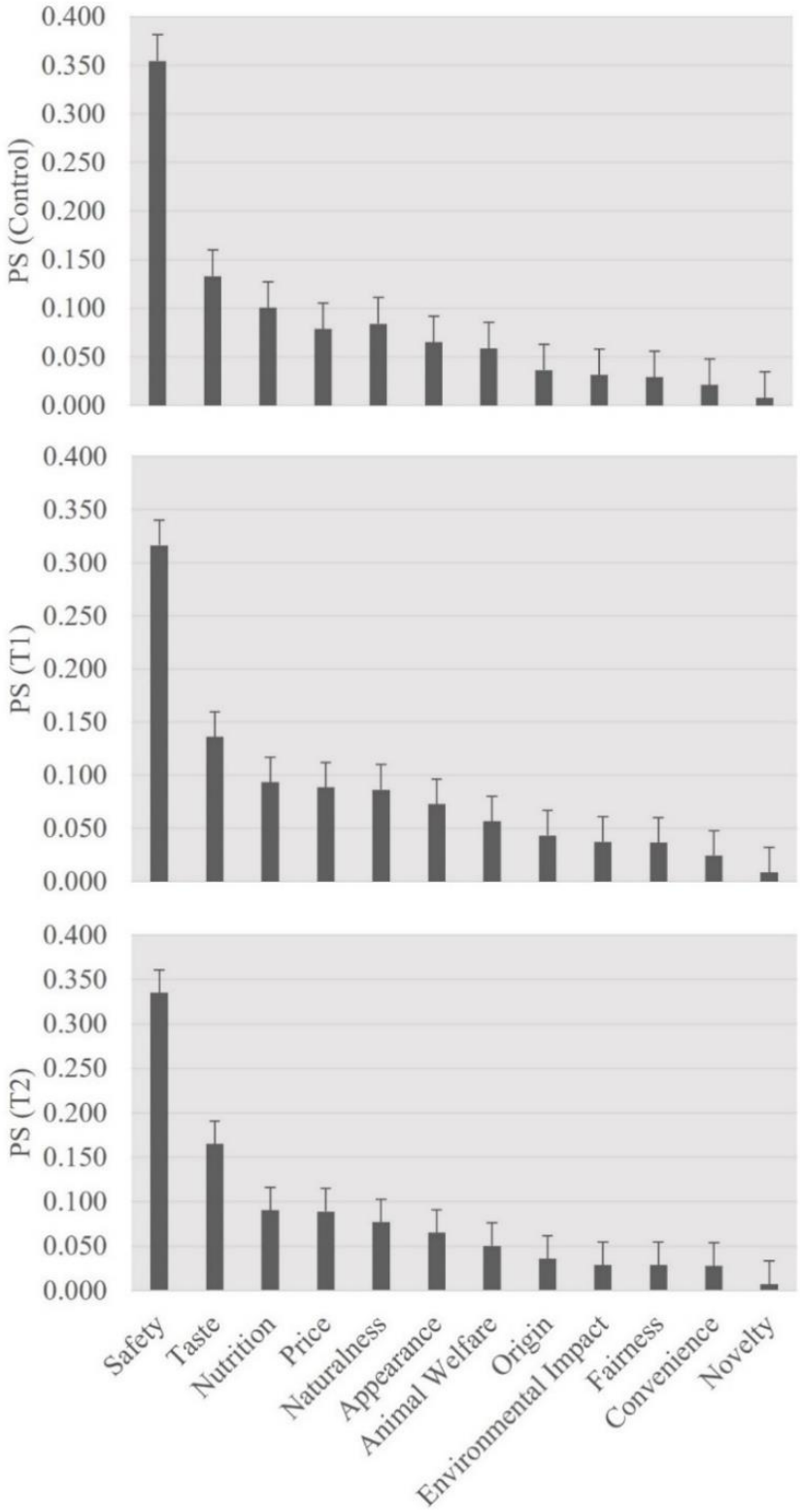
**p<0.01, *p<0.05

[a] Standard error in brackets

As shown in Figure 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.*

Figure 2

Preference Shares for Food Values by Treatment Group



5.3. 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 6. 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 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.*

Table 6

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**

**p<0.01, *p<0.05

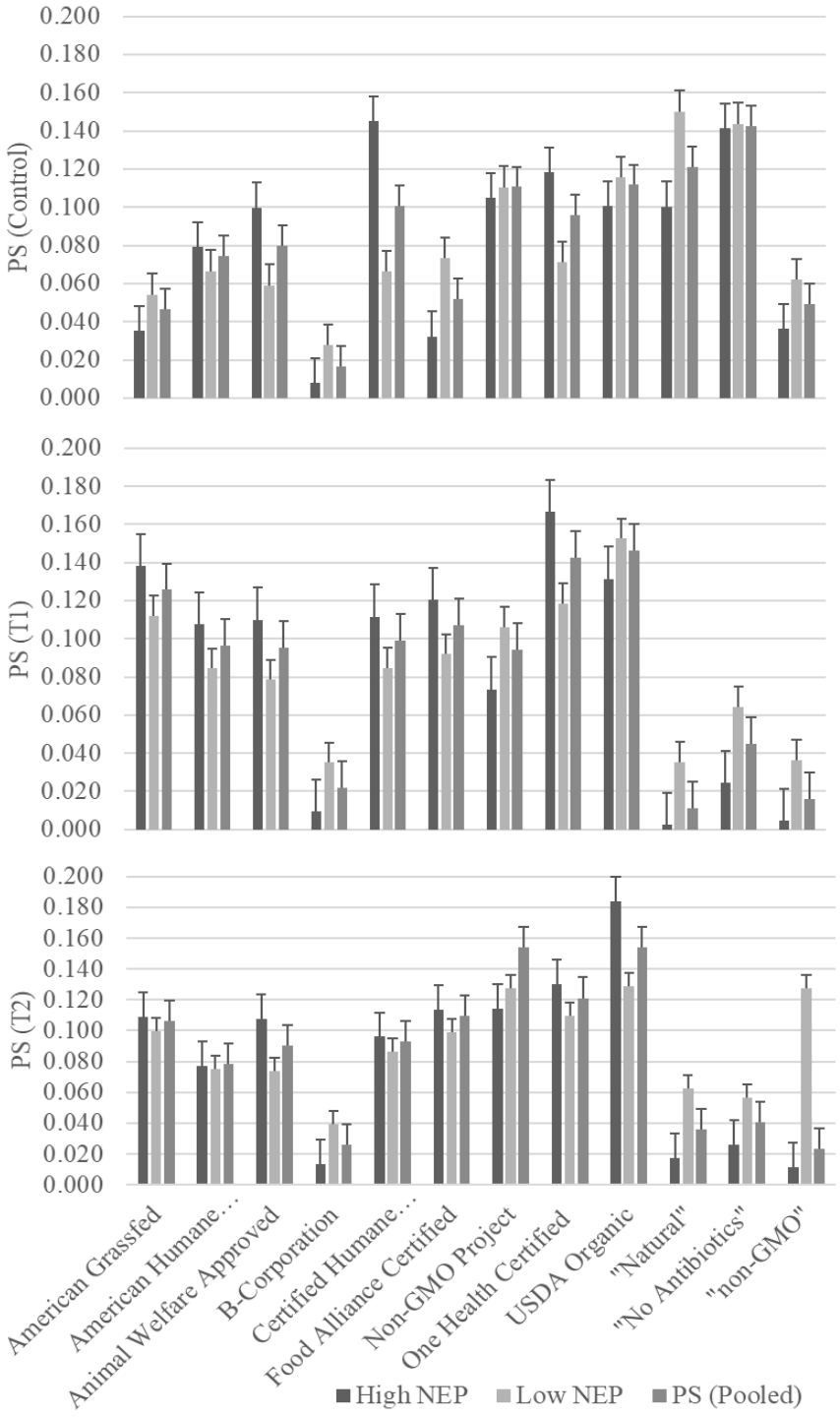
6. Robustness checks

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 Figure 3). 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 dataset. 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 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 dataset. 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



The second robustness test was used to identify if the shopping frequency influenced preference shares. Participants who indicated shopping for groceries more than once a week were considered frequent shoppers. As shown in Figure 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 7). The T2 group had the most labels with significant changes in 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.

Table 7

Change in Preference Shares (ΔS) for Food Labels based on Infrequent vs. Frequent Shopping by Treatment Groups [a]

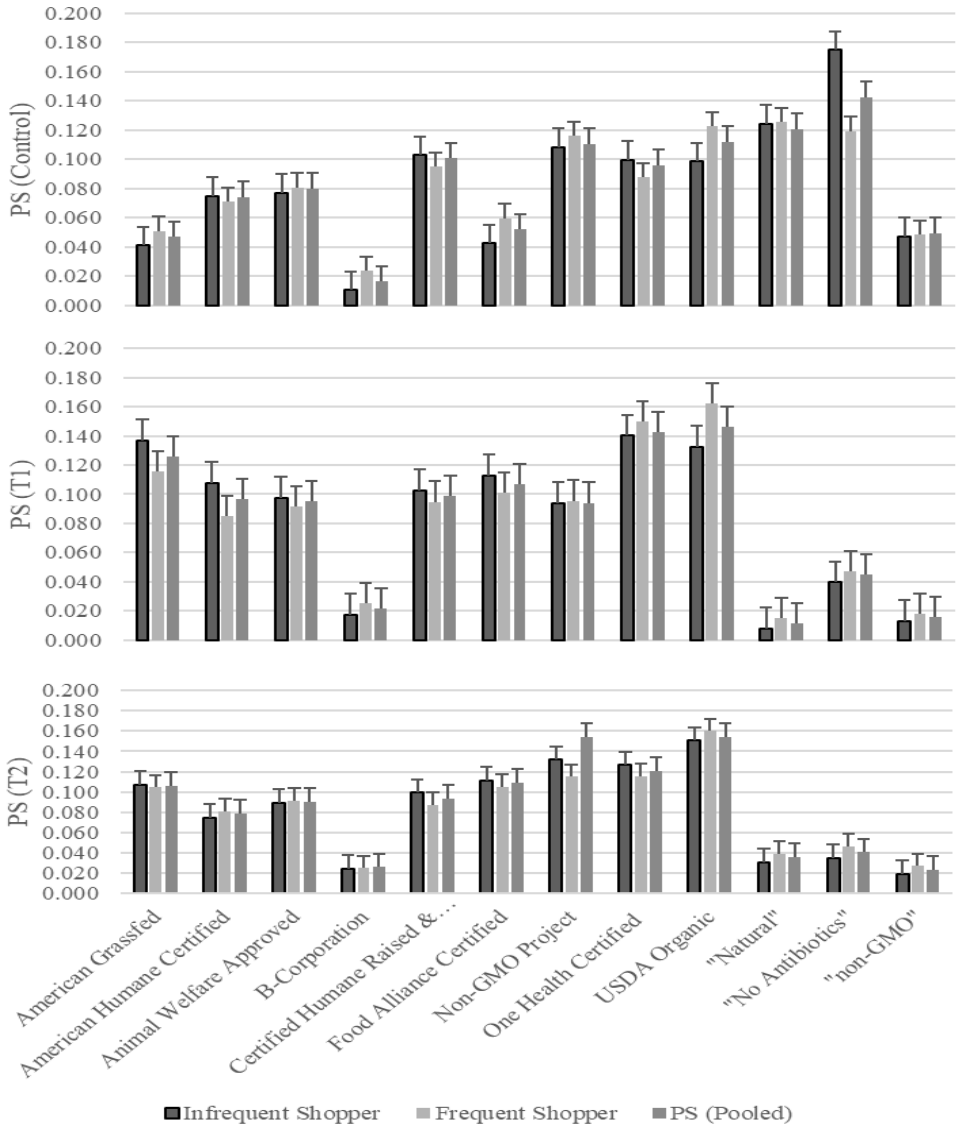
	Control	**T1**	**T2**
	Infrequent vs. Frequent	**Infrequent vs. Frequent**	**Infrequent vs. Frequent**
Food Label	ΔS	ΔS	ΔS
Seals			
Food Alliance	0.017	-0.012	-0.006*
Animal Welfare Approved	0.004	-0.006*	0.002
Certified Humane Raised & Handled	-0.008	-0.008	-0.012
American Humane Certified	-0.004	-0.023	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).

Figure 4

Preference Shares for Food Labels by Treatment Group based on Shopping Frequency



7. 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 Best-Worst Scaling 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 4 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 (Bazzani et al., 2018; Cerroni et al., 2021; Lusk & Briggeman, 2009). 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, but too much information is unnecessary and can have an adverse effect on consumer perception of the label. 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 should be replicated to identify further the correlation between food values and food labels globally. 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.

8. 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.

Reducing consumer misperception of food labels will benefit consumers, retailers, and producers. If consumers show a preference or understanding of a label, companies will be more inclined to be certified because it will make their products stand out. As shown in this study, consumer preferences change as information is provided for some labels; however, too much information could overwhelm the consumers. There is a delicate balance between too little information and too much information. Therefore, labels should be clear and include a description of the requirements for certification to increase consumer knowledge.

Consumer fatigue related to food labeling is a concern (Fang et al., 2019). Labels should be designed with their represented food values in mind. Our results show that consumers perceive a label as less important when the label does not align with the core food values. Policymakers should keep this in mind when developing guidelines to help alleviate consumer misperception and misinterpretation of labels, including seals and claims.

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Appendices

Table A1

General Findings About Each Label Included in the Study

Seal or Claim	General Findings	Source
American Grassfed	The benefits of this seal include that cattle graze on pasture, allowing them to eat only grass their entire life, and animals are not treated with antibiotics or growth hormones. There are strict criteria for obtaining this seal. The nonprofit American Grassfed Association oversees the seal. Farms are inspected every 15 months to ensure that cattle are fed only grass (no grain) and that the animals are not given any antibiotics or growth-promoting hormones.	Consumer Reports [CR], 2019d
Animal Welfare Approved	The benefits of this seal include animals being raised on a pasture, small cages and close confinement are prohibited, all animals are allowed to engage in their natural behaviors, and painful procedures are prohibited. There are strict criteria for obtaining this seal from A Greener World (AGW), the nonprofit organization that oversees this seal. The AGW has specific animal welfare guidelines for beef cattle, dairy cows, poultry raised for meat, laying hens, and pigs. Farms and slaughterhouses are inspected annually to ensure all standards are being met, including animals are always treated humanely, animals are allowed to engage in their natural behaviors, growth-promoting drugs are not used, and antibiotics cannot be used to prevent diseases.	Consumer Reports [CR], 2019f
Non-GMO Project Verified	The benefits of this seal include that the food must contain no or less than 0.9% genetically modified organisms (GMOs), and the product must be verified using independent certification companies. There are strict criteria for obtaining this seal from the Non-GMO Project. The strict verification system consists of the food product being tested frequently for genetically modified organisms. Products containing this seal cannot be made with ingredients made from crops grown with genetically engineered seed or genetically engineered animals. The inspection process includes onsite inspections, paperwork reviews, and regular testing of ingredients.	Consumer Reports [CR], 2019h
USDA Organic	The benefits of this seal include that the standards are backed by federal law, annual on-farm inspections, minimal pesticide use, animals are raised without antibiotics or added hormones, and no genetically modified organisms. The only limitation of this seal is that it has weak animal welfare requirements. The USDA Organic seal has strict criteria for obtaining the seal. Products with the Organic	Consumer Reports [CR], 2019j; Fortin, 2016

	claim or the USDA Organic seal must meet the USDA standards for crops, how animals are raised, how the food is processed, and the ingredients that can be used in the product. The criteria for obtaining this seal include minimal standards for animal welfare because the animals must be provided living conditions that allow them to perform their natural behaviors. Farms or facilities are inspected annually by USDA approved certifying agencies to obtain this seal.	
Certified Humane Raised and Handled	There are many benefits to this seal, including animal abuse is prohibited, animals are provided comfortable living conditions, animals must be allowed to move freely, employees are trained in animal welfare practices, and inspectors with knowledge about animal welfare conduct annual inspections. The nonprofit organization, Humane Farm Animal Care, oversees this seal. To obtain this seal, companies must ensure that animals are allowed to move and engage in natural behaviors, all farmworkers must be trained in humane animal care, antibiotics can be used to treat illness, and growth-promoting drugs are prohibited. There are some limitations to this seal, including that beef and dairy cows are not required to have access to a pasture, and outdoor access is not mandatory for all animals.	Consumer Reports [CR], 2019g
American Humane Certified	The benefits of this seal include strict policies prohibiting animal abuse, animals' basic physical needs must be met, employees trained in animal welfare, and annual inspections are used to ensure standards are met. The American Humane Association sets the standards and oversees this seal. The main criteria for the seal include meeting the animals' basic needs, humane treatment on the farm, and humane treatment during transport or slaughter. It is important to note that a farm can be certified if it adheres to "85% of the criteria at the time of inspection" (para. 3). The downfall is that consumers do not know which criteria were met and which were not. Another limitation of this seal is that providing comfortable living conditions is limited and is not applied to every animal. The farms and slaughterhouses are inspected annually by independent certifying agencies with trained inspectors. However, not every requirement has to be met for the farm to pass inspection.	Consumer Reports [CR], 2019e
One Health Certified	This seal was developed by meat and poultry industry experts and is only used on chicken and turkey products. The label is meant to demonstrate the “company’s commitment to animal welfare, environmental issues, and responsible antibiotic use" but there are no strict animal welfare requirements or any limitations on antibiotics or air	Consumer Reports [CR], 2019i

	and water pollution (para. 3). The standards for the seal "largely reflect the industry norm of raising animals in crowded indoor conditions" (para. 3). The paperwork is audited annually, facility visits are announced, and not every facility housing animals are inspected.	
Certified B Corporation	The B Corporation certification includes many social and environmental attributes, including community service, fair trade, human rights, carbon/GHG emissions, energy production, recycling, and water quality, to name a few. The B Corporation certification is awarded by completing the B Impact Assessment (BIA). The BIA evaluates a company's interaction with "workers, customers, community, and environment" (B Corporation, 2021, Complete the Assessment section). The B Lab staff verifies the score from the BIA to ensure the company meets the 80-point bar for certification. To maintain certification, the BIA must be updated and verified every three years (B Corporation, 2021). The certification process is conducted through its own organization, which is considered a second-party verification.	Ecolabel Index, 2021a; B Corporation, 2021
Food Alliance Certified	Food Alliance Certification ensures safe and fair working conditions, humane treatment of animals, and careful stewardship of natural resources. The certification is independently verified and is considered a third-party verification. This voluntary certification that "food-based businesses can use to differentiate and add value to products" (Is Food Alliance a policy organization section). The application process includes the initial application, site inspection, inspection report, certification decision, and maintaining certification. The certification for farmers and ranchers can be used for three years. Food Alliance can conduct unscheduled audits, and farmers and ranchers complete annual updates to maintain certification.	Food Alliance, 2016a; Ecolabel Index, 2021
All Natural or Natural	This marketing term lacks a definition in food law. There are no benefits to the All Natural or Natural claim because it has no clear meaning on most foods. To obtain the claim on meat and poultry, the USDA only requires a “one-time review of an application by the producer but does not require any additional verification” (Verification section). For all other foods, the claim can be used and is not verified by any government agency.	Fortin, 2016; Consumer Reports [CR], 2019a
No Antibiotics	The only benefit of using this claim is to hopefully reduce antibiotic use in animals, which will benefit public health. However, as a stand-alone claim on a food label, *no antibiotics*, *raised without antibiotics*, and *no antibiotics ever* does not have a "consistent meaning across different	Consumer Reports [CR], 2019b

	foods," and the "verification requirements are weak" (para. 3). For meat and poultry, the USDA requires that companies "submit a copy of their label for approval," and the application is reviewed one time "based on the supporting documentation provided by the producer, without independently verifying or inspecting any farms or facilities" (Verification section). The FDA oversees dairy products and egg cartons. Suppose a dairy product or egg carton contains the "no antibiotics" claim. It does not mean that the animals were not given antibiotics because the claim does not have to be verified before going on the market.	
Non-GMO	This claim has no benefits because it does not "have any consistent standards or rules" (para. 2). Testing is not required to verify the claim, and third-party verification is only required for meat, poultry, and egg products. For products made with vegetables, fruits, grains, or other plant foods, the FDA has issued guidance for food manufacturers that states, "food or ingredients derived from plants in products bearing a Non-GMO claim should not be produced through the use of genetic engineering" (Non-GMO Plant Foods section). However, while the guidance is meant to explain the FDA's view on the topic, "companies are not legally bound to follow any recommendations in the guidance" (Non-GMO Plant Foods section). The USDA requires that meat, poultry, and egg product producers submit a copy of their label for approval if it includes a Non-GMO claim. However, the application is only approved once "based only on the supporting documentation provided by the producer" and "no such verification is required for other types of foods" (Verification section).	Consumer Reports [CR], 2019c

Note. These 12 seals and claims were included in the study. These general findings explain the criteria for obtaining the seal or claim, the verification procedures, and what the claim or seal represents.

Table A2

Food Labels and Food Values Comparison

Food Label & Definition	Food Value (or Attribute)				
	Naturalness	**Safety**	**Environmental impact**	**Animal welfare**	**Fairness**
American Grassfed: The logo determines that animals were fed a lifetime diet of 100% forage; were raised on pasture, not in confinement; and were never treated with hormones or antibiotics.	X				

Non-GMO project verified: The non-GMO seal means that a product has been produced according to rigorous best practices for GMO avoidance, including testing of risk ingredients.	X					
USDA Organic: USDA Organic food is produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; antibiotics; growth hormones; or ionizing radiation.	X	X	X			
One Health Certified: One Health Certified is a systems-based, industry-developed animal care program that enables farmers and producers to prioritize animal health and welfare while working toward safe, responsible and transparent animal care.			X			
Certified B Corporation: B Corporations are a new type of corporation which uses the power of business to solve social and environmental problems.			X			X
Food Alliance Certified: Food Alliance Certification ensures safe and fair working conditions, humane treatment of animals, and careful stewardship of natural resources.			X		X	X
Animal Welfare Approved: Animal Welfare Approved (AWA) is a standard for farm animal welfare - the basic premise is that animals must be able to behave naturally and be in a state of physical and psychological well-being.					X	
Certified Humane Raised and Handled: Designed to certify that animals raised for dairy, lamb, poultry, and beef products are treated humanely.					X	
American Humane Certified: The main criteria for the seal include meeting the animals' basic needs, humane treatment on the farm, and humane treatment during transport or slaughter.					X	

Table A3

Each Label Image, Description, and Verification Statement Used in the Questionnaire

Label Image	Description	Verification
	The logo determines that animals were fed a lifetime diet of 100% forage; were raised on pasture, not in confinement; and were never treated with hormones or antibiotics.	An independent organization (third party)
	Animal Welfare Approved (AWA) is a standard for farm animal welfare - the basic premise is that animals must be able to behave naturally and be in a state of physical and psychological well-being.	An independent organization (third party)
	B Corporations are a new type of corporation which uses the power of business to solve social and environmental problems.	Own organization (second party)
	Food Alliance Certification ensures safe and fair working conditions, humane treatment of animals, and careful stewardship of natural resources.	Independent organization (third party)
	The non-GMO seal means that a product has been produced according to rigorous best practices for GMO avoidance, including testing of risk ingredients.	An independent organization (third party)

	USDA Organic food is produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; antibiotics; growth hormones; or ionizing radiation.	Independent organization (third party)
	Designed to certify that animals raised for dairy, lamb, poultry, and beef products are treated humanely.	It is verified by its own organization (second party).
	The main criteria for the seal include meeting the animals' basic needs, humane treatment on the farm, and humane treatment during transport or slaughter.	They are inspected annually by independent certifying agencies. Only 85% of the criteria must be met to be certified.
	One Health Certified is a systems-based, industry-developed animal care program that enables farmers and producers to prioritize animal health and welfare while working toward safe, responsible and transparent animal care.	Paperwork is audited annually by an independent third party.
 No Antibiotics	The claims *no antibiotics*, *raised without antibiotics*, and *no antibiotics ever* do not have consistent meanings across foods.	Not verified
 Non-GMO	This claim has no benefits because it does not have consistent standards or rules.	Not verified
 All Natural or Natural	This claim has no clear meaning on most foods.	Meat, poultry, and eggs are reviewed once by the USDA. Other foods – natural has no clear meaning and is not verified.

Note. All label images, descriptions, and verification information were retrieved from Consumer Reports (2019) and Ecolabel Index (2022). The control group only saw the label image during the label choice sets. Treatment 1 saw the label image and description during the label choice sets. Treatment 2 saw the label image, description, and verification statement during the label choice sets.