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Assessing consumers' valuation for Front-of-Package 'Health' labeling under FDA guidelines

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ABSTRACT

Suboptimal diets contribute significantly to diet-related chronic diseases and mortality in the United States. To address this, Front-of-Pack (FOP) labels have been proposed to help consumers make healthier food choices. In 2022, the FDA introduced 15 potential health labels aimed at providing critical information and nudging consumers toward healthier food choices, yet the effects of these labels on consumer preferences remain ambiguous. Using the Becker–DeGroot–Marschak mechanism in a laboratory experiment, this study investigates the influence of health and taste labels, and information provision, on consumer willingness to pay (WTP) for yogurt qualifying for the FDA-endorsed health label. Findings indicate that health labels alone reduce WTP, potentially due to perceived compromises on taste and skepticism towards health claims. However, the addition of credible information regarding FDA qualification mitigates these negative effects. Exploratory subsample analyses reveal that the health label is discounted among consumers who are nutritionally knowledgeable, health-conscious, pleasure driven, and frequent label users. However, providing information about the health label mitigates this discount among the former three types of consumers. The study underscores the importance of providing credible, detailed information and targeted educational campaigns to enhance the effectiveness of health labels. These insights can inform policymakers and stakeholders in developing more effective food labeling strategies to promote healthier dietary choices and improve public health outcomes. By unraveling the nuances of how consumers respond to health and taste labels, our research offers valuable guidance for designing labeling strategies that resonate with consumer values and preferences.

1. Introduction and background

Suboptimal diets consist of insufficient intake of nutritional components as well as unnecessary intake of unhealthy foods (O'Hearn et al. 2023). They are highly associated with a considerable amount of diet-related chronic diseases – including diabetes, obesity, and cardiovascular disease – and account for about one in five deaths in adults in the US (Pomeranz et al. 2019; Micah et al. 2021). Although significant improvements have been made to American diets over the past two decades, many individuals in the US still suffer from nutritionally inadequate diets (Zhang et al. 2018; Pomeranz et al. 2019).

The Back-of-Pack (BOP) Nutrition Facts Label has been mandated by the FDA under the Nutrition Labeling and Education Act in the US since 1990 (Garretson and Burton 2000; Grebitus and Davis 2017) to help increase awareness and encourage healthier and more nutritious food choices. However, previous studies have demonstrated mixed results on the influence of the Nutrition Facts Label on US consumers' grocery shopping behaviors and dietary choices (Chang and Nayga 2011; Martini and Menozzi 2021; Garretson and Burton 2000; Cavaliere, Ricci, and Banterle 2015; Cavaliere, De Marchi, and Banterle 2016; Bossuyt et al. 2021; Villas-Boas et al. 2020). This is mainly due to the fact that these comprehensive labels are perceived as inaccessible and too complicated for many consumers (Muzzioli et al. 2022; Donini et al. 2022).

To address these issues, a Front-of-Pack (FOP) labeling system in multiple formats has been both voluntarily and mandatorily implemented by several public institutions in different countries and regions, including Finland, Ecuador, Chile, Thailand, Canada, and Israel (Kanter, Vanderlee, and Vandevijvere 2018; Fialon, Nabec, and Julia 2022; Pomeranz et al. 2019). Implementing such a label in the US would not only provide critical and accessible information for consumers as a

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supplement to the current Nutrition Facts Label, but could also motivate the food industry to reformulate and improve their products in terms of healthfulness (Kanter, Vanderlee, and Vandevijvere 2018; Kasapila and Shaarani 2016). However, unlike the Nutrition Facts Panel, FOP labels in the US do not have a universally-adopted format, and differ by various attributes, including appearance, public health messages, and nutritional focus (Kanter, Vanderlee, and Vandevijvere 2018; Pomeranz et al. 2019; McLeod et al. 2024). Furthermore, unlike many other countries, FOP labeling schemes in the US remain largely unregulated.

On September 29, 2022, the Food and Drug Administration (FDA) published a proposal which would define the term "Healthy" – a claim that can be made through FOP labels – in terms of nutritional requirements, reflecting a shift toward contemporary nutritional science and the Dietary Guidelines for Americans (FDA 2022). This initiative represents a pivotal move towards ensuring that nutrient content claims on food products are in sync with current dietary recommendations, thereby aiding consumers in making informed choices conducive to maintaining a nutritious diet. To qualify for this new FDA-regulated health claim/label, the food product must be low in added sugar, sodium, and saturated fat.[1] This regulatory update is expected to have broad implications, encompassing a range of stakeholders, including food manufacturers, dieticians, healthcare professionals, and the public. It reflects a holistic approach to public health, recognizing the integral role of diet in promoting health and preventing disease. As such, this action by the FDA represents a significant stride toward aligning food labeling with the goal of fostering healthier dietary choices among general US population. Yet, the influence of such health label on consumers' preferences and behaviors remains ambiguous.

While many consumers prioritize taste and may view healthier options as less flavorful, research indicates a negative correlation between the appeal of a product's taste and the presence of health claims on its labeling (Liem, Toraman Aydin, and Zandstra 2012; Bialkova, Sasse, and Fenko 2016; Prada et al. 2021). Taste labels, unlike health labels, are subjective and not FDA-regulated, often suggesting a product's deliciousness or quality through text. They tend to have a significant influence on consumer behavior (Angka et al. 2020; Hémar-Nicolas et al. 2021; Bialkova, Sasse, and Fenko 2016). Moreover, previous studies have demonstrated that consumers' preferences for taste often outweigh their concerns for health, leading them to choose less healthy options that are perceived as tastier (Liem, Toraman Aydin, and Zandstra 2012; Feng and Park 2018). On the other hand, health labels can improve consumers' perceptions of the healthiness of a product but might negatively impact taste expectations (Raghunathan, Naylor, and Hoyer 2006; Wansink and Chandon 2006). This raises an intriguing question: how do consumers' preferences shift when they encounter both health and taste labels? Understanding the individual and interaction effects of health and taste labels is crucial.

In this study, we employ the Becker–DeGroot–Marschak (BDM) mechanism with different treatments in an incentive compatible laboratory experiment to answer several questions regarding the influence of health and taste FOPs on consumers' food preferences (Becker, Degroot, and Marschak 1964). We assess consumer WTP for health and taste labels on a "FDA-qualified healthy" food product, examine the interplay between these labels on consumer preferences, and evaluate the influence of information educating about the health label's criteria on consumers' valuation of the labels. The findings aim to address whether the FDA health label is beneficial, how taste labels interact with health claims, and the value of providing informational campaigns to educate about the new health label. Our study provides insights on promoting healthier dietary choices by delving deeper into consumer preferences for FOP labels, which can improve public health outcomes. By unraveling the nuances of how consumers respond to health and taste labels, our research can offer valuable guidance for developing more effective labeling strategies that resonate with consumer values and preferences.

2. Materials and methods

2.1. Experimental procedures

A laboratory experiment was conducted in a large land-grant university in Southern US to elicit consumers' preferences for healthy food products, their grocery shopping behaviors, and their dietary practices. The experimental protocol was approved by the university's Institutional Review Board, and was pre-registered with the American Economic Association's registry for randomized control trials. A multifaceted approach was used for subject recruitment, including posts on online platforms (e.g., local Facebook groups), invitations via email listservs, and banners in various locations around town (e.g., grocery stores, shopping malls, farmer's markets).

The experimental design, which directly determines the reliability and quality of the data collected (Mao, Kessels, and van der Zanden 2024), was carefully crafted to ensure robust results. Potential participants were invited to answer a short prescreening survey to determine eligibility. Eligible participants were US citizens or residents, 18 years or older, primary household shoppers (i.e., share at least 50 % of grocery shopping responsibilities for their households), regular yogurt consumers, not pregnant or breastfeeding, and without dietary restrictions, allergies, or diabetes. A total of 531 qualified subjects, out of 1,999 who filled out the prescreening, were invited to the experiment via email. Eventually, 308 subjects completed the experiment.

To elicit consumers' WTP for food products meeting the criteria of the FDA-endorsed health label, we employ the full-bidding method, BDM mechanism. The BDM mechanism is widely used in experimental economics to determine consumers' maximum WTP for a particular good (Becker, Degroot, and Marschak 1964). We chose the BDM mechanism for its flexibility, wide application in measuring consumers' preferences, and its theoretical incentive compatibility (Ahles, Palma, and Drichoutis 2024; Vossler and Holladay 2018). Prior to engaging in our study, the subjects were explicitly informed that they would get up to $30 compensation for their participation.

In our BDM procedure, subjects indicated their maximum WTP for a cup of yogurt after carefully inspecting the product. We selected Dannon Light + Fit Strawberry Greek Yogurt as our focal product in this experiment for several compelling reasons. First, it is a widely recognized product with strong consumer familiarity, ensuring that many participants are likely to encounter it in the market or be regular consumers themselves. Second, this yogurt has garnered a high rating of 4.7 out of 5 stars for its taste, based on hundreds of consumer reviews on Target, making it an excellent candidate for a taste label. Most importantly, it is one of the few yogurt products that meets the FDA's healthy designation criteria, adding significant value to our study on health labels. To eliminate potential branding effects, we purged the product's brand information and measured subjects' knowledge of the brand of the yogurt product (these procedures are detailed in the treatment design subsection).

Prior to entering the BDM bidding process, detailed instructions and examples of the BDM mechanism were provided to participants, emphasizing the real (binding) nature of their decisions. They were instructed that if their WTP exceeded a randomly drawn price (market price), they would be required to purchase the product at the randomly drawn price. The random price was drawn from a uniform distribution, and the range of the distribution, determined to be $0 to $3 based on market prices from multiple grocery stores, was disclosed to subjects prior to beginning the BDM. To ensure participants thoroughly understood the BDM process, they were given three quiz questions before bidding, as detailed in Appendix A1. To further enhance their

[1] Different food categories have different thresholds for the "healthy" qualification. Detailed information on requirements for each food product defined by the FDA can be found in Appendix Table A1.

Fig. 1. Treatment package design. Note: Subjects in *Health* and *Health + Info* observed the same package design. However, those in *Health + Info* receives additional information regarding the qualification of the health label. This mechanism applies to *Health + Taste* and *Health + Taste + Info* as well.

understanding, we displayed the correct answers to all quiz questions and implemented a time-delayed "proceed" button, ensuring participants had ample time to grasp the instructions.

2.2. Treatment design

Participants were randomly assigned to one of six groups. To assess the impacts of health and taste labels, we replaced the original yogurt packaging with our custom design, eliminating any potential bias from brand-related or other extraneous information. As illustrated in Fig. 1, our packaging includes essential details like the product name, flavor, the Nutrition Facts Label, ingredients, and the FOP label(s) under investigation. This ensures that our study focuses solely on consumer reactions to the labels in question. We included a survey question to verify if participants could identify the yogurt's brand. Eventually, only three subjects out of 308 were able to identify the brand of the yogurt, which ensures that branding effects did not influence our study.

The *Control* group was shown the yogurt without any health or taste labels to establish a basis for comparison with all other groups which were exposed to combinations of the labels. Two distinct groups assessed the product with either the health label alone (hereafter *Health*) or the taste label alone (hereafter *Taste*). Another group evaluated the product with both labels displayed together (hereafter *Health + Taste*). The remaining two groups observed the health label or both the health and taste labels, similar to the *Health* and *Health + Taste* groups, but with additional information about the health label. Specifically, these subjects were informed that the health label aligns with FDA guidelines, which dictate low levels of saturated fat, added sugar, and sodium. Therefore, we refer to these two treatments as *Health + Info* and *Health + Taste + Info*, respectively. Table 1 includes a summary of the

Table 1
Treatment assignments and detailed information of the health label.

Treatment group	Health label	Taste label	Health label information
1. Control			
2. Health	✔		
3. Health + Info	✔		✔
4. Taste		✔	
5. Health + Taste	✔	✔	
6. Health + Taste + Info	✔	✔	✔

Health label information details:

The product you have just observed features a "Healthy" symbol.
This label indicates that the product meets the FDA's proposed criteria for being designated as "Healthy," which specifically requires the product to be low in saturated fat, added sugar, and sodium.

Notes: This information is exactly individuals in *Health + Info* and *Health + Taste + Info* observed.

treatment structure as well as the exact information individuals received in *Health + Info* and *Health + Taste + Info.*

2.3. Consumer behavioral scale measures

Different measures from established literature were also collected as they were proven highly correlated with consumers' food consumption behaviors in previous studies. Our experimental approach included the Consumer Nutrition Knowledge Scale, which consists of 20 statements that are simply true or false questions, and is a great measure of consumers' nutrition knowledge with high internal reliability (Dickson-Spillmann, Siegrist, and Keller 2011). The summation of points from this scale serves as the variable, Nutrition Knowledge Scale. Other measures, including consumers' General Health Interest and Pleasure Measure, were also included in the survey. Established in previous literature, both serve as good measures of consumers' attitudes to health-related and hedonic characteristics of foods (Roininen, Lähteenmäki, and Tuorila 1999). These measures include 8 and 6 statements, respectively, to which subjects report their level of agreement on a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). Socio-demographic and other behavioral questions, such as yogurt consumption and label use frequencies, were also measured in this experiment.

3. Results

3.1. Descriptive statistics and treatment balance

Table 2 presents the mean values of the demographic variables for the *Control* and all treatment groups, while Table 3 reports the descriptive statistics of the behavior scale measures included in our study. We employ standardized differences (Imbens and Wooldridge 2009) to assess the balance between treatment groups in our study because traditional statistical tests, such as chi-squared tests, may be inappropriate for this purpose (Canavari et al. 2019). These tests are designed to evaluate population-level inferences rather than the characteristics of the sample at hand. Balance is a sample property rather than a population parameter, and using tests based on population inferences can lead to misleading conclusions (Imai, King, and Stuart 2008; Ho et al. 2007). Instead, standardized differences provide a more direct and intuitive measure of balance by quantifying the difference between group means or proportions on a common scale, allowing researchers to assess whether the groups are similar with respect to key covariates (Canavari et al. 2019; Deaton and Cartwright 2018). Moreover, standardized differences are less sensitive to sample size, whereas statistical significance from traditional tests can be heavily influenced by large sample sizes, detecting trivial differences that are not practically meaningful (Imbens and Wooldridge 2009). We adopt a threshold of 0.25, with values below this indicating small differences between groups (Canavari et al. 2019). This method ensures that our analysis focuses on substantive differences between groups, enhancing the

Table 2
Descriptive statistics of demographic variables and standardized differences across treatments.

Variable	1 Control Mean	2 ***Health*** Mean (Std.Diff)	3 ***Health + Info*** Mean (Std.Diff)	4 ***Taste*** Mean (Std.Diff)	5 ***Health + Taste*** Mean (Std.Diff)	6 ***Health + Taste + Info*** Mean (Std.Diff)
Female	0.65	0.63 (0.06)	0.68 (0.06)	0.73 (0.17)	0.69 (0.08)	0.72 (0.15)
Age	1.81	1.67 (0.12)	1.74 (0.06)	1.62 (0.18)	1.52 (0.25)	1.54 (0.25)
Education	4.31	4.42 (0.08)	4.62 (0.24)	4.31 (0.0)	4.31 (0.0)	4.24 (0.05)
Income	4.92	4.92 (0.0)	4.82 (0.04)	4.48 (0.19)	4.39 (0.21)	4.83 (0.05)
White	0.64	0.56 (0.15)	0.7 (0.14)	0.65 (0.04)	0.69 (0.12)	0.44 (0.39)
Hispanic	0.21	0.27 (0.14)	0.24 (0.07)	0.19 (0.05)	0.27 (0.14)	0.28 (0.15)
Observations	52	48	50	52	52	54

Notes: Gender, Race, and Ethnicity are reported as proportions, while all other variables are reported as mean values. The values in parentheses represent the standardized differences between the control group and the corresponding treatment groups.

Table 3
Detailed summary of descriptive statistics for scale measures across treatments.

Behavioral Scale Measures	*Full Sample* Mean (Std. Dev) [Min, Max]	*Control* Mean (Std. Dev) [Min, Max]	*Health* Mean (Std. Dev) [Min, Max]	*Health + Info* Mean (Std. Dev) [Min, Max]	*Taste* Mean (Std. Dev) [Min, Max]	*Health + Taste* Mean (Std. Dev) [Min, Max]	*Health + Taste + Info* Mean (Std. Dev) [Min, Max]
Physical Health Condition	54.30	53.82	55.01	55.05	53.80	54.86	53.39
	(5.76)	(4.59)	(4.91)	(5.31)	(6.38)	(6.12)	(6.80)
	[24.95, 65.65]	[38.27, 62.14]	[37.73, 62.66]	[38.23, 65.65]	[24.95, 65.15]	[26.34, 64.73]	[26.78, 61.43]
Nutrition Knowledge Scale	16.60	16.08	16.81	16.82	16.92	16.62	16.37
	(2.30)	(2.33)	(2.01)	(2.41)	(2.12)	(2.29)	(2.56)
	[9, 20]	[9, 20]	[10, 20]	[9, 20]	[10, 20]	[10, 20]	[11, 20]
Pleasure Measure	4.90	5.06	5.10	4.85	4.91	4.83	4.67
	(0.88)	(0.91)	(0.63)	(0.90)	(0.87)	(0.92)	(0.97)
	[1.33, 7]	[2.33, 6.83]	[3.83, 6.67]	[2, 7]	[2.33, 6.83]	[2, 6.5]	[1.33, 7]
General Health Interest	4.51	4.4	4.65	4.73	4.48	4.47	4.35
	(1.00)	(1.03)	(0.92)	(1.17)	(0.93)	(0.96)	(0.97)
	[1.50, 6.50]	[1.50, 6.13]	[2.13, 6.50]	[1.50, 6.50]	[2.13, 6.50]	[2.25, 6.50]	[2.25, 6.00]
Yogurt Consumption Frequency	3.98	4.17	3.94	3.82	3.92	3.73	4.28
	(1.43)	(1.37)	(1.51)	(1.49)	(1.45)	(1.44)	(1.28)
	[1, 6]	[1, 6]	[1, 6]	[1, 6]	[1, 6]	[1, 6]	[1, 6]

Notes: The descriptive statistics of scale measures are reported in Table 3. For each measure, the first row reports the mean, the second row shows the standard deviation in parentheses, and the third row presents the minimum and maximum values in square brackets.

credibility of our causal inferences.

Based on standardized differences of demographic variables across treatments, the treatment groups appear to be generally well balanced across most demographic variables. Gender, race, and ethnicity proportions show minor standardized differences, indicating that these variables are similarly distributed across the control and treatment groups. The standardized differences for continuous variables such as age, education, and income also remain within acceptable ranges for most treatments, suggesting that these variables are similarly distributed across groups. While there is a slightly larger imbalance in race (White) between the *control* and *Health + Taste + Info* group (0.39), this variable was well balanced across all other treatment groups. Overall, the demographic variables are generally well balanced, ensuring that any observed differences in outcomes are driven by the treatment effects rather than demographic disparities.

3.2. *Treatment effects and distribution differences*

Fig. 2 illustrates the mean WTP for each treatment. We found that compared to the *Control* group, both the *Health* and *Health + Taste* treatments have significantly lower WTPs. These treatments demonstrated a discount of $0.29 (or 18 %) and $0.39 (or 25 %) for the product, respectively. However, the non-significant differences in WTP for the *Health + Info* and *Health + Taste + Info* treatments compared to the *Control* group suggest that providing additional information regarding the qualifications of the health label mitigates the discount for consumers.

We observed a total of three zero bids across all treatments, representing a very small proportion of the sample. Censored regression models, such as the Tobit model, are suitable for BDM or auction studies when there is a significant proportion of zero bids (Lusk and Shogren 2007). However, in cases where zero bids are minimal, Tobit models can introduce unnecessary complexity and may not be appropriate for capturing the distribution of WTP values (Wu et al. 2021; Lusk and Shogren 2007). Previous research suggests that in cases with minimal zero bids, models such as Ordinary Least Square (OLS) provide a more robust and interpretable analysis (Lusk and Shogren 2007). Therefore, multiple OLS specifications were estimated to further analyze the treatment effects on consumers' WTP for healthy yogurt products, as shown in Table 4. Specifically, the Baseline Model includes only the treatments as exploratory variables. The second model, the Behavior-Adjusted Model, includes the treatments and additional behavioral measures. In the third model, the Demographic-Adjusted Model, we included the treatments and the demographic variables. Lastly, the Saturated Model encompasses all variables, including treatments, behavioral measures, and demographic characteristics. Rather than including five dummy variables for the treatment groups, a more concise coding method was used. The five treatments were recoded as *Health, Taste,* and *Info*, which were included in the OLS models.[2] Specifically, an indicator variable for each of the three main characteristics (Health, Taste, and Info) are constructed. For each characteristic, the indicator variable takes the value 1 for the presence of the characteristic (e.g., health = 1 if the health FOP is present) and 0 otherwise. This allows us to measure the effect of each characteristic on consumer WTP for the product.

The results in Table 4 reveal that consumers strongly and consistently discount the *Health* label across all models, as seen by the negative and statistically significant coefficient on the *Health* variable. Conversely, the *Taste* label neither increases nor decreases WTP. Notable, we find evidence that consumers value the qualification information. The positive and significant coefficient on *Info* implies that the presence of information about the health label increases WTP for the yogurt products carrying the health label. Also importantly, the combined coefficient $\beta_{Health} + \beta_{Info}$ is not statistically significant, as shown by the *p*-values at the bottom of Table 4, implying that the discount resulting from placing the health label on the yogurt product is completely offset by providing consumers with information about the health label. A similar test was conducted on the combined coefficient $\beta_{Health} + \beta_{Taste}$ to examine whether the inclusion of a taste label counteracts the negative WTP resulting from the health label. The significance of this sum of coefficients, as shown at the bottom of Table 4, indicates that the taste label does not successfully offset the discount on the health label. Among the behavioral variables, consumers who were classified as more nutritionally knowledgeable exhibit lower WTP. Additionally, education level is positively correlated with WTP.

4. Exploratory analysis

Previous literature indicates that consumer heterogeneity is widespread, with varying preferences and perceptions of food products (Hambaryan, Lai, and Kassas 2024; Villas-Boas et al. 2020). To ensure robustness and account for the diversity in consumer preferences, we

[2] The models with the full set of treatment dummies, without recoding, were also estimated and are presented in Appendix Table A2. The results remain largely consistent with those reported in the main text, demonstrating the robustness of these findings.

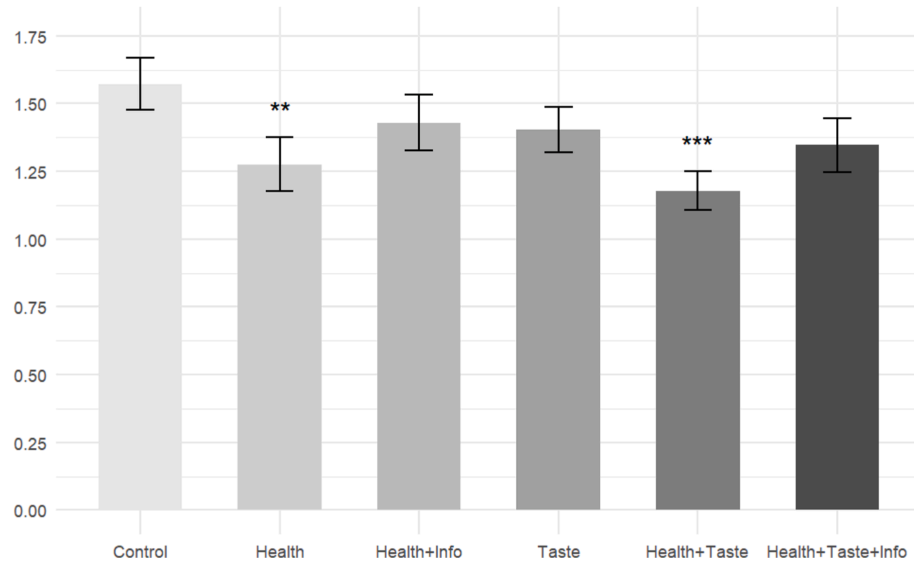

Fig. 2. Individual WTP across treatments. *Note:* The level of significance of the *t*-test results comparing the control group with each treatment is indicated by asterisks. Three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

conducted additional subsample analyses as exploratory analysis based on the median of key variables, following the split-sample approach outlined by Feigenberg et al. (2023). This allowed us to examine how different subgroups respond within the broader sample. We subsequently analyzed the effects separately for each subsample using OLS regressions. This split-sample approach allows for a deeper examination of how different consumer segments respond to health and taste labels on yogurt products.

4.1. Exploratory subsample analysis: Nutrition Knowledge scale

Table 5 presents the subsample analysis based on consumers' Nutrition Knowledge Scale, with a median score of 17. Consequently, the pooled sample was divided into two subsamples based on this median score. In total, 185 subjects have lower nutrition knowledge, while 123 subjects have higher nutrition knowledge.[3] The multiple regression results indicate that participants with lower nutrition knowledge generally do not respond to the labels or the provided information. In contrast, nutritionally knowledgeable consumers consistently discount the *Health* label across all models. Notably, these consumers place a high value on the information, which increased their WTP for the healthy yogurt. Specifically, the combined coefficient $\beta_{Health} + \beta_{Info}$ is not statistically significant in two of the 4 specifications, providing suggestive evidence that information provision could be strong enough to completely offset the discount on the health label for these consumers. Combining the health label with a taste label, however, does not effectively counteract the discount on the health label for higher nutrition knowledge consumers.

4.2. Exploratory subsample analysis: General Health Interest

Table 6 presents the OLS regression results for consumers, segmented by low and high General Health Interest. With the median General Health Interest score at 4.625, the low and high General Health Interest subgroups consisted of 155 and 153 observations, respectively. For low health-interest consumers, no statistically significant coefficients are observed, indicating that they are unresponsive to FOP labels or *Info*. Conversely, consumers with higher interest in health show more notable results. Specifically, they strongly discounted the *Health* label. However, the highly significant coefficients for the information suggest a strong valuation of the qualification information, which appears sufficient to offset the discount for the *Health* label, as indicated by the insignificant *p*-values one the combined coefficient $\beta_{Health} + \beta_{Info}$. Once again, the *Taste* label failed to mitigate the *Health* label discount.

4.3. Exploratory subsample analysis: Pleasure Measure

Table 7 shows the subsample OLS regression results, divided by low and high Pleasure Measure. With the median Pleasure Measure score at 5, respondents were divided into two subgroups with 148 (low Pleasure Measure) and 160 (high Pleasure Measure) subjects. For consumers with lower Pleasure Measure, they do not value or discount the FOP labels or the Info. However, consumers with higher Pleasure Measure (i.e., those who care more about the hedonic aspects of food) show different results. They significantly discount the health label and highly value the qualification information. The linear hypothesis testing the combined coefficient $\beta_{Health} + \beta_{Info}$ also suggests that the information counteracts the discount on *Health* label. However, the *Taste* label does not have a similar effect.

4.4. Exploratory subsample analysis: Label Use Frequency

Table 8 displays the regression results, divided by less frequent and more frequent label users. The median Label Use Frequency is 3, which divides the subjects into two groups of 168 (less frequent users) and 140 (more frequent users) observations, respectively. The regression results suggest indifference to both the *Health* and *Taste* labels, but a strong preference for the qualification information among less frequent label users. In contrast, more frequent label users generally discount the *Health* label, and neither the qualification information nor the *Taste* label is able to mitigate this discount.

5. Discussion

5.1. Full sample analysis

The presence of the *Health* label induces downward pressure on consumer WTP, as observed in the regression analysis, which can be

[3] The subsample with lower nutrition knowledge includes individuals who score 17 or below on Nutrition Knowledge Scale.

Table 4
Full sample regression results.

Variables	Baseline Treatment Model (Model 1: Treatments Only)	Behavior-Adjusted Model (Model 2: Treatments + Scale Measures)	Demographic-Adjusted Model (Model 3: Treatments + Demographics)	Saturated Model (Model 4: Treatments + Scale Measures + Demographics)
Health	−0.262***	−0.236**	−0.270***	−0.237**
	(0.093)	(0.093)	(0.092)	(0.092)
Taste	−0.116	−0.079	−0.121	−0.094
	(0.075)	(0.077)	(0.075)	(0.076)
Info	0.162*	0.166*	0.139	0.138
	(0.093)	(0.092)	(0.092)	(0.092)
Nutritionally Knowledgeable Consumers		−0.166**		−0.180**
		(0.078)		(0.079)
Health-Conscious Individuals		0.054		0.012
		(0.082)		(0.084)
Hedonistic Consumers		0.013		0.017
		(0.076)		(0.077)
Frequent Label Users		0.133*		0.122
		(0.078)		(0.078)
Physical Health Condition		−0.0003		−0.003
		(0.007)		(0.007)
Yogurt Consumption Frequency		−0.049*		−0.038
		(0.028)		(0.028)
BMI		0.009		0.010
		(0.006)		(0.006)
Female			0.126	0.127
			(0.081)	(0.082)
Age			−0.042	−0.063
			(0.043)	(0.044)
Education			0.081**	0.091***
			(0.033)	(0.034)
Income			0.028*	0.028*
			(0.016)	(0.016)
White			−0.116	−0.071
			(0.078)	(0.079)
Hispanic			0.038	0.008
			(0.089)	(0.089)
Employed			0.014	−0.011
			(0.078)	(0.078)
Married			−0.139	−0.172
			(0.111)	(0.111)
Constant	1.547***	1.487***	1.146***	1.198**
	(0.075)	(0.464)	(0.178)	(0.478)
Observations	308	308	308	308
R^2	0.034	0.077	0.082	0.125
Linear Hypothesis Tests	Model 1 *p-value*	Model 2 *p-value*	Model 3 *p-value*	Model 4 *p-value*
$H_0 : \beta_{Health} + \beta_{Info} = 0$	0.279	0.441	0.153	0.280
$H_0 : \beta_{Health} + \beta_{Taste} = 0$	0.002***	0.009***	0.001***	0.006***

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

Table 5
Subsample regression results by Nutrition Knowledge.

Variables	Lower Nutrition Knowledge				Higher Nutrition Knowledge			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Health	−0.046	−0.049	−0.055	−0.046	−0.605***	−0.554***	−0.572***	−0.503***
	(0.123)	(0.123)	(0.117)	(0.123)	(0.145)	(0.146)	(0.147)	(0.150)
Taste	−0.162*	−0.125	−0.167*	−0.142	−0.077	−0.041	−0.085	−0.046
	(0.098)	(0.100)	(0.097)	(0.100)	(0.116)	(0.117)	(0.117)	(0.120)
Info	0.114	0.117	0.108	0.094	0.272*	0.325**	0.279**	0.315**
	(0.121)	(0.123)	(0.119)	(0.123)	(0.141)	(0.144)	(0.143)	(0.146)
Behavioral Variables	No	Yes	No	Yes	No	Yes	No	Yes
Demographics	No	No	Yes	Yes	No	No	Yes	Yes
Observations	182	182	182	182	120	120	120	120
R^2	0.019	0.084	0.106	0.154	0.130	0.206	0.197	0.272
Adjusted R^2	0.003	0.031	0.049	0.062	0.108	0.135	0.117	0.146
Residual Std. Error	0.663	0.653	0.647	0.643	0.638	0.628	0.635	0.625
F Statistic	1.17	1.59	1.87	1.68	5.93	2.90	2.48	2.15
	(df = 3; 181)	(df = 10; 174)	(df = 11; 173)	(df = 18; 166)	(df = 3; 119)	(df = 10; 112)	(df = 11; 111)	(df = 18; 104)
Linear Hypothesis Tests	Model 1 *p-value*	Model 2 *p-value*	Model 3 *p-value*	Model 4 *p-value*	Model 5 *p-value*	Model 6 *p-value*	Model 7 *p-value*	Model 8 *p-value*
$H_0 : \beta_{Health} + \beta_{Info} = 0$	0.572	0.576	0.658	0.694	0.019**	0.109	0.043**	0.200
$H_0 : \beta_{Health} + \beta_{Taste} = 0$	0.166	0.259	0.134	0.218	<0.001***	0.002**	<0.001***	<0.001***

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

Table 6
Subsample regression results by Health Interest.

Variables	Lower General Health Interest				Higher General Health Interest			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Health	−0.092	−0.117	−0.113	−0.136	−0.436***	−0.416***	−0.492***	−0.449***
	(0.127)	(0.127)	(0.125)	(0.125)	(0.135)	(0.130)	(0.136)	(0.131)
Taste	−0.145	−0.129	−0.138	−0.112	−0.083	0.008	−0.078	0.032
	(0.105)	(0.105)	(0.107)	(0.108)	(0.110)	(0.106)	(0.109)	(0.106)
Info	−0.004	0.029	−0.033	−0.016	0.330**	0.367***	0.281**	0.343***
	(0.129)	(0.130)	(0.127)	(0.129)	(0.133)	(0.128)	(0.132)	(0.127)
Behavioral Variables	No	Yes	No	Yes	No	Yes	No	Yes
Demographics	No	No	Yes	Yes	No	No	Yes	Yes
Observations	155	155	155	155	153	153	153	153
R^2	0.018	0.102	0.100	0.184	0.075	0.229	0.152	0.296
Adjusted R^2	−0.001	0.039	0.031	0.076	0.057	0.174	0.086	0.202
Residual Std. Error	0.645	0.632	0.635	0.620	0.674	0.631	0.664	0.620
F Statistic	0.928	1.633	1.441	1.703*	4.034**	4.211***	2.298**	3.137***
Linear Hypothesis Tests	Model 1 *p-value*	Model 2 *p-value*	Model 3 *p-value*	Model 4 *p-value*	Model 5 *p-value*	Model 6 *p-value*	Model 7 *p-value*	Model 8 *p-value*
$H_0 : \beta_{Health} + \beta_{Info} = 0$	0.450	0.490	0.250	0.232	0.426	0.704	0.121	0.422
$H_0 : \beta_{Health} + \beta_{Taste} = 0$	0.148	0.135	0.125	0.130	0.003***	0.017**	0.001***	0.015**

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

attributed to several factors. Previous literature suggests that consumers often perceive healthy food products to be less indulgent or associate them with lower taste expectations (De Temmerman et al. 2021; Jürkenbeck, Mehlhose, and Zühlsdorf 2022; Hall et al. 2020). One potential explanation is that a health label might evoke a perception of compromise on taste or indulgence, leading consumers to discount these products. This perception explains why consumers do not discount taste labels, at least when presented alone on yogurt products.

Furthermore, as demonstrated in the literature, consumers can be confused or even skeptical about food claims, especially health labels, and some might even view these claims as marketing tactics rather than genuine information (Mitra et al. 2019; Mazis and Raymond 1997; Cho, Ye, and Kim 2024). This skepticism could contribute to the negative effects of the healthy label on consumers' WTP found in our study. However, we observe that when health labels are accompanied by additional information explaining the label, the discount is counteracted. The same did not hold for the taste label though, the presence of which failed to offset or decrease the discount on the health label. Literature shows that consumers' perceived credibility of authoritative sources (e.g., the FDA, CDC, other non-profit organizations, and governments) influences their behavior (Fong, Guo, and Rao 2021; Baden Lindsey R. et al. 2020; Liu et al. 2024; Peng et al. 2024; Huang et al.

Table 7
Subsample regression results by Pleasure Measure.

Variables	Lower Pleasure Measure				Higher Pleasure Measure			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Health	−0.009	−0.043	−0.007	−0.025	−0.461***	−0.413***	−0.483***	−0.433***
	(0.133)	(0.130)	(0.135)	(0.133)	(0.128)	(0.129)	(0.126)	(0.126)
Taste	−0.181*	−0.085	−0.181	−0.103	−0.061	−0.026	−0.045	−0.015
	(0.106)	(0.104)	(0.110)	(0.111)	(0.108)	(0.107)	(0.108)	(0.108)
Info	0.040	0.079	0.017	0.064	0.270**	0.288**	0.261*	0.288**
	(0.125)	(0.122)	(0.128)	(0.128)	(0.136)	(0.134)	(0.132)	(0.130)
Behavioral Variables	No	Yes	No	Yes	No	Yes	No	Yes
Demographics	No	No	Yes	Yes	No	No	Yes	Yes
Observations	148	148	148	148	159	159	159	159
R^2	0.021	0.167	0.067	0.191	0.078	0.152	0.183	0.252
Adjusted R^2	0.001	0.106	−0.008	0.078	0.061	0.095	0.123	0.156
Residual Std. Error	0.634	0.599	0.636	0.609	0.679	0.667	0.656	0.644
F Statistic	1.028	2.748**	0.894	1.694*	4.418**	2.664**	3.022***	2.632***
Linear Hypothesis Tests	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	p-value	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*
$H_0 : \beta_{Health} + \beta_{Info} = 0$	0.809	0.774	0.941	0.759	0.151	0.353	0.087	0.270
$H_0 : \beta_{Health} + \beta_{Taste} = 0$	0.258	0.425	0.270	0.441	0.002***	0.011**	0.002***	0.009***

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

Table 8
Subsample regression results by Label Use Frequency.

Variables	Lower Label Use Frequency				Higher Label Use Frequency			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Health	−0.125	−0.118	−0.143	−0.126	−0.350**	−0.372**	−0.408***	−0.391***
	(0.116)	(0.119)	(0.119)	(0.122)	(0.150)	(0.150)	(0.145)	(0.148)
Taste	0.007	−0.005	−0.010	−0.021	−0.155	−0.110	−0.141	−0.114
	(0.095)	(0.095)	(0.097)	(0.098)	(0.126)	(0.128)	(0.120)	(0.123)
Info	0.231**	0.225**	0.241**	0.221**	0.083	0.069	0.059	0.011
	(0.110)	(0.112)	(0.114)	(0.116)	(0.155)	(0.154)	(0.152)	(0.154)
Behavioral Variables	No	Yes	No	Yes	No	Yes	No	Yes
Demographics	No	No	Yes	Yes	No	No	Yes	Yes
Observations	165	165	165	165	140	140	140	140
R^2	0.026	0.069	0.055	0.096	0.063	0.147	0.217	0.266
Adjusted R^2	0.008	0.016	−0.012	−0.006	0.042	0.088	0.149	0.163
Residual Std. Error	0.596	0.593	0.602	0.600	0.721	0.704	0.680	0.674
F Statistic	1.467	1.294	0.821	0.941	3.050**	2.496**	3.217****	2.595***
Linear Hypothesis Tests	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	p-value	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*	*p-value*
$H_0 : \beta_{Health} + \beta_{Info} = 0$	0.359	0.360	0.411	0.425	0.080*	0.052*	0.019**	0.013**
$H_0 : \beta_{Health} + \beta_{Taste} = 0$	0.458	0.447	0.353	0.381	0.009**	0.002**	<0.005***	0.001***

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

2023). This highlights the important role that FDA can play in serving as a credible source that mitigates the discount on consumer WTP for the healthy labeling. Ultimately, displaying the health label (without any additional supporting information) can result in adverse effects on consumer valuations for food products. It is thus crucial that the health label is accompanied by credible information to effectively reduce consumer skepticism and enhance the perceived value of health claims.

5.2. Impact of nutrition knowledge and health interest

Consumers with higher nutrition knowledge and greater interest in health generally discount health labels. However, we observe that they highly value the qualification information, and displaying the "FDA qualification" statement offsets the discount associated with the health label in both groups. This finding underscores the importance of credibility and critical information in mitigating consumer skepticism, enhancing understanding of food labels, and nudging consumers toward healthier food choices.

In contrast, results show that less nutritionally knowledgeable or health-conscious consumers are generally unresponsive to any FOP labels, aligning with findings in the literature (Kaur, Scarborough, and Rayner 2017; Barsyte, Kiudyte, and Degutis 2017; Andrews, Netemeyer, and Burton 2009; Raghunathan, Naylor, and Hoyer 2006; Duan et al. 2022). In our study, these subjects are not willing to pay a premium nor discount any labels. However, these groups of consumers are individuals who need more guidance and nudging toward healthier food choices (Andrews, Netemeyer, and Burton 2009; Ares, Giménez, and Gámbaro 2008; Baglione, Tucci, and Stanton 2012). Therefore, their unresponsiveness could highlight a potential gap in effective communication and education about the importance of nutrition labels for this segment of the population. This raises the potential need for targeted and tailored communication methods for different subsets of consumers, such as alternative food labels or ways of conveying information.

5.3. Effects of label use frequency

For less frequent label users, no significant effects were observed for either label, indicating a general disinterest or lack of concern for labels, as they do not factor these into their purchasing decisions. However, it is the information that nudges those consumers toward a healthier food choice. For consumers who frequently rely on food labels, the results imply that they discount the *Health* label, and neither the *Info* nor the *Taste* label is strong enough to offset this discount. This can potentially be attributed to the fact that those frequent label users may already have strong perceived understanding of product's healthfulness, or they are more accustomed to reading the Nutrition Facts Label, which potentially enables them to judge a product's healthfulness without needing the *Health* FOP label (Wansink and Chandon 2006; Raghunathan, Naylor, and Hoyer 2006).

5.4. Pleasure measure analysis

Results from the subsample analysis by consumers' Pleasure Measure provide additional insights. For less indulgent consumers, there are no significant premiums or discounts for any of the food labels, suggesting they are unresponsive to FOP labels. Literature also suggests that FOP labels often fail to influence the purchasing decisions of consumers who do not prioritize sensory enjoyment in their food choices (Draper et al. 2013; Ganderats-Fuentes and Morgan 2023; Ikonen et al. 2020). This may support the idea that less hedonistic consumers are less likely to factor in FOP labels when making purchasing decisions.

Conversely, pleasure-driven consumers (i.e., subjects with higher Pleasure Measure) decrease their WTP when the health label is present. This could be due to the perception of lower taste expectations associated with healthy foods. These consumers are less willing to accept products labeled as "Healthy." This suggests that imposing a Health label alone on healthy foods fails to nudge these consumers toward healthier choices and, conversely, leads to undesirable effects among hedonistic consumers. Instead, the results once again highlight the importance of information provision, which significantly increases the WTP and offset the discount on the *Health* label.

6. Conclusions and policy implications

Using the BDM mechanism in a laboratory experiment setting, this study investigates the impacts of health labels, taste labels, and information provision on consumers' WTP for healthy yogurt products, revealing several critical insights. Multiple OLS regression analysis results indicate that health labels, particularly when presented alone, tend to lower WTP. This is likely due to perceived compromises on taste and skepticism towards health claims, which is well-aligned with literature. However, this negative effect is mitigated or reduced when additional credible information, such as the FDA qualification, is provided. This suggests the importance of trustworthiness in health labeling and demonstrates that helping consumers understand the meaning of the label can mitigate the negative effects of health labels.

Consumers with a higher nutrition knowledge and more health interest have a higher tendency to discount health labels. However, they highly value the additional FDA qualification information, and the existence of information alleviates the discount, again reinforcing the potential need for credible and detailed information to gain consumer trust. This finding further confirms that simply implementing a health label or claim on food products might not be sufficient for promoting healthier consumption behaviors. To address consumer skepticism or confusion, health labels should be accompanied by endorsements from credible sources like the FDA to improve consumer trust and mitigate the negative impact on WTP.

Additionally, a large number of less nutritionally knowledgeable consumers, individuals with less interest in health, and infrequent label users seem to show a general disinterest in health labels. Pleasure-driven consumers even significantly discount their WTP when health labels are present, suggesting that these labels may deter rather than encourage healthier food choices among this segment. Tailored communication methods may be essential to bridge the gap in knowledge and improve label effectiveness. These findings imply a potential need for targeted education campaigns to increase awareness and understanding of FOP labels, particularly for less nutritionally knowledgeable consumers and when new regulations are introduced. However, in practice, implementing such educational efforts may require creative and multifaceted approaches to ensure effectiveness. Additionally, policymakers should consider how such campaigns could be integrated with other strategies to deliver timely information to consumers. Similar to the FDA's efforts to educate consumers after updating the Nutrition Facts label requirements in 2018, policymakers should support a similar campaign for the new FDA-endorsed health label. This approach can increase accessibility and reduce confusion among consumers, ensuring a smooth and effective transition into the food market. This could include outreach through digital platforms or in-store educational materials to ensure that all consumer segments, particularly those who may be resistant or confused by health labels, receive adequate information. By integrating these insights into policy and practice, stakeholders can better align food labeling strategies with consumer preferences, ultimately promoting healthier dietary choices and improving public health outcomes.

While this study represents an important step towards a deeper understanding of consumer reactions to the FDA qualified "Health" label in the US food market, it is important to acknowledge certain limitations. While we follow the alternative approach of Feigenberg et al. (2023) by conducting a split-sample exploratory analysis, an analysis with all interaction terms is needed fully avoid omitted variable bias. However, our sample size of 308 was not adequately powered to support such analysis, which involved a total of 151 explanatory variables, also risking model overfitting. Additionally, the laboratory setting, while beneficial for controlling variables, may not completely capture real-world purchasing behaviors (Cao et al. 2024). Nevertheless, although the custom-designed labels may not exactly mirror real-world labels, the controlled laboratory environment enables us to use these custom designs to avoid branding effects and other extraneous factors, thereby providing clearer causal estimates of consumers' WTP. While our study provides valuable insights into how information provision can mitigate reductions in WTP in the presence of a health label, the dissemination of information in real-world settings is far more complex than in a lab environment. In our experiment, participants were presented with an information script and then asked to submit their WTP. However, in real-world scenarios, information campaigns designed to educate consumers about the new health label implemented by the FDA can be delivered through various channels, such as news releases and social media. Importantly, there is no guarantee that all consumers will be exposed to this information before making purchasing decisions on products featuring the FDA health label. Moreover, the focus on a single yogurt product limits the generalizability of the findings to other food categories. Future research could enhance the external validity of these findings by conducting field or natural experiments in real-world settings, such as grocery stores, expanding the sample size to support interaction term analysis and reduce the potential for omitted variable bias, and including a wider variety of food products beyond yogurt. These approaches would offer more generalizable insights and better capture consumer behavior outside the controlled lab environment.

CRediT authorship contribution statement

Jianhui Liu: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Bachir Kassas:** Writing – review & editing, Supervision, Methodology, Conceptualization. **John Lai:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Di Fang:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Rodolfo M. Nayga:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of Competing Interest

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.

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Appendix A

Table A1
Individual food product requirements.

	Food group equivalent minimum	Added sugar limit	Sodium limit	Saturated fat limit
Vegetable product	1/2 cup-equivalent	0 % DV	10 % DV	5 % DV
Fruit product	1/2 cup-equivalent	0 % DV	10 % DV	5 % DV
Grain product	3/4 oz-equivalent wholegrain	5 % DV	10 % DV	5 % DV
Dairy product*	3/4 cup-equivalent	5 % DV	10 % DV	10 % DV
Game meat	1 1/2 oz equivalent	0 % DV	10 % DV	10 % DV
Seafood	1 oz equivalent	0 % DV	10 % DV	10 % DV
Egg	1 oz equivalent	0 % DV	10 % DV	10 % DV
Beans, peas, and soy products	1 oz equivalent	0 % DV	10 % DV	5 % DV
Nuts and seeds	1 oz equivalent	0 % DV	10 % DV	5 % DV (excluding saturated fat derived from nuts and seeds)

Notes: In accordance with the FDA's proposed guidelines, individual food products must comply with specific nutrient limitation criteria concerning added sugar, sodium, and saturated fat to bear the "Healthy" claim. For example, a dairy product as we used in our study is required to contain no more than 5 % Daily Value (DV) of added sugar, 10 % DV of sodium, and 10 % DV of saturated fat per ¾ cup-equivalent serving size.

Table A2
Full sample regression results without recoding treatments.

Variables	Baseline Treatment Model (Model 1: Treatments Only)	Behavior-Adjusted Model (Model 2: Treatments + Scale Measures)	Demographic-Adjusted Model (Model 3: Treatments + Demographics)	Saturated Model (Model 4: Treatments + Scale Measures + Demographics)
Health	−0.298**	−0.224*	−0.319**	−0.237*
	(0.133)	(0.134)	(0.131)	(0.133)
Health + Info	−0.144	−0.071	−0.178	−0.105
	(0.131)	(0.134)	(0.131)	(0.133)
Taste	−0.169	−0.071	−0.184	−0.098
	(0.130)	(0.134)	(0.129)	(0.133)
Health + Taste	−0.395***	−0.319**	−0.406***	−0.335**
	(0.130)	(0.133)	(0.129)	(0.132)
Health + Taste + Info	−0.225*	−0.142	−0.269**	−0.191
	(0.129)	(0.132)	(0.129)	(0.132)
Physical Health Condition		−0.0002		−0.003
		(0.007)		(0.007)
Nutritionally Knowledgeable Consumers		−0.166**		−0.179**
		(0.079)		(0.079)
Health-Conscious Individuals		0.054		0.013
		(0.083)		(0.085)
Hedonistic Consumers		0.012		0.017
		(0.076)		(0.077)
Frequent Label Users		0.134*		0.121
		(0.079)		(0.080)
Yogurt Consumption Frequency		−0.049*		−0.039
		(0.029)		(0.029)
BMI		0.009		0.010
		(0.006)		(0.006)
Female			0.126	0.127
			(0.081)	(0.083)
Age			−0.043	−0.063
			(0.044)	(0.045)
Education			0.082**	0.091***
			(0.033)	(0.034)
Income			0.028*	0.028*
			(0.016)	(0.016)
White			−0.114	−0.070
			(0.080)	(0.081)
Hispanic			0.037	0.008
			(0.089)	(0.090)
Employed			0.012	−0.011
			(0.078)	(0.078)
Married			−0.142	−0.173
			(0.112)	(0.112)
Constant	1.573***	1.480***	1.173***	1.198**
	(0.092)	(0.470)	(0.185)	(0.483)
Observations	308	308	308	308
R^2	0.035	0.077	0.083	0.125

Notes: The level of significance is indicated by asterisks, with three asterisks representing a p-value less than 0.01, two asterisks representing a p-value less than 0.05, and one asterisk representing a p-value less than 0.10.

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