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HEALTH EDUCATION & BEHAVIOR

Health Education & Behavior
1–10

DOI: 10.1177/1090198116651082
heb.sagepub.com
SAGE

Evaluating the Impact of U.S. Food and Drug Administration–Proposed Nutrition Facts Label Changes on Young Adults' Visual Attention and Purchase Intentions

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Abstract

Background. The U.S. Food and Drug Administration (FDA) has proposed modifying the Nutrition Facts Label (NFL) on food packages to increase consumer attention to this resource and to promote healthier dietary choices. *Aims.* The present study sought to determine whether the proposed NFL changes will affect consumer attention to the NFL or purchase intentions. *Method.* This study compared purchase intentions (yes/no responses to "would you purchase this food?" for 64 products) and attention to NFLs (measured via high-speed eye-tracking camera) among 155 young adults randomly assigned to view products with existing versus modified NFLs. Attention to all individual components of the NFL (e.g., calories, fats, sugars) were analyzed separately to assess the impact of each proposed NFL modification on attention to that region. Data were collected in 2014; analysis was conducted in 2015. *Results.* Modified NFLs did not elicit significantly more visual attention or lead to more healthful purchase intentions than did existing NFLs. Relocating the percent daily value component from the right side of the NFL to the left side, as proposed by the FDA, actually reduced participants' attention to this information. The proposed "added sugars" component was viewed on at least one label by a majority (58%) of participants. *Discussion.* Results suggest that the proposed NFL changes may not achieve FDA's goals. Changes to nutrition labeling may need to take a different form to meaningfully influence dietary behavior. *Conclusion.* Young adults' visual attention and purchase intentions do not appear to be meaningfully affected by the proposed NFL modifications.

Keywords

diet, health behavior, health communications, health policy, health promotion, nutrition

Nutrition Facts Labels (NFLs) on American food packages were standardized by the U.S. Food and Drug Administration (FDA) in 1990 (Nutrition Labeling and Education Act of 1990) to provide consumers with uniform nutrition information to aid in making healthy food choices (Taylor & Wilkening, 2008). Nutrition labels, particularly the pervasive NFLs, and the policies that regulate labeling comprise an important part of the environment in which consumers make their food and beverage choices. FDA recently proposed the first substantial NFL updates since introducing these labels (FDA, 2014). According to the FDA, the

> new Nutrition Facts label will make it easier for consumers to make informed decisions about the food they eat. The label reflects the latest scientific thinking about nutrition and the links between what people eat and chronic diseases like obesity and cardiovascular disease. (FDA, 2014)

The FDA drew on evidence-based dietary recommendations to consume lower levels of sodium, added sugars, and saturated fat (Dietary Guidelines Advisory Committee, 2010) and evidence that consumers are, on average, already consuming sufficient levels of vitamins A and C. These informed proposed modifications including an "added sugars" section and replacing vitamins A and C with potassium and vitamin D, which many Americans under consume. The FDA has also proposed increasing font sizes for serving and calorie information and relocating percent daily value (%DV) information from the right-hand side of the label to the left-hand side, in order to emphasize and draw more attention to these parts of the label (Figure 1). The hope is that consumers will use NFLs to select more healthful foods, which in turn would help prevent common diet-related diseases

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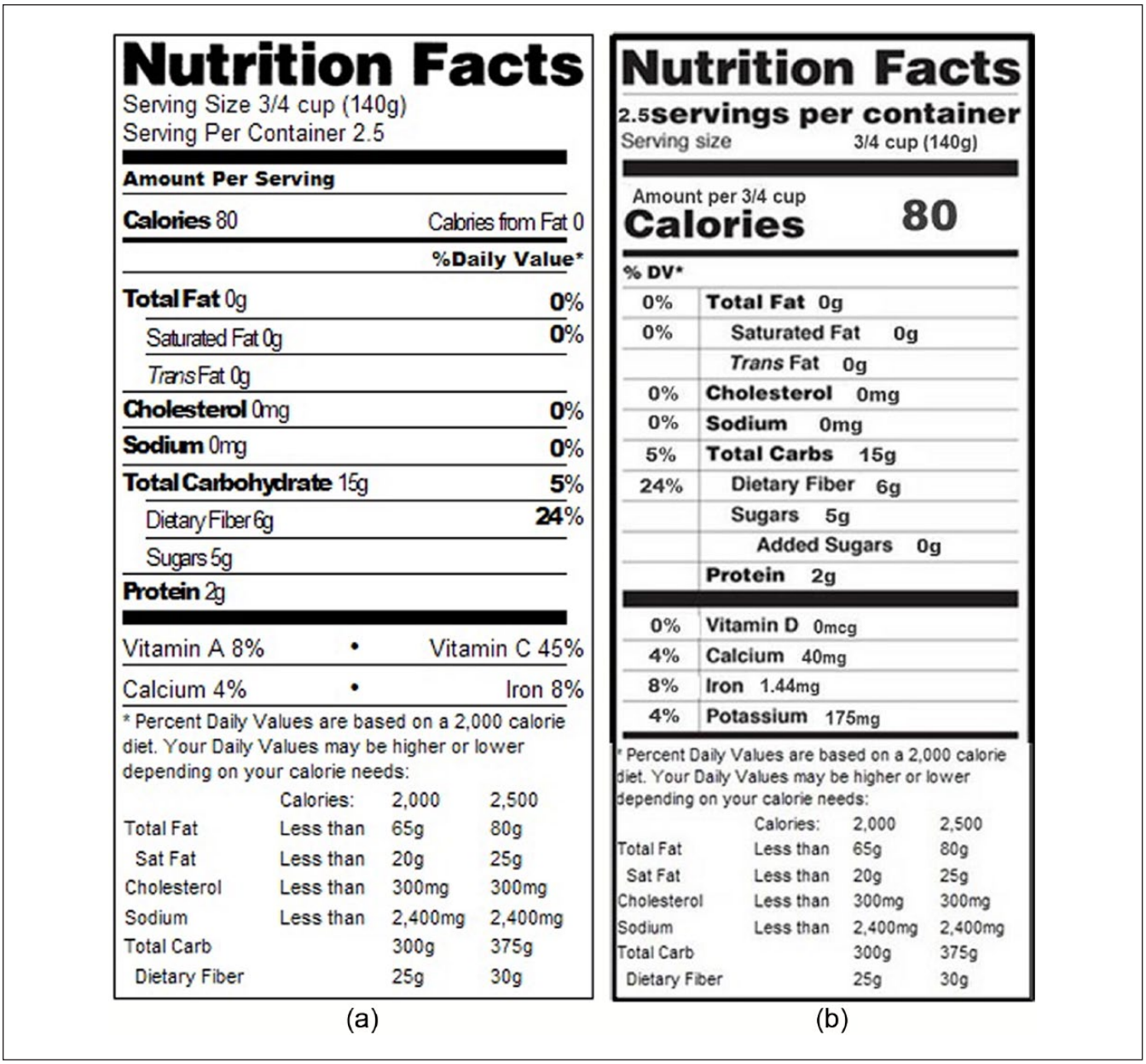

Figure 1. Existing (a) and modified (b) nutrition facts labels, as tested.

such as diabetes and cardiovascular disease (Centers for Disease Control and Prevention, 2014; Fryar, Chen, & Li, 2012; Ollberding, Wolf, & Contento, 2011). However, young adults, the group for whom prevention of chronic diseases is most feasible, have shown the greatest decrease in NFL use. Young adults have reduced their reported use of the NFL 10% between 1995 and 2005 compared with declines of less than 4% for all other age groups (Todd & Variyam, 2008). To prevent chronic diseases, increasing young adults' attention to NFLs is an important goal.

Previous eye-tracking research provided important insights about consumer interaction with NFLs. First, calorie information is the most viewed NFL component (Graham & Jeffery, 2011b; Wolfson, Graham, & Bleich, 2016). Second, visual attention to label regions decreases incrementally from top to bottom of the NFL, with upper regions (e.g., calories, serving information, fat) receiving more attention than lower regions such as vitamins and minerals (Graham & Jeffery, 2011a). Third, nutrition information located centrally receives more attention than nutrition information located peripherally in a consumer's visual field (Graham & Jeffery, 2011a). These findings suggest many of the proposed NFL changes may be ineffective at increasing consumer attention.

Information processing theories such as the elaboration likelihood model (ELM; Petty & Cacioppo, 1986) also

suggest that the proposed NFL modifications are unlikely to change how consumers use NFLs. Specifically, the ELM proposes that information is processed through two paths: thoughtful consideration of information and less-deliberative use of peripheral, heuristic cues. Consumers with the motivation and ability to use NFLs to identify healthy food options would be equally likely to attend to and engage in thoughtful processing of both existing and modified NFLs. On the other hand, neither existing nor modified NFLs encourage peripheral processing, which allows individuals to form impressionistic judgments such as "this is good" or "this is bad" without engaging in thoughtful elaboration. Such peripheral processing occurs among individuals with low levels of interest in and/or understanding of the information being communicated, and could be facilitated through simplifying devices such as colors and symbols, which can be processed with few cognitive resources. The black and white numeric format of the modified NFL would not be expected to encourage peripheral processing, and thus is anticipated to be useful only for those same capable, motivated consumers who are already using existing NFLs.

For NFL modifications to achieve FDA's desired results of eliciting greater consumer attention and more healthful dietary decisions (FDA, 2014), modified NFLs must be seen and used; yet no studies to date have examined the impact of the proposed label changes on consumer attention or behavior. Therefore, the current study objectively measures young adults' attention to the proposed NFL changes using eye-tracking technology and also assesses purchase intentions. Participants were randomly assigned to view foods labeled with existing NFLs or NFLs modified according to FDA recommendations. Based on the ELM of information processing and on existing research using eye tracking to measure consumer interaction with NFLs, we made the following specific hypotheses related to visual attention:

1. *Moving %DV from right hand to left hand side of NFL:* Given that consumers preferentially focus on centrally located information, FDA's proposed relocation of %DV information will not elicit increased attention.
2. *Increasing font size of calories and serving size:* Given that consumers view information at the top of the NFL much more than information at the bottom, increasing the font size for calorie and serving size information will not increase participants' attention to these already highly viewed NFL components.
3. *Adding potassium, vitamin D, and added sugars information:* Given that consumers rarely view information at the bottom of the NFL, participants, on average, will not view the added sugars, potassium, and vitamin D information.

Due to the hypothesized lack of change in attention to NFLs based on the proposed modifications, and the lack of additional cues to promote heuristic processing, we also hypothesized that purchase intentions would not differ between participants randomly assigned to see existing NFLs versus modified NFLs.

Method

Participants

Participants were a convenience sample of 155 two- and 4-year college students from Colorado, USA, enrolled in an introductory-level Psychology course.

Materials and Procedures

The present laboratory experiment used a high-speed eye-tracking camera to objectively measure young adults' visual attention to NFLs and also gathered purchase intentions for 64 prepackaged foods commonly found in a large national U.S. supermarket chain. The foods represent 15 popular food categories spanning a wide range of healthfulness (see Table 3), with either 4 or 5 representative items per category. Participants viewed the 64 foods in random order with the following information provided for all items: photo of food, price, product description, ingredients list, and nutrition information (see Figure 2), on a computer and indicated via mouse click whether or not they would purchase each food. Participants were randomly assigned to one of two groups: (1) saw existing, unmodified NFLs or (2) saw NFLs modified according to FDA recommendations (Figure 1). Institutional review board approval was obtained from the Colorado State University Institutional Review Board. Participants provided informed consent. Data were collected in 2014, and analysis was conducted in 2015.

Visual Attention. This parameter was measured in milliseconds (ms) using the Eyelink1000 high-speed eye-tracking camera (SR Research, Mississaugua, Canada). Nine-point calibration and validation procedures were conducted prior to beginning data collection. In addition, use of a chinrest ensured the highest possible levels of accuracy (0.25° of visual angle) and resolution (0.01°). Interest areas created in SR Research's Experiment Builder software package measured attention to each NFL component (i.e., attention was measured separately for calories, fat, etc.) The primary attention outcomes were the following: (1) percentage of participants who viewed the label component on ≥1 NFL, (2) *percentage of labels* on which viewers looked at a particular region, and (3) *mean viewing time* per label for those NFLs on which the specific region was viewed.

Purchase Intention. This parameter was recorded for each of the 64 foods. Participants selected "Yes," "No," or "Not applicable" in response to the question, "Would you purchase this food?" Participants selected "Not applicable" if

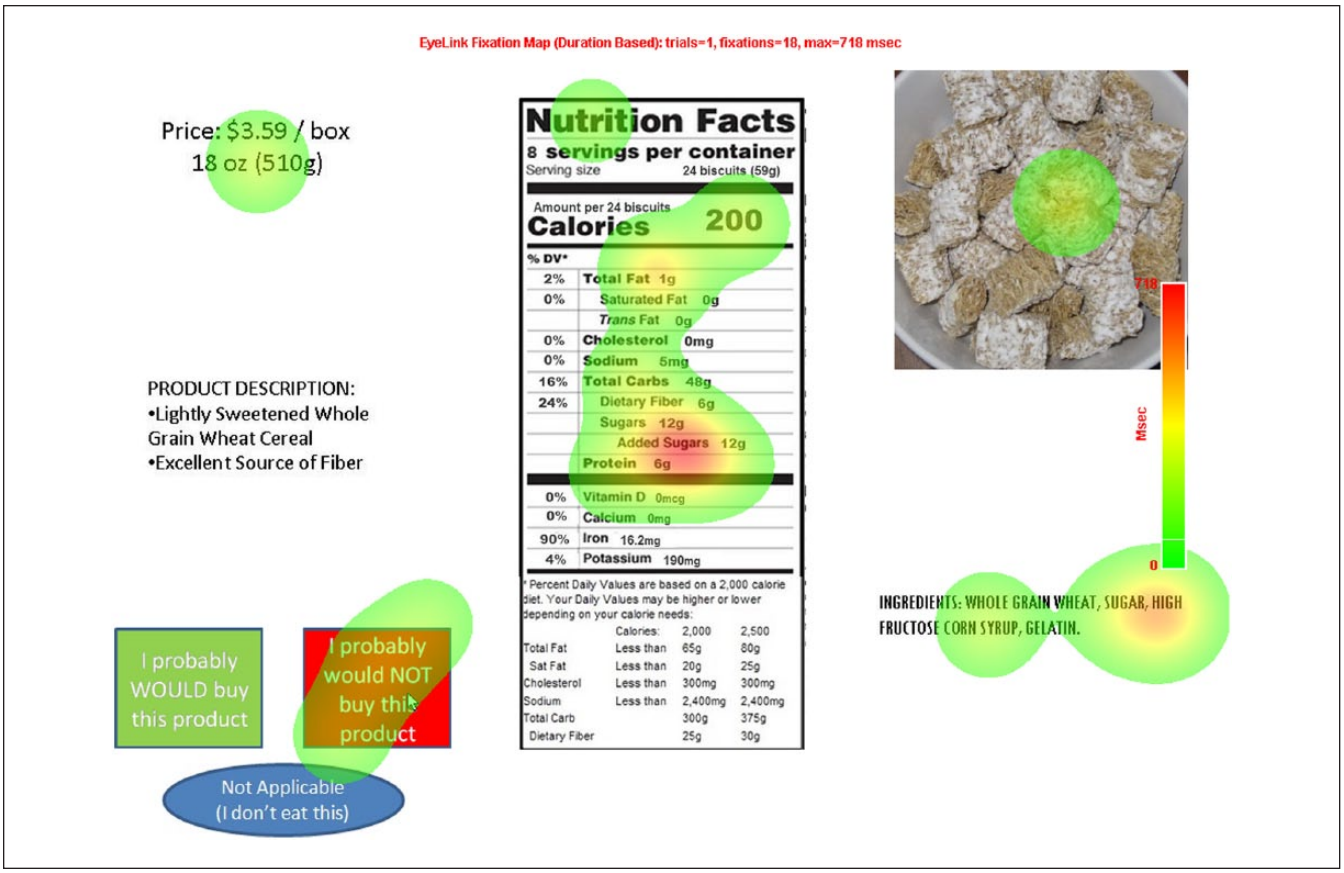

Figure 2. Sample food as viewed by a participant, with heatmap displaying visual attention.
Note. Modified NFL (Nutrition Facts Label) shown here. Darker shading on heatmap represents higher concentrations of visual attention

they had a food allergy preventing them from eating the pictured food.

Demographic Information. Age, sex, race, and ethnicity were self-reported by participants using the Department of Health and Human Services standards, which allow one or more categories to be selected for race and ethnicity (Dorsey & Graham, 2011). Participants could omit any demographic items they did not wish to answer.

Statistical Analysis

A power analysis (two-tailed, $\alpha = .05$), conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007), indicated adequate power ($1 - \beta = .87$) to detect medium effects ($d = .5$), excellent power (.99) to detect large effects ($d = .8$), but insufficient power (.23) to detect small effects ($d = .2$). Independent samples t tests were conducted using SPSS v22.0 (IBM, Armonk, NY) to detect between-group differences on the four primary outcomes (three measures of visual attention and purchase intentions). Because there were 19 t tests conducted for each outcome, a Bonferroni-adjusted $p = .0026$ was set as the threshold for statistical significance. To examine the influence of participant sex, a known correlate of nutrition label use (Cowburn & Stockley, 2005), moderator analyses for all outcome variables were conducted via regression analyses with the following predictor variables: Label type, Sex, and a Label type × Sex interaction term.

Results

Demographics

Of the 155 study participants, 71.0% were female, 89.7% were Caucasian, 82.6% were non-Hispanic, and the mean age was 20.6 ± 4.1 years. After random assignment, there were 69 participants in the "Existing Label" group and 86 participants in the "Modified Label" group. The two groups did not differ significantly on known demographics. Table 1 presents demographics for the overall sample and by study condition.

Visual Attention

All participants viewed at least one NFL during the food choice task. When viewing an NFL, the average participant spent 3.2 seconds attending to the entire label (range

Table 1. Participant Characteristics Overall and by Experimental Condition.

Demographic characteristic	Overall (N = 155)		Existing labels[a] (n = 69)		Modified labels[b] (n = 86)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age (years)	20.6	4.1	21.2	5.4	20.1	2.7
	n	%	*n*	%	*n*	%
Sex[c]						
Female	110	71.0	44	63.8	66	76.7
Male	40	25.8	21	30.4	19	22.1
Race[c]						
White	139	89.7	63	91.3	76	88.4
Black	6	3.9	3	4.3	3	3.5
Other	11	7.1	5	7.2	6	7.0
Ethnicity[c]						
Hispanic	23	14.8	10	14.5	13	15.1
Non-Hispanic	128	82.6	56	81.2	72	83.7

[a]Existing nutrition facts labels were presented for all 64 food products. [b]Nutrition facts labels that were modified in accordance with Food and Drug Administration recommendations were presented for all 64 food products. [c]Column percentages may not sum to 100 as respondents were free to select none, one, or more sexes, races, and ethnicities.

0.7 to 9.3 seconds). Based on Bonferroni corrected α = .0026, none of the three outcomes of visual attention were significantly different between the existing and modified NFL groups. Likewise, no significant Label type × Sex interactions emerged at corrected levels of significance. The few differences in visual attention between label types that emerged using a conventional p value (<.05) are discussed below.

Percentage of Participants Viewing Each Label Component. The percentage of participants who viewed each label component at least once during the entire food selection task (i.e., one or more times on one or more labels) was compared across conditions to determine if the modified NFL format increased participants' attention to certain label components. As summarized in Table 2, no region included on both labels was viewed by a greater percentage of Modified Label participants compared with Existing Label participants. In contrast, a significantly higher percentage of Existing Label participants viewed five %DV components (saturated fat %DV, cholesterol %DV, sodium %DV, calcium %DV, and iron %DV) than did Modified Label participants. A larger percentage of Existing Label participants versus Modified Label participants also viewed the sugars region of the label, although the proposed added sugars component of the modified NFL was viewed at least once by more than half of the participants in the Modified Label group. Among these participants, added sugars received more attention than the sugars section of the modified label. Approximately the same proportions of participants viewed the proposed vitamin D and potassium label components as the vitamins they replaced from the existing NFL (i.e., vitamins A and C %DV). The modified NFLs also contain sections for International System (SI) units of vitamins and minerals (e.g., mg, µg), which do not appear on existing NFLs. These four NFL regions (calcium SI units, iron SI units, vitamin D SI units, and potassium SI units) were viewed on at least one NFL by 36% to 57% of Modified Label participants, making these newly added regions more likely to be viewed than their corresponding %DV regions on the modified NFL. A general pattern of visual attention relating to relative label position emerged for both existing and modified labels: Label components near the top of the NFL were viewed by a higher percentage of participants than were those components in the middle of the NFL, which, in turn, were viewed by more participants than those components at the bottom of the NFL. No Label type × Sex interactions resulted for percentage of participants viewing label components.

Percentage of Labels on Which Viewers Looked at Each Component. Considering only those participants identified above who looked at a given label component at least once, the percentage of labels on which a particular NFL region was viewed was also compared across condition (Table 2). As with the "percentage of *participants*" results above, the percentage of *labels* results revealed that no region of the modified NFL was viewed on a greater percentage of labels compared with the corresponding region of the existing NFL. Also paralleling the "percentage of *participants*" results, %DV components tended to be viewed on more existing NFLs (where they were located on the right side) than on modified NFLs, where they were

Table 2. Visual Attention to Existing and Modified Nutrition Facts Labels.

	Existing labels (n = 69)				Modified labels (n = 86)			
NFL region	Never viewed (%)[a]	Viewed ≥1 time (%)[b]	Labels viewed (%)[c]	Mean view time (ms)[d]	Never viewed (%)[a]	Viewed ≥1 time (%)[b]	Labels viewed (%)[c]	Mean view time (ms)[d]
Serving size	0	100	19	262	4.7	95.3	17	276
Calories	0	100	27	281	2.3	97.7	29	276
Fat	4.3	95.7	13	178^	4.7	95.3	13	194^
Fat DV	30.4	69.6	5*	155	44.2	55.8	3*	166
Saturated fat	2.9	97.1	14	185	2.3	97.7	13	197
Saturated fat DV	37.7	62.3*	6*	162	57	43*	3*	161
Trans fat	7.2	92.8	11	184^	4.7	95.3	11	211^
Cholesterol	18.8	81.2	11	210	9.3	90.7	11	218
Cholesterol DV	52.2	47.8*	5^	149	73.3	26.7*	3^	150
Sodium	21.7	78.3	11	239	30.2	69.8	12	246
Sodium DV	60.9	39.1*	7*	209^	77.9	22.1*	2*	171^
Carbohydrates	23.2	76.8	9	199^	33.7	66.3	10	228^
Carbohydrates DV	63.8	36.2	6*	219	77.9	22.1	2*	213
Fiber	36.2	63.8	10	233	36	64	11	212
Fiber DV	68.1	31.9	4*	151^	74.4	25.6	2*	124^
Sugars	27.5	72.5*	10	230	52.3	47.7*	11	227
Added sugars[e]	NA	NA	NA	NA	41.9	58.1	12	250
Protein	34.8	65.2	8	226	34.9	65.1	11	223
Calcium	NA	NA	NA	NA	55.8	44.2	6	232
Calcium DV	44.9	55.1*	5*	176	80.2	19.8*	2*	151
Iron	NA	NA	NA	NA	50	50	5	248
Iron DV	72.5	27.5*	2	202	94.2	5.8*	2	174
Vitamin A DV[f]	39.1	60.9	7	228	NA	NA	NA	NA
Vitamin D[f]	NA	NA	NA	NA	43	57	8	210
Vitamin D DV	NA	NA	NA	NA	80.2	19.8	2	141
Vitamin C DV[f]	59.4	40.6	3	173	NA	NA	NA	NA
Potassium[f]	NA	NA	NA	NA	64	36	5	226
Potassium DV	NA	NA	NA	NA	91.9	8.1	2	198

Note. DV = daily value; NA = not applicable; NFL = Nutrition Facts Label.

[a]Never Viewed denotes the percentage of participants who did not view the given label component of any of the 64 NFLs. [b]Viewed ≥1 Time denotes the percentage of participants who viewed the given label component at least once on at least one of the 64 NFLs. [c]Labels Viewed denotes the percentage of the 64 labels on which the specific label component was viewed by those participants who viewed the component at least once. [d]Mean View Time denotes the mean number of milliseconds for which the specific label component was viewed by those participants who viewed the component on at least one NFL. [e]Added sugars was only available on the modified NFLs (see Figure 1). [f]Existing labels list vitamins A and C as well as iron and calcium; Modified labels contain vitamin D as well as calcium, iron, and potassium (see Figure 1).

*Difference between those who saw existing labels and modified labels significant at $p < .05$; none of these significant differences remain statistically significant when Bonferroni-adjusted ($p < .0026$).

^Denotes between-group differences that did not reach conventional levels of statistical significance ($p < .05$), but did have an effect size greater than $d = .2$.

relocated to the left side. Six %DV sections (fat %DV, saturated fat %DV, sodium %DV, carbohydrate %DV, fiber %DV, and calcium %DV) were viewed on more NFLs by the Existing Label group than by the Modified Label group. In addition, although it had a $p > .05$, a seventh %DV section, cholesterol, was viewed by more participants in the Existing Label group than in the Modified Label group with a nearly medium effect size of $d = .42$. The %DV portions of the modified NFL were viewed on only 2% to 3% of labels, and these 2% to 3% figures reflect viewership among only those participants who viewed these areas at all, which was less than half of the participants for nearly all, and less than 25% of participants for most, %DV components. As with the "percentage of *participants*" results, the same general pattern of visual attention relating to relative position on the label emerged: Among both existing and modified NFLs, the label components near the top of the NFL were viewed on a higher percentage of labels than those in the middle of the NFL, which, in turn, were viewed on more labels than those at the bottom of the NFL. Also as with the "percentage of *participants*" results, no Label type × Sex interactions were detected for percentage of participants viewing label components.

Table 3. Purchase Intention by Label Type and Food Category.

Type of food	Percentage selecting "Yes, would purchase"		
	Existing label (n = 69)	Modified label (n = 86)	p value
Cereal[a]	55.1	50.2	.274
Chip	58.0	57.6	.932
Cookie[a]	40.6	45.8	.291
Cracker	56.9	53.2	.390
Fruit (canned)	75.4	76.7	.742
Fruit (frozen)	55.4	52.6	.534
Ice cream	48.6	53.2	.401
Meat (cold cuts)	62.0	60.2	.757
Nut	60.1	62.8	.591
Pizza[a]	35.4	41.4	.176
Snack	46.7	49.4	.544
Soup	46.0	41.9	.397
Vegetable (canned)	52.2	52.0	.979
Vegetable (frozen)[a]	58.6	55.8	.597
Yogurt	59.1	52.6	.225

[a]Mean purchase intention across five items; for all other categories, mean across four items.

Viewing Time Per Label Component. The mean number of milliseconds for which a particular NFL region was viewed by the participants who viewed that label component at least once was also compared across study conditions (Table 2). These results revealed no differences that were statistically significant at the $p < .05$ level. However, five between-group differences with ps $> .05$ did have effect sizes that were greater than $d = .2$. Three of these differences reflected greater viewing time of modified NFL regions (fat, trans fat, and carbohydrates) relative to their counterparts on the existing NFL; the two remaining differences were for %DV sections (sodium %DV and fiber %DV), both of which received more viewing time on existing NFLs versus modified NFLs. Although the two portions of the label located at the very top of both existing and modified NFLs (i.e., servings and calories) did receive the most viewing time of all label components, the location-based pattern described above for both "percentage of participants" viewing NFLs and "percentage of labels" on which each component was viewed (i.e., more attention at the top than the middle and more attention to the middle than the bottom) did not emerge for viewing time. One Label type × Sex interaction was discovered for mean viewing time of the protein region of the NFL: Males spent 282 ms viewing this region on Existing Labels compared with 222 ms on modified labels; for females these numbers were 195 ms and 226 ms, respectively.

Purchase Intentions

The percentage of respondents indicating that they would purchase each food was compared between the Existing Label group and the Modified Label group. As with the visual attention results reported above, a Bonferroni correction for conducting multiple t tests rendered all p values for purchase intentions nonsignificant. Only one of the t tests comparing purchase intentions between study conditions produced a $p < .05$ (for rice cakes, the lowest-calorie product available among the 64-item set, participants were more likely [$p = .049$] to indicate that they would purchase the product when it had the modified NFL than the existing NFL).

In addition to the purchase intention comparisons for each individual product, purchase intention was also compared across condition for 15 food categories represented by the 64 items (Table 3) to determine if modified NFLs are more influential on young adults' intentions for some food types than for others. In these analyses, the mean percentage of participants who indicated that they would purchase, for example, breakfast cereal was calculated as the mean of the percentage selecting each of five breakfast cereals. The same procedure was used for canned soups, frozen fruits, and so on. As with the analyses examining each food individually, these food group analyses revealed that the modified NFLs did not lead to different purchase intentions than existing NFLs for any of the 15 categories of foods examined.

Discussion

In this study, we compared the current NFL with a modified NFL reflecting the FDA's proposed changes. This study focused on the influence of three main NFL changes: (1) *Moving %DV from the NFL's right to left side*; (2) *Increasing font size of calories and serving size*; and (3) *Adding potassium, vitamin D, and added sugars*. We examined the influence of these changes on young adults' visual attention and food purchase intentions. Overall, as hypothesized based on both prior research and information processing theories like

the ELM, the proposed NFL changes did not appear to increase young adults' attention to NFLs or significantly affect hypothetical food purchasing decisions. We did not see any influence of label type on purchase intentions for products spanning 15 food types.

One potential negative effect of the proposed changes is that the relocation of %DV information (from the NFL's right side to the left) had the unintended effect of reducing participants' attention to this information. It is possible this occurred because consumers are used to seeing this information on the right side of the label, however, we would expect that the novel placement of the %DV information alone would draw more attention, but this did not occur. This preliminary evidence suggests further testing of the %DV is especially needed as relocating this information as proposed may negatively affect consumer attention to %DV information.

In terms of increasing the font size of calories and serving size, we did not find evidence that larger font better captured young adults' attention. Overall, participants did not view any individual nutrients on the modified NFL significantly more than on the existing NFL. The one label type x sex interaction that was significant at $p < .05$ (time spent viewing the protein region of the NFL) should be interpreted with caution because it did not meet the threshold of significance when controlling for multiple tests and because of the small cell sizes, particularly for males—only 16 and 10 of whom viewed protein on the existing and modified labels, respectively). However, the interaction revealed that male participants spent more time looking at protein information on existing labels than did females but that this sex difference did not exist for the modified labels.

One potentially positive finding was that the proposed added sugars line appeared to be a desirable addition to NFLs, at least among participants viewing it on the modified label. Within that group, more participants sought out added sugars information when it was available than the standard sugars label component. However, consistent with previous research examining NFL use via eye-tracking methodology (Graham & Jeffery, 2011a), participants in this study had a tendency to focus their attention on the top of the NFL and to pay less attention to the middle of the label and even less attention to the bottom. This tendency means that label components such as vitamins and minerals, which are located at the bottom of the NFL, received far less attention than did label components located near the top, such as serving size, calories, and fat. Although the percentage of labels on which participants viewed the vitamins and minerals portion of the NFL was very low (2% to 8%), the addition of SI unit sections to the vitamins and minerals sections of the modified NFL did appear to be of interest to some of the participants who viewed these NFLs.

Implications for Policy

The proposed NFL modifications may not be the optimal changes for increasing consumer attention or changing purchasing intentions. Modifications that are more visually apparent or that use nonnumeric strategies may be more beneficial as consumers often have difficulty using quantitative information when making dietary decisions (Campos, Doxey, & Hammond, 2011; Cowburn & Stockley, 2005; Vanderlee, Goodman, Yang, & Hammond, 2012). Based on the ELM (Petty & Cacioppo, 1986), it is also expected that adding colors, symbols, or other cues to NFLs would facilitate heuristic processing and make NFLs useful to consumers with less motivation and ability to process nutrition information than current NFL users. It will be important for future research to explore other kinds of modifications that could better inform consumers and lead to healthier food purchases. For example, traffic light labeling has produced long-term increases in healthfulness of foods chosen in cafeteria settings (Thorndike, Riis, Sonnenberg, & Levy, 2014), and research in the United Kingdom indicates that pairing traffic light style labels with interpretative text such as %DV along with indications of whether nutrient levels are "high," "medium," or "low" appears to be particularly helpful among consumers with low socioeconomic status (Malam, Clegg, Kirwan, & McGinigal, 2009). It is possible that more salient NFL changes, such as traffic light labeling, or more understandable metrics, such as high/medium/low labels, that could help consumers quickly understand amounts of different nutrients may have a greater impact on consumers than the proposed NFL modifications and should be studied. With growing interest in front-of-package labeling strategies, future studies should also examine whether salient and meaningful front-of-package nutrition labels are better able to communicate information to consumers and/or increase use of the NFL. In addition, future research on nutrition information usage should compare consumer behavior as it relates to participants' dietary goals and dietary restraint. Prior research suggests that individuals with specific dietary goals and those with high levels of dietary restraint are more likely to use nutrition information when making food choices (e.g., D. L. Miller, Castellanos, Shide, Peters, & Rolls, 1998; Ogden & Wardle, 1990; Satia, Galanko, & Neuhouser, 2005).

Limitations and Strengths

This study has several limitations. First, although declining rates of NFL use (Todd & Variyam, 2008) and low NFL comprehension (Sharf et al., 2012) among young adults makes this an important population to examine, including only college students in this study makes it difficult to generalize these results to other populations. In addition, although this study had sufficient power to detect medium and large effects, the sample size limited our ability to detect small effects. The effects that reached traditional levels of statistical significance ($p < .05$) all had medium-to-large effect sizes ranging from $d = .45$ to $d = .84$. However, as noted, some smaller effects were detected by effect size but did not attain p values of less than .05 in the present study (effect sizes for

non-significant results ranged from very small, $d = .002$, to nearly moderate in magnitude, $d = .42$, including six that exceeded $d = .2$, indicating a small effect).

Although participants in this study did not devote much attention to the vitamins and minerals on the existing or the modified NFLs, there might be certain subsets of consumers who are particularly interested in potassium and vitamin D information because they are at risk for dietary deficiencies. Having such information on the label is, of course, important for these consumers, and having dietary modification goals is linked with greater use of NFLs (L. M. S. Miller & Cassady, 2012). Another limitation was measuring purchase intentions in a laboratory setting, rather than in a real-world setting. However, we studied label changes under conditions where participants could easily view the NFL and had ample time to scan it. Thus, the lack of gains in attention with the proposed changes under "ideal" label viewing conditions suggests attention to the label would likely be less in a real-world setting that has many more competing distractions and decisions to make, and when accessing the NFL requires picking up a package, rather than just looking at readily visible information. This supposition is supported by previous research demonstrating much lower rates of visual attention to NFLs among participants selecting foods from a grocery aisle, rather than on a computer (Graham, Heidrick, & Hodgin, 2015). Nonetheless, it is also important to test the proposed changes in real-world environments as certain real-world elements not included in the laboratory (e.g., other shoppers, distractions) may reduce the generalizability of laboratory results.

Finally, we did not test FDA's proposal to modify NFL serving size information to "represent how people eat and drink today" (FDA, 2014), because we do not know what those modifications would look like for the 64 products tested. Recent evidence suggests that the proposed changes to make serving size more consistent with consumer behavior may actually have effects contrary to FDA's intent and may lead to overconsumption (Dallas, Liu, & Ubel, 2015).

This study also has important strengths. It is the first study to examine how the proposed FDA modifications influence individuals' attention and purchase intentions. Eye-tracking technology provides an objective measure of attention, which is an important variable on the causal path linking labels to consumer behavior (Bialkova et al., 2014). We examined a large number of products and assessed all FDA-proposed modifications at once to control for how changes might influence one another when displayed together.

Conclusions

Nutrition labeling is an important structural approach to promoting health with the potential to reach and benefit many consumers. Proposed policy changes affecting nutrition labeling should be accompanied by assessment of consumer behavior to evaluate whether the changes to the food environment produce the desired effect. In this study, modified NFLs did not draw more attention or lead to more healthful food purchase intentions than existing NFLs. The FDA-proposed changes to NFLs tested here may not achieve the FDA's goals of attracting consumers' attention and making it easier for consumers to make healthy choices. More and/or different changes to nutrition labeling policy may be necessary to achieve FDA's objectives.

Acknowledgments

The authors would like to acknowledge Jayci Miltenberger for her contributions to this study.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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