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Journal of Food Distribution Research
Volume 42, Issue 3

Examining the Effectiveness of Nutrition Information in a Simulated Shopping Environment

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Abstract

We conduct an experiment with grocery store shoppers using an onsite survey to examine the effectiveness of nutrition labels provided on grocery store shelves. We measure effectiveness of the nutrition labels in terms of how well the labels attract attention and if they affect shopper behavior. Based on our sample, we find that shelf label nutrition information not only attracts shopper attention but affects shopper behavior as well. Further, we find the effect is moderated by a shopper's propensity to use nutrition information. Our results suggest providing nutrition information via grocery store shelf labels may be a useful medium to convey nutrition information to shoppers. Additionally, increasing interest in nutrition information and the ability to use the information can have important implications.

Keywords: nutrition labels, grocery stores, experiment

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Introduction

Due to the current obesity epidemic in the US and abroad, there is growing interest in helping consumers make healthier choices. Although manufacturers in the US are already required by the Nutrition Labeling and Education Act of 1990 to provide nutrition facts panels on almost all processed food products, other methods of providing nutrition information are being developed by manufacturers and retailers. One method that is becoming prevalent with retailers across the US is grocery store chains offering their own nutrition information on their store shelves along with price and unit price information using proprietary labels and rating methods[1]. In general, these labels offer a reduced summary of information that is provided on nutrition facts panels often using a scoring metric such as a hundred-point-system or a star rating.

These grocery store nutrition labels not only enhance the image of the retailer, but they may also benefit consumers by helping to direct them to healthier choices; especially if the information is accurate, easy to access and easy to comprehend for consumers. Berning et al (2010) demonstrate positive consumer preferences for this type of grocery store nutrition labels provided by grocery stores in the US. Similarly, Balcombe, Fraser and Di Falco (2010) find support for the traffic light system used in the United Kingdom which identifies nutritional quality on product packages using a traffic light symbol.

For this study, we create our own grocery store shelf label based on a common template and include a section to provide nutrition claims. We present these labels to shoppers using quasi-experimental methods to examine the effectiveness of shelf label nutrition information. We measure the effectiveness of shelf label nutrition information using two criteria: 1. if it attracts attention; 2. if it affects behavior. Accounting for individual differences, we find that prominent nutrition labels are effective at attracting attention and this effect is enhanced by a prominent unit price label. Alternatively, less prominent nutrition labels are no different at attracting attention than providing no nutrition label at all. In terms of effectiveness, this emphasizes the importance of providing visible information to shoppers.

We further find that shoppers provided with shelf label nutrition information select a greater share of healthy products than shoppers who are not provided with nutrition information. Not surprisingly, this effect is moderated by a shopper's consciousness of nutrition label information.

As more grocery store chains offer nutrition information to consumers on their shelf space it is important to understand the impact of such marketing information on consumer behavior. This study provides evidence that this type of information can be used to both attract consumer attention and influence the products they select. However, the display of the information is an important consideration. Increasing shoppers' interest in nutrition information and their ability to use the information can have important implications as well. Policymakers interested in dealing with the obesity epidemic may want to become more involved with how retailers and manufacturers provide their own proprietary nutrition information.

[1] An example is the Nuval nutrition scoring system which is being used by retail grocery stores across the country.

Motivation

A significant amount of research suggests that simpler forms of nutrition information may be more beneficial to shoppers than complex forms, such as nutrition facts panels. Levy and Fein (1998) find that nutrition labels that require calculations do not appear to be helpful to consumers and Viswanathan (1994) points to the importance of summary information in facilitating the usage of nutrition information and that verbal presentation of nutrition information lead to a greater degree of usage than numerical. Additionally, Verbeke (2005) finds that nutrition information is likely to be effective when it addresses specific informational needs and can be processed and used by its target audience. Consequently, proprietary nutrition labels provided by grocery stores which provide simpler forms of nutrition information may be beneficial to consumers. In particular, Feunkes et al. (2008) suggest that simple labels may be more useful in quick decision environments as consumers need less time to evaluate simpler, front-of-pack labels versus more complex labels. With a large number of goods, side-by-side comparison of many complicated nutrition labels may be overwhelming for shoppers. In a review of research of consumer understanding of nutrition labels, Cowburn and Stockley (2005) suggest that improvements in nutrition labeling, in particular non-numerical interpretational aids like verbal descriptions, could contribute to making the point-of-purchase environment more conduce to selection of healthy choices.

In the United Kingdom a voluntary traffic light system (TLS) has been added to the front of food product packages to help consumers make healthier choices. Food products with TLS labels indicate whether the food has high, medium or low amounts of fat, saturated fat, sugars and salt. A recent study finds that consumers were more likely to identify healthier foods using the TLS (Kelly et al. 2009). Balcombe, Fraser and Di Falco (2010) find that shoppers understand the TLS label system and appear to use the TLS to avoid "red light" foods, which are foods of poorer nutritional quality.

Given the growing interest and potential benefit from providing nutrition information to consumers in alternative formats, nutrition information provided by grocery stores may provide an effective method for providing shoppers with nutrition information. Such proprietary store labels have already emerged in several grocery store chains displayed alongside grocery store shelf labels. Shelf labels are located at the point of purchase on the shelf label and require little additional effort by consumers to acquire. Shelf labels already provide price and unit price information and may also be used to provide nutrition information in a manner that is easier for shoppers to process than traditional nutrition facts panels.

An important question to be answered is how effective are nutrition labels provided by grocery stores. There are many approaches that can be taken to examine the effectiveness of product labels. In their meta-analysis of warning labels literature, Argo and Main (2004) identify five dimensions of warning label effectiveness that represent a sequential processing of information: attention, reading and comprehension, recall, judgments and behavioral compliance. While all five dimensions are also relevant to understanding how shoppers might process nutrition information, we focus on the first and last steps in the sequential process: how well nutrition labels attract attention and how effective shelf label nutrition information is at affecting behavior.

Attention broadly encompasses measures of noticeability, awareness, attention and recognition. Specifically, attention can be defined "as the selection or prioritization for processing of certain categories of information" (Wells and Matthews 1994). In a grocery store with a large number of items and an extensive amount of product information, nutrition labels that are effective must appear as enough of a priority to warrant a shopper to allocate time to processing the label. Conversely, if a label is not noticeable, then clearly the label will not be effective.

There are several factors that appear to influence how well labels attract attention. Not surprisingly, the vividness of the display of the label plays a role in how well it attracts attention. Young and Wogalter (1990) note that vividness-enhancing characteristics such as font size, color, spacing, level of specificity, and symbols improve comprehension and recall of verbal warning messages and better identify semantic meanings. Adams and Edworthy (1995) find text size having the greatest effect on perceived urgency of warning labels, followed by border width. As such, we expect that shelf labels that are bold and vivid will be more effective in terms of attracting attention.

While attracting attention is an important consideration for advertising nutritional quality, more relevant to grocery stores and policy makers is the effect of shelf label nutrition information on shopper behavior, i.e. behavioral compliance. Nutrition labels act as an informative advertising by identifying qualitative attributes that shoppers cannot identify by themselves.[2] If superior nutritional content is viewed as a vertically differentiating characteristic (i.e. healthy food is better than unhealthy food), then, ceteris paribus, healthy items will be preferred by shoppers. As such, we might expect nutrition labels identifying such characteristics to complement or enhance the image of healthy items, making those healthy items more desirable for purchase. Based on the assumption that healthy foods are viewed as better than unhealthy, we hypothesize that shoppers who are presented shelf label nutrition information will select a larger share of healthier items than shoppers who are not.

Experimental Approach

We surveyed 1200 shoppers at three store locations of the same grocery chain in the East Bay, California area. The 3 stores are located in areas with high, medium and low median incomes. Survey participants were given a set of instructions with a survey and were compensated with a $10 store gift card upon completion of the survey.

In the instructions, each participant is given a hypothetical shopping list comprised of four products: salad dressing, mayonnaise-type products (this includes Miracle Whip brand products), microwave popcorn and peanut butter. Participants were shown the same pictures of 12 different types of each product as they might appear on an actual grocery store shelf. They were asked to select products from each product category as if they were actually shopping for the products. Further, they could select multiple brands and quantities in each product group, but were asked

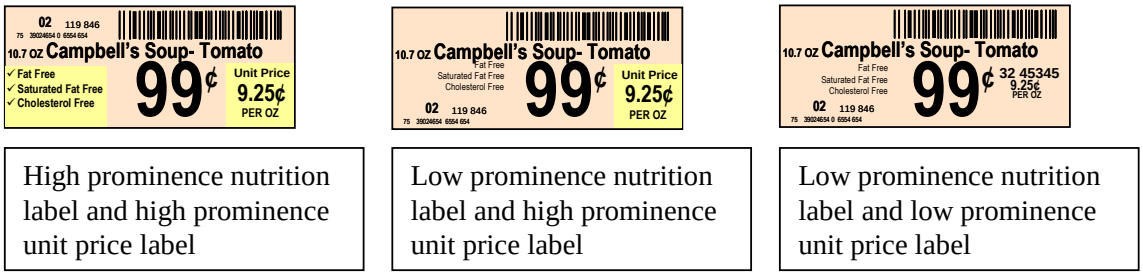
[2] In theory, shoppers can identify nutritional content by themselves. However, the process would be prohibitively expensive for most consumers.

to select at least one item from each product group.[3] If participants didn't see a product they would normally buy, or would not normally buy the product, they were asked to assume that they were shopping for a house guest or friend who wanted the product.

The products were selected to appeal to a large number of shoppers; that is, shoppers generally have some experience purchasing some of these items. These items also vary in nutritional content within each product category.

Treatments

Shelf labels were presented below each product item. On each label, we varied the presentation of unit price (two levels) and nutrition information (three levels) for a total of six different shelf label treatments (Figure 1). The unit price and nutrition information were displayed as either low prominence or high prominence where prominence refers to the display information in term of font, text size, and text highlighting. The nutrition labels also had a treatment of not present. The prices and unit prices did not vary across treatments as the primary interest was the effect of labels rather than prices. The six different surveys were randomly distributed to the survey participants.



High prominence nutrition label and high prominence unit price label	Low prominence nutrition label and high prominence unit price label	Low prominence nutrition label and low prominence unit price label

Figure 1. Shelf Label Treatment Examples

The nutrition information provided on the labels is based on USDA standards for nutrition claims. The USDA (2004) has standards for claims regarding six nutritional items: calories, fat, saturated fat, cholesterol, sodium and sugar. An example of a nutritional claim is *low fat* or *cholesterol free*.

Survey Participant Characteristics

We gathered demographic information from the survey participants (Table 1 provides a description of the sample population). In addition to identifying age, gender, household size, education and income, we developed some other measures as well. The household shopping

[3] Some surveys appeared to be completed without a firm understanding of the survey. For example, some respondents, for unknown reasons, selected every possible item for all four product categories. To systematically remove outliers we deleted any survey in which the participant select more than $20 per person for any item. We also tried removing surveys using a limit of $10 per person which caused little change in the results.

performed is a self-reported measure of how much of household shopping the survey participant is responsible for. In addition, participants were asked to answer nine, seven-point Likert scale questions regarding their nutrition consciousness (Figure 2). Composite scores for each individual's nutrition consciousness were created which are intended to represent self-reported level of nutrition consciousness; the Cronbach alpha- score was $\alpha = .92$. The nutrition consciousness score is a continuous variable in the range of 9 and 63. We also scored participants price label consciousness using five, seven-point Likert scale questions (Figure 3**,** $\alpha = .92$). The price consciousness score is a continuous variable in the range of 5 and 35. Finally, participants were scored on three, seven-point questions regarding their use of nutrition information (Figure 4, $\alpha = .93$). These three questions were used to create a composite measure of the shopper's consciousness of nutrition information. The nutrition label consciousness score is a continuous variable in the range of 3 and 21.

Table 1. Demographic Characteristics of Survey Respondents

Demographic	**Mean**	**Standard Deviation**
age (years)	41.4	17.1
gender (female)	65.3%	--
household size	3.5	1.8
household shopping performed	66.3%	31.2%
nutrition consciousness score	43.5	13.8

Level of Education	**Percentage**	**Level of Education**	**Percentage**
grade school	3.3%	2-year associate degree	9.6%
some high school	8.4%	4-year bachelor degree	14.8%
graduated from high school	21.2%	some graduate school	5.2%
some college	26.9%	graduate degree	10.6%

Annual Household Income (gross)	**Percentage**	**Annual Household Income (gross)**	**Percentage**
$0-5,000	5.1%	$50,001-60,000	8.6%
$5,001-10,000	4.6%	$61,001-70,000	7.6%
$10,001-15000	4.0%	$70,001-80,000	7.6%
$15,001-20,000	3.5%	$80,001-90,000	6.4%
$20,001-25,000	5.7%	$90,001-100,000	4.2%
$25,001-30,000	6.1%	$100,001-111,000	5.4%
$30,001-40,000	8.7%	$110,001-120,000	2.5%
$40,001-50,000	11.4%	over $120,000	8.7%

1. My diet is nutritionally balanced.
2. I try to monitor the number of calories I consume daily.
3. I try to consume a healthy amount of calories each day.
4. I try to avoid high levels of fat in my diet.
5. I try to avoid high levels of saturated fat in my diet.
6. I try to avoid high levels of cholesterol in my diet.
7. I try to avoid high levels of sodium in my diet.
8. I try to avoid high levels of sugar in my diet.
9. I am interested in nutritional information about the food I eat.

Figure 2. Survey Questions used to Calculate Nutrition Consciousness Scores

1. I am not willing to go to extra effort to find lower prices..
2. I will grocery shop at more than one store to take advantage of low prices..
3. The money saved by finding low prices is usually not worth the time and effort.
4. I would never shop at more than one store to find low prices.
5. The time it takes to find low prices is usually not worth the effort..

Figure 3. Survey Questions used to Calculate Nutrition Consciousness Scores

1. In general, how often do you read the NUTRITION FACTS panel that reports nutrient information on food products?
2. In general, how interested are you in reading nutrition and health-related information?
3. I really care about reading nutrition information and nutrition labels..

Figure 4. Survey Questions used to Calculate Nutrition Consciousness Scores

Attention Effect: Analysis and Results

After performing the shopping survey shoppers are asked to rate how noticeable the nutrition information was using a seven point scale anchored by *not noticeable* (score of 0) and *very noticeable* (score of 7). To test how noticeable the nutrition information was for each individual *i* across treatment groups, we estimate the value of the scale as a function of the treatment variables using an ordered probit with robust standard errors:

$$(1) \qquad score_i = \alpha_0 + \alpha_{unit} \cdot D_{unit} + \alpha_{low} \cdot D_{low} + \alpha_{high} \cdot D_{high} + \mu_i,$$

where each *D* is a dummy variable for each treatment, α are parameters to be estimated and μ is an error term. We also examine the interaction of the treatment effects and include several demographic variables (*Z*) with conformable matrix β specified as:

$$score_i = \alpha_0 + \alpha_{unit} \cdot D_{unit} + \alpha_{low} \cdot D_{low} + \alpha_{high} \cdot D_{high}$$
$$+ \alpha_{unit*low} \cdot D_{unit} \cdot D_{low} + \alpha_{unit*high} \cdot D_{unit} \cdot D_{high} + \beta \cdot Z_i + \mu_i \quad (2)$$

The estimate of the primary treatment effect (Table 2, column 1) shows that the high prominence nutrition label has a significant impact at a 10 percent level on whether or not the nutrition information was noticeable (0.15). The low prominence nutrition label had no significant effect. This demonstrates that the high prominence nutrition label had an effect on how noticeable the nutrition information appeared.

The interaction of the high prominence nutrition information and high prominence unit price information (Table 2, column 2) is larger and significant at the 5 percent level. Again, the low prominence nutrition information is not significant. Interacting the nutrition information and unit price treatment values reveals how both types of information complement each other in terms of attracting attention.

Table 2. The Effect of Nutrition Label Treatments on Attention

DV= score of noticeable nutrition information			
Variable			
Low prominence nutrition	-0.0144	-0.141	-0.202
label treatment	-0.0868	-0.123	-0.147
High prominence nutrition	0.150*	-0.0508	-0.0455
label treatment	-0.0874	-0.124	-0.143
unit price treatment	-0.0402	-0.256**	-0.240*
	-0.0702	-0.127	-0.135
Low prominence nutrition label	--	0.245	0.312
treatment X unit price treatment		-0.174	-0.207
High prominence nutrition label	--	0.401**	0.379**
treatment X unit price treatment		-0.175	-0.19
Age	--	--	0.00579**
			-0.00248
Gender (female = 1)	--	--	0.0112
			-0.0801
Household size	--	--	0.0254
			-0.0255
Education	--	--	-0.036
			-0.0235
Nutrition label consciousness score	--	--	0.0301***
			-0.00873
Price consciousness score	--	--	-0.0139**
			-0.00552
Nutrition consciousness score	--	--	0.0132***
			-0.00371
Observations	882	882	794

Robust standard error below estimates
***p<0.01, **p<0.05, *p<0.1

Finally, we add several covariates to our model. This includes not only demographic variables, but dummy variables to capture differences in treatment locations (three locations) and days of the survey (three days). With these covariates included, the interaction of high prominence nutrition information and high prominence unit price information is still significant. This suggests that the high prominence nutrition information has a significant impact in different locations and as the survey took place over time. We also find that older shoppers, those that identify themselves as being nutritionally conscious (*nutrition consciousness score*) and conscious of nutrition information (*nutrition label consciousness score)* tend to have a higher rating of how noticeable the nutrition information was. Alternatively, those that are more price conscious (*price consciousness score*) have a lower attention score for the nutrition labels.

Overall, these initial results emphasize the importance of display in providing nutrition label information to shoppers. The more prominent the nutrition information, the more likely that they will attract shopper attention. Further, the results demonstrates how the display of certain types of information can complement one another. Specifically, prominent unit price information and high prominence nutrition information tend to stand out the most.

Behavioral Compliance: Analysis and Results

Given that that we find varying levels of attention due to our shelf label treatments, we next examine if the labels have any effect on behavior. A common metric used in examining micro-level changes in food demand is expenditure share, where expenditure share represents the percentage of total expenditures allocated to a given product. We examine the effect of shelf label nutrition information on behavioral compliance in terms of the expenditure share of healthy items purchased. Defining each of the products in the survey as x_j, we categorized each product as healthy (x_h) or unhealthy (x_i), where $h,i \in j$. Dropping individual subscript, we calculate the expenditure share for healthy items as: $\sum(x_h \cdot p_h) \Big/ \sum(x_j \cdot p_j)$ where *p* is the price paid for each item. An increase in expenditure share represents a move toward healthier product choices; a decrease represents a move toward more unhealthy products. We estimate the effect of the different label treatments on the expenditure share of healthy items for each product category. Again, omitting the individual subscript and the constant term for simplicity, the estimated model is specified as:

$$\frac{\sum(x_h \cdot p_h)}{\sum(x_j \cdot p_j)} = \alpha_{unit} \cdot D_{unit} + \alpha_{PR\times Unit} \cdot D_{unit} \cdot PR + \alpha_{low} \cdot D_{low} + \alpha_{L\times Low} \cdot D_{Low} \cdot L + \alpha_{High} \cdot D_{High} + \alpha_{L\times High} \cdot D_{High} \cdot L + \beta \cdot Z + \varepsilon \quad (3)$$

The α and β terms are parameters to be estimated and ε is an error term. The unit price (D_{unit}), low prominence nutrition (D_{low}) and high prominence nutrition (D_{high}) dummy variables represent the unit price, low prominence nutrition label and high prominence nutrition label treatments respectively. These terms are used to capture any direct treatment effect. Because there is likely to be significant heterogeneity, the unit price treatment is also interacted with the

price consciousness variable (*PR*) to estimate how individual awareness of price information effects this treatment. Similarly, the low and high prominence nutrition label treatments are interacted with the *nutrition label consciousness* variable (*L*) to determine how individual awareness of nutrition information effects the nutrition label treatments.

For the dependent variable, we define healthy items by the number of nutritional claims presented on a given label. Shelf labels with more nutrition claims should stand out more than labels with fewer claims. Therefore, we expect that labels with more claims will be more effective at attracting attention. Given the previously discussed sequential processing of information, it follows that shelf labels that are more effective at attracting attention will also be more effective at affecting behavior. We then expect that the more nutrition claims on a shelf label, the greater the effect on consumer behavior. For example, a shelf label with one nutrition claim, e.g. *low sodium,* may have less of an effect on behavior than a label with three claims, e.g. *low sodium, low fat, low calories*. Shoppers who are exposed to shelf label nutrition information may be more likely to select items with three nutrition claims than items with just one nutrition claim. Ultimately, we are testing how nutrition information acts as a visual cue for shoppers and not necessarily the effect of the actual informational content each nutrition claim provides. That is, we estimate how the presence of more nutrition claims impacts behavior and do not explicitly test how different types of claims are processed and utilized.

Since expenditure share can take values from 0 to 1, we follow Papke and Wooldridge (1996) and estimate a Generalized Linear Model (GLM). Specifically, we estimate GLM specifying the binomial family and a logit link function with robust standard errors.

An issue with estimating equation 3 is the potential endogeneity of several of the demographic variables, particularly nutrition consciousness and the nutrition label consciousness. If there are factors that are unobserved to the econometrician in the error term that are correlated with either of these variables, then our estimates of these terms will be biased. There are several factors which may limit the impact of endogeneity. First, the treatments are randomly assigned to the participants. As such, any omitted variables in the error term associated with a self-selection process are mitigated. Additionally, any unobserved exogenous market effects are unlikely to impact this analysis since the data was generated using a survey experiment approach. That is, other forms of marketing that may influence an individual's nutrition label consciousness *and* their choice of healthy products are not likely to be in the error term because our data is collected in a semi-controlled environment. There still could be exogenous marketing factors that impact survey participant choices. However, our inclusion of many individual level demographic variables should help control for unobserved factors in the error term. Given all this, we consider endogeneity to be a minor issue for our particular analysis, but recognize that it is an important consideration to this type of research in general.

Salad Dressings

We estimate four different models in which define healthy salad dressings as having at least one nutrition claim, two claims, three claims and then four claims. In all four cases, both the low and high prominence nutrition labels, moderated by individual nutrition label consciousness score, has an impact on an individual's expenditure share of healthy salad dressings (Table 3, columns

1-4). The moderation effect of the nutrition label consciousness score demonstrates the heterogeneous effect of the treatment across individuals. For example, with three nutrition claims, the base effect of the high prominence nutrition label is negative (-0.864) but increases with the nutrition label consciousness score by a factor of 0.0723. This suggests that the high prominence nutrition label has a positive effect on individuals with a nutrition label consciousness score above 12 (0.864 / 0.0723 = 11.95) and that these shoppers select a larger proportion of healthy salad dressings. Alternatively, there is a negative effect for those with a lower nutrition label consciousness score. The threshold is even higher for the low prominence nutrition label. Individuals with a nutrition label consciousness score above 16 (1.276 / 0.0803 = 15.89) select a greater proportion of healthy salad dressings.

The maximum value for the nutrition label consciousness score is 21 and the average is 15.4. However, the distribution is skewed to the left, with most people reporting a higher score. As such, both the low and high prominence nutrition labels have an impact on selecting more healthy salad dressings. Further, those shoppers who pay attention to labels are more likely to be effected by their presence, an expected result.

Table 3. Model of Expenditure Share for Healthy Salad Dressings

DV= Healthy Salad Dressing Expenditure Share				
Variable	*1 claim*	*2 claims*	*3 claims*	*4 claims*
Age	0.0119***	0.00205	-0.000473	-0.00155
	-0.00456	-0.00378	-0.00467	-0.0059
Gender (female = 1)	-0.0789	-0.018	0.171	-0.158
	-0.152	-0.125	-0.157	-0.198
Household size	-0.0915**	-0.131***	-0.0973*	0.0228
	-0.0456	-0.0422	-0.0515	-0.0613
Education	-0.0623	0.0503	0.0505	0.0677
	-0.0424	-0.0353	-0.0415	-0.0571
Unit price treatment	0.208	0.0327	0.543	0.106
	-0.371	-0.286	-0.341	-0.439
Unit price treatment	-0.00246	0.00975	-0.0132	0.0132
X price consciousness	-0.0139	-0.0111	-0.0134	-0.017
Low prominence nutrition	-1.032**	-0.695**	-1.276***	-1.786**
label treatment	-0.401	-0.337	-0.489	-0.71
High prominence nutrition	-0.716*	-0.959**	-0.864*	-1.644***
label treatment	-0.407	-0.384	-0.501	-0.602
Low prominence nutrition label	0.0735***	0.0513***	0.0803***	0.0991**
treatment X nutrition label				
consciousness	-0.0234	-0.019	-0.0273	-0.0386
High prominence nutrition label	0.0615***	0.0724***	0.0723**	0.108***
treatment X nutrition label				
consciousness	-0.0232	-0.0219	-0.0281	-0.0333
Nutrition consciousness score	-0.00013	-0.00175	0.000922	0.00288
	-0.00623	-0.00497	-0.0063	-0.0076
Shopping percentage	-0.00828	-0.177	-0.348	-0.705**
	-0.252	-0.2	-0.237	-0.301
Constant	0.787	-0.133	-0.974	-1.618**
	-0.594	-0.481	-0.599	-0.727
Observations	790	790	790	790

Robust standard error below estimates
***p<0.01, **p<0.05, *p<0.1

Mayonnaise

Mayonnaise products are defined as healthy if they have at least three, four, then five nutrition claims (Table 4, columns 1-3)[4]. The low prominence nutrition label has a modest effect on the expenditure share for healthy mayonnaise, moderated by the nutrition label consciousness score. The threshold for the nutrition label consciousness score is much higher, however, than with the salad dressings. For example, with 3 nutrition claims the low prominence nutrition label has a positive effect on expenditure shares of healthy mayonnaise for individuals with a nutrition label consciousness score greater than 19 (0.963 / .0507 = 18.99). This is a much higher value, suggesting the effect of the nutrition label only impacts individuals who are highly interested in nutrition labels. The high prominence nutrition label has no significant effect on behavior. The unit price label, moderated by price consciousness score, also has an impact on the selection of more healthy mayonnaise. This could suggest that unit price is an important consideration when purchasing healthy mayonnaise, however this is only speculation.

Table 4. Model of Expenditure Share for Healthy Mayonnaise

DV= Healthy Mayonnaise Expenditure Share			
Variable	*3 claims*	*4 claims*	*5 claims*
Age	0.0156***	0.0118**	0.00763
	-0.00455	-0.00467	-0.00765
Gender (female = 1)	-0.184	-0.226	-0.585***
	-0.148	-0.151	-0.226
Household size	0.00321	0.0494	0.0111
	-0.043	-0.0437	-0.071
Education	0.0431	-0.00189	0.0918
	-0.0407	-0.0423	-0.0716
Unit price treatment	-0.548	-0.635*	-1.469**
	-0.354	-0.365	-0.688
Unit price treatment	0.0245*	0.0254*	0.0494*
X price consciousness	-0.0137	-0.014	-0.0259
Low prominence nutrition	-0.963**	-0.774*	-1.513**
label treatment	-0.434	-0.428	-0.756
High prominence nutrition	0.237	0.52	0.617
label treatment	-0.43	-0.433	-0.743
Low prominence nutrition label treatment X nutrition label consciousness	0.0507**	0.0334	0.0801*
	-0.0244	-0.0242	-0.0414
High prominence nutrition label treatment X nutrition label consciousness	-0.00492	-0.0327	-0.0382
	-0.0246	-0.025	-0.0429
Nutrition consciousness score	0.00814	0.00465	0.0177*
	-0.00607	-0.0062	-0.0107
Shopping percentage	-0.326	-0.25	-0.842**
	-0.239	-0.243	-0.411
Constant	-1.134*	-0.971	-3.390***
	-0.612	-0.622	-1.002
Observations	788	788	788

Robust standard error below estimates
***p<0.01, **p<0.05, *p<0.1

[4] The minimum number of claims on any mayonnaise in our sample is three; therefore it is the cutoff for classifying a product as healthy.

Popcorn

Healthy popcorn is defined as having at least three nutrition claims and then at least five nutrition claims (Table 5, columns 1 and 2)[5]. The high prominence nutrition label moderated by the nutrition label consciousness score has an effect with both three and five claims. The threshold of the nutrition label consciousness is 15 for 3 claims (1.343 / 0.089 = 15.089) and 19 for 5 claims (3.424 / 0.182 = 18.81). Based on this, it appears that only individuals with high nutrition label consciousness scores are affected by nutrition labels with a lot of nutrition claims. This result is interesting in contrast to Berning et al (2011) who found using a field experiment that nutrition labels for microwave popcorn lead to a decrease in purchases of labeled popcorn. Their suggestion was that nutrition labels might signal less-preferred taste. While this finding seems to be at odds with their field experiment results, there are important differences in the analyses. First, this research is able to capture greater individual heterogeneity and account for an individual's propensity to use nutrition information. Additionally, this analysis identifies stated preference results, whereas Berning et al (2011) explores actual purchasing behavior.

Table 5. Model of Expenditure Share for Healthy Popcorn

DV= Healthy Popcorn Expenditure Share		
Variable	*3claims*	*5 claims*
Age	0.000409	0.0023
	-0.00488	-0.0128
Gender (female = 1)	0.11	-0.364
	-0.151	-0.42
Household size	-0.0506	-0.317**
	-0.0473	-0.134
Education	0.000468	-0.107
	-0.0435	-0.141
Unit price treatment	-0.0491	-1.261
	-0.351	-0.92
Unit price treatment	0.00584	-0.0223
X price consciousness	-0.0136	-0.0315
Low prominence nutrition	-0.56	0.622
label treatment	-0.404	-0.843
High prominence nutrition	-1.343***	-3.424**
label treatment	-0.483	-1.606
Low prominence nutrition label	0.0291	-0.028
treatment X nutrition label consciousness	-0.0231	-0.0548
High prominence nutrition label	0.0890***	0.182**
treatment X nutrition label consciousness	-0.0274	-0.0914
Nutrition consciousness score	0.0171***	-0.021
	-0.00655	-0.016
Shopping percentage	0.211	0.308
	-0.243	-0.688
Constant	-0.992*	-15.22***
	-0.581	-1.393
Observations	788	788

Robust standard error below estimates
***p<0.01, **p<0.05, *p<0.1

[5] There were not enough popcorn products in our sample with four claims; therefore a natural jump was from three to five claims.

Peanut Butter

Healthy peanut butter is defined as having at least two nutrition claims and then at least three nutrition claims (Table 6, columns 1 and 2). The high prominence nutrition label moderated by the nutrition label consciousness score has an effect on the expenditure share of healthy peanut butter. The threshold of the nutrition label consciousness score is roughly 13.5 for 2 claims (1.568 / 0.116 = 13.517) and 16 for 3 claims (3.308 / .205 = 16.13). The low prominence nutrition label moderated by the nutrition label consciousness score has an effect on the expenditure share of healthy peanut butter with 3 or more nutrition claims.

Table 6. Model of Expenditure Share for Healthy Peanut Butter

DV= Healthy Peanut Butter Expenditure Share		
Variable	*2 claims*	*3 claims*
Age	0.00298	0.0106
	-0.0054	-0.00929
Gender (female = 1)	0.0464	0.529*
	-0.18	-0.313
Household size	-0.0921*	-0.152
	-0.0532	-0.099
Education	0.115**	0.162*
	-0.051	-0.0831
Unit price treatment	0.162	-0.517
	-0.446	-0.851
Unit price treatment	-6.62E-05	0.0221
X price consciousness	-0.017	-0.0329
Low prominence nutrition	-1.574**	-0.336
label treatment	-0.653	-0.859
High prominence nutrition	-1.568**	-3.308**
label treatment	-0.726	-1.363
Low prominence nutrition label	0.0761**	0.0141
treatment X nutrition label consciousness	-0.0355	-0.0416
High prominence nutrition label	0.116***	0.205***
treatment X nutrition label consciousness	-0.0393	-0.0732
Nutrition consciousness score	0.0295***	0.00821
	-0.00837	-0.0117
Shopping percentage	-0.272	-0.77
	-0.284	-0.482
Constant	-2.408***	-3.903***
	-0.732	-1.207
Observations	784	784

Robust standard error below estimates
***p<0.01, **p<0.05, *p<0.1

Summary of Results

In this experiment, we find that shelf label nutrition information provided on grocery store shelf labels has an affect on shopper behavior and that the effect is moderated by the likelihood to use nutrition labels, as measured by the nutrition label consciousness score. Specifically, we find that shoppers with a high nutrition label consciousness score are more likely to select healthy

products, where healthy products are identified by the number of nutrition claims presented on their shelf label.

The effect we identify is consistent across four different product groups. Additionally, the effect is consistent across different definitions of healthy based on the number of nutrition claims. This suggests that the presence of any nutrition claim has an impact on behavior rather than the number of nutrition claims. We also find that the effect of nutrition labels is stronger for certain products. With salad dressing and peanut butter, the effects appear to be strongest. This may be because these are common products that are consumed more regularly. Further, salad dressing is a complement to an inherently health product, salad.

The limited effects found with mayonnaise products point to the strong brand influence among shoppers. Shoppers ultimately purchase these items according to experience and taste and are generally loyal to a specific type of mayonnaise product[6]. With microwave popcorn, the limited effect may be due to the consumption of popcorn as a snack item. Shoppers purchase popcorn as a treat to be consumed more sparingly than vegetables and therefore are less concerned with the nutritional content. The differences in the effect of nutrition labels based on product function needs to be further examined.

Conclusions

In response to growing health concerns and shopper demand, more grocery stores and manufacturers are beginning to offer their own nutrition information. We attempt to examine the effectiveness of this type of nutrition information offered on grocery store shelf labels. Based on our first measure of label effectiveness, attention, it appears that shelf label nutrition information does attract the attention of shoppers when it is in bold text and highlighted. In terms of behavioral compliance, we find that the nutrition label treatments affect shopper behavior for certain products and this behavior is moderated by our measure of nutrition consciousness.

Shoppers are inundated with advertisements and product displays in grocery stores. Consequently, the effect of shelf label information may become swamped by an excess of information. The moderating effect of the individual nutrition label consciousness score may provide useful insight into how to improve consumers' use of nutrition labels. To help improve the use of nutrition information, it may be beneficial to help shoppers identify nutrition information provided to them by grocery stores, thereby raising their nutrition consciousness. For example, grocery stores may create value for shoppers by providing specific, well-placed and well-designed nutrition information, thereby making the information easier to locate. Additionally, stores may engage in educating their shoppers about the nutrition labels they provide. For example, the NuVal nutrition label is a shelf label nutrition scoring system being used extensively across the country. Its promotion has been accompanied by an awareness campaign documenting the interpretation of the nutrition score. Additional information regarding their labels is available at their website as well (http://www.nuval.com/). While providing

[6] Many survey participants were upset that *Best Foods* brand mayonnaise was not an available choice in the experiment, citing it as "their brand".

nutrition information can be beneficial to shoppers, it is also important to find ways to help shoppers both use and interpret the information provided.

There are several limitations to this research as well that should be considered. First, as pointed out by a reviewer, evaluating nutritional quality is a complex procedure. Effectively communicating such information can be very difficult. This study does not measure comprehension of nutritional information being communicated. Instead, this analyses focuses on the impact of visual cues. That is, as shoppers see nutrition label claims, they behave differently. Clearly more research is necessary to evaluate consumer comprehension of this information as well. Second, there is considerable heterogeneity in consumer ability. We attempt to capture this to an extent using measures of individual nutrition consciousness and nutrition label consciousness. This provides only a limited picture of consumer differences, however. Again, further research into assessing consumer types and abilities would enhance this research area.

Acknowledgements

This research was funded by the National Research Initiative Competitive Grant Program of the Cooperative State Research, Education and Extension Service, USDA, Grant #2005-01743.

The author wishes to thank without implicating Hayley Chouinard, Kenneth Manning, and Jill McCluskey for their input and direction and recognize Rosangela Bando, Sofia Villas-Boas, Grant Chen, Melissa Hidrobo, Kristin Kiesel, Quoc Luong, and Bruno Romani for their roles in the store surveys. The author is grateful to Steve Flaming for facilitating store participation as well as Ying Hu for providing early research assistance.

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