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Is Simpler Always Better? Consumer Evaluations of Front-of-Package Nutrition Symbols

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Abstract

Consumers of packaged goods products in the U.S. recently have faced an onslaught of front-of-package (FOP) nutrition symbols and icons, including the controversial “Smart Choices” single summary indicator. In a between-subjects experiment with 520 adult consumers, the authors compare effects of the Smart Choices (SC) icon, the more complex Traffic Light - Guideline Daily Amounts icon (TL-GDA), and a no FOP icon control for a nutritionally-moderate food that qualifies for the SC icon. Drawing from principles of heuristic processing and halo effects, the authors predict and find that the SC icon can lead to positive (and potentially misleading) nutrient evaluations and product healthfulness when compared to the TL-GDA icon or no FOP icon control. The authors also find that nutrition consciousness is more likely to moderate effects related to the Nutrition Facts Panel than the FOP nutrition icon information. Implications are offered for public health officials, nutrition researchers, and food manufacturers, as the U.S. Food & Drug Administration (FDA) considers front-of package nutrition alternatives for use in the U.S.

Keywords: Nutrition Labeling, Front-of-Package Symbols, Nutrition Consciousness, FDA

Is Simpler Always Better? Consumer Evaluations of Front-of-Package Nutrition Symbols

Consumers of packaged food products in the U.S. now face a dizzying array of front-of-package (FOP) nutrition symbols and icons, including Kraft's "Sensible Solution," PepsiCo's "Smart Spot," Unilever's "Eat Smart" logo, the American Heart Association's "Heart Check," General Mills' "Goodness Corner," the "Guiding Stars" from Hannaford Brothers, Kellogg's use of the Guideline Daily Amounts, and, until recently, the Keystone Group and Nutrition Roundtable's "Smart Choices" icon (Childs 2008; CSPI 2006; Fooducate.com 2008; IOM 2010; Sebolt 2008). Other front-of-package icons proposed for the near future include a simple front-of-pack symbol from Walmart (Skiba 2011) and the "Nutrition Keys" (GMA 2010; 2011), displaying per serving nutrition information on icons for calories, saturated fat, sodium and sugars.

To combat confusion created by the many symbols in the U.S. market, the "Smart Choices" icon was developed by the Keystone Group (a large industry, government, and academic coalition), and appeared on packages from firms, such as Unilever, Kraft, Coca-Cola, Pepsi, and Kellogg's, from August through October 2009 (Lupton et al. 2010). In general, the intent of the FOP symbols and icons is to help consumers make better choices in constructing a balanced diet due to their simplicity and suggested ease of use (Food Standards Agency 2008; 2009a; Sebolt 2008). Consumer testing by the Keystone Group indicates that the simplicity of summarizing the diverse nutrition information in the Nutrition Facts Panel into a single indicator to classify products is a highly desirable attribute for consumers (Lupton et al. 2010). Similarly, research in the European Union (EU) has indicated that consumers generally like and prefer simpler, "healthy choice tick" FOP icons (Feunekes et al. 2008). However, work by the Food Standards Agency in the U.K. also suggests that more complex FOP icons, such as Multiple Traffic Lights with percentages and levels based on the

Guideline Daily Amounts, may help with the evaluation of several nutrients for a given food (Food Standards Agency 2008).

It is within this context that the U.S. Food & Drug Administration (FDA) recently issued several requests for further research (FDA 2009; *Federal Register* 2010) to answer important questions of exactly how consumers will interpret and use different front-of-package symbols, especially in the presence and absence of the Nutrition Facts Panel. Moreover, a recent critical review of food labeling practices in the U.S. indicates that “appropriate consumer research [on front of package nutrition labels] in the United States is vitally important” (Center for Science in the Public Interest 2009, Part III, p. 10). Thus, the primary purpose of our study is to test a simpler, summary icon (i.e., Smart Choices), a more complex icon (i.e., Traffic Light – Guidelines Daily Amounts), and a no front-of-package icon control for their effects on nutrition evaluations, nutrient use accuracy, product attitudes and purchase intentions. In addition, based on prior nutrition labeling research (cf. Burton et al 1994; Keller et al. 1997; Kemp et al. 2007; Howlett et al. 2008), we examine consumers’ “nutrition consciousness” as a potential moderator of effects of front-of-package nutrition icons relative to Nutrition Facts Panel information. These study objectives focus on the recent FDA call for research (*Federal Register* 2010, p. 22605) in determining exactly how consumers will evaluate front-of-package (FOP) summary icons versus nutrient specific symbols.

Summary and Nutrient-Specific FOP Symbols

One viable option for providing simplified front-of-package (FOP) nutrition information is a summary symbol, such as the Smart Choices icon. Yet, when introduced in late August 2009, the Smart Choices icon met with an immediate, negative reception from a variety of sources in the public health community (e.g., Neuman 2009; Nestle 2009; Pinkston 2009; Ruiz 2009; State of Connecticut 2009). For example, the inclusion of the Smart Choices icon for Froot Loops cereal became a focal point of much of the criticism. Although initially it did not qualify for the icon, Froot Loops was

reformulated to reach standards set by the Smart Choices Program by (1) meeting the required levels of positive nutritional attributes of fiber and vitamins A and C, and (2) not exceeding limits set for negative attributes on fat, sodium and sugar. Criticism focused on the fact that the cereal contained the maximum amount of sugar allowed in the cereal category, 12 grams per serving, which for Froot Loops accounted for more than 40 percent of the product when measured by weight. Without examining the specific information in the Facts Panel, this high concentration of sugar is not evident to the consumer. In August 2009, the FDA submitted a letter addressing its concern regarding the Smart Choices Program and has decided to undertake an independent evaluation of various FOP systems (Neuman 2009; Taylor and Mande 2009). Michael R. Taylor, Senior Advisor to the FDA Commissioner, noted that there would be concerns with any front-of-package system that may “in any way be based on cherry-picking the good and not disclosing adequately the components of a product that may be less good” (Neuman 2009). Of importance to the current study, certain allowable levels of cholesterol (60 mg per serving) and sodium (480 mg per serving) that meet the criteria for the Smart Choices icon (Smart Choices Program 2009, p. 2) are at levels determined to be *high* by the Food Labeling Rules set by the FDA (*Federal Register* 1993, p. 2411).

In contrast to the single, summary indicator of relative healthfulness, another viable option for providing FOP nutrition information is with a nutrient-specific symbol, such as the Traffic Light – Guideline Daily Amounts (TL-GDA). The front-of-package, TL-GDA format offers a nutritional snapshot of information from the Facts Panel that covers the attributes generally of greatest interest to consumers. In March 2006, the United Kingdom (UK)’s Food Standards Agency recommended voluntary use of the front-of-pack 'traffic light' labeling approach in conjunction with the EU’s GDA system (Food Standards Agency 2009b). Such an approach has several voluntary options that are being used, including simple colored traffic lights with absolute GDA information, colored traffic lights with absolute GDAs and percentages of their daily amount, and monochrome traffic lights with

absolute GDAs and percentages – but in smaller font size. For example, the Multiple Traffic Light system with absolute GDAs and percentages identifies the specific levels of sugar available in a single serving of Froot Loops (12 grams), as well as other important attributes such as calories, fat, and saturated fat, and the percentage of the recommended daily amount that is contained in one serving. Thus, while it offers specific absolute and percentage amounts of calories and important nutrients, it does not condense and simplify these various attributes into a single indicator of relative healthfulness. The current study tests the colored traffic lights (i.e., red, amber, and green) with absolute and percentage GDA information, and is based on icons in use in Avondale and Marks & Spencer food stores in the UK (Signposting Schemes in the UK Marketplace 2010). Percentages of the GDA information are based on the Daily Values in use on Nutrition Facts Panels in the U.S.

Supporting Rationale and Hypotheses

Favorable effects of simplified indicators of health are consistent with the tenets of *heuristic* or peripheral route processing (e.g., Eagley and Chaiken 1993; Petty and Cacioppo 1986). When faced with a complex decision environment, peripheral cues or heuristics can reduce the effort needed in processing nutrition information and allow the consumer to make judgments and evaluations based on the simplified cue or heuristic (Eagly and Chaiken 1993, p. 330). In addition, *halo effects* (Nesbett and Wilson 1977) are likely in that the presence of the front-of-package nutrition symbol can lead consumers to generalize that the product is more favorable on other nutrition elements not explicitly identified in the FOP symbol (Roe, Levy and Derby 1999, p. 91). Such halo effects have been found in the case of health claims (Roe, Levy, and Derby 1999) and nutrient content claims in advertising (Andrews, Netemeyer, and Burton 1998). In contrast, and in terms of evaluation of product nutrition *quality*, the Nutrition Facts Panel offers a myriad of nutrition attribute information (e.g., calories, calories from fat, total fat, saturated fat, cholesterol, sodium, total carbohydrates, sugar, fiber, protein, vitamins and minerals). The most appropriate way to integrate this information (and nutrient and

health claims) into a single summary assessment of quality can be a very difficult task often accomplished by only the most knowledgeable, nutrition-conscious consumers (i.e., “the nutrition elite,” Andrews, Netemeyer, and Burton 2009). So, for such a problematic judgment task, a summary indicator (e.g., the Smart Choices icon) ideally can act as a heuristic cue that reduces the complexity and noise within the package environment, thus minimizing consumer effort. As noted above, however, it also may result in a halo effect for other nutrients that are not as favorable. Although not as simplistic as the SC icon, the TL-GDA format reduces Facts Panel information into a set of nutritional criteria relevant to most consumers, and places the information on the front of the package where it is easy to see and access. The recognizable color coding in the traffic lights offers an important heuristic of tiered information on the levels of calories and specific nutrients, but does not provide a summary recommendation on the overall or aggregated nutritional value of the product. Thus, the TL-GDAs require some effort from consumers for evaluation, and therefore, are not as likely as the SC icon to halo or generalize to key negative nutrients. However, because they focus on a more limited, yet highly accessible, set of nutrients than the Facts Panel, there remains some opportunity for the haloing of non-disclosed nutrition elements and evaluations.

Effects Related to Front-of-Package Nutrition Icons

In this study, we make use of a “mixed” (i.e., moderate) nutrition value food that meets the requirements for inclusion of the Smart Choices icon on the front of the package (see Appendices A and B). For a nutritionally mixed (moderate) product such as this, we anticipate that any simplified FOP information (i.e., for both the SC and the TL-GDA icons) will strengthen the perceptions of overall product healthfulness and specific nutrient evaluations versus a no front-of-package control condition (H1a). In addition, we predict that the single, simplified summary (SC) icon will lead to greater healthfulness and more favorable evaluations relative to the TL-GDAs that explicitly report the absolute nutrient attribute levels and percentage of the recommended daily values (H1b).

Differences between the icons should be most evident for nutrients that meet the requirements for the Smart Choices program, but have values that are relatively high and at the maximum of the required Smart Choices icon limits for this nutritionally-moderate food.¹ Thus, we predict that:

- H1a: Those exposed to FOP nutrition icons (i.e., Smart Choices or Traffic Light - Guideline Daily Amounts) will have more favorable nutrient and overall healthfulness evaluations than those not exposed to FOP nutrition icons.
- H1b: Those exposed to less complex FOP nutrition icons (i.e., Smart Choices) will have more favorable nutrient and overall healthfulness evaluations than those exposed to more detailed FOP nutrient level icons (Traffic Light - Guideline Daily Amounts).

Prior nutrition research shows that package information that impacts nutrition perceptions also will extend to overall product attitudes, purchase intentions and perceptions related to disease risk from consuming the product (cf. Burton et al. 2006; Ford et al. 1996; Kozup et al. 2003). Based on this body of work, we predict that easy-to-access and understand FOP nutrient information for the mixed (moderate) nutrition value food item will have a favorable effect on overall product attitudes, evaluations, and purchase intentions. Specifically, we predict that:

- H2a: Those exposed to FOP icons (i.e., Smart Choices or Traffic Light - Guideline Daily Amounts) will have more favorable product attitudes and purchase intentions, and lower perceptions of the likelihood of heart disease and weight gain than those not exposed to FOP nutrition icons.
- H2b: Those exposed to less complex FOP nutrition icons (i.e., Smart Choices) will have more favorable product attitudes and purchase intentions, and lower perceptions of the likelihood of heart disease and weight gain than those exposed to more detailed FOP nutrient level icons (Traffic Light - Guideline Daily Amounts).

Effects Related to Consumer Nutrition Consciousness

Several studies have shown that individual difference variables, such as nutrition consciousness, motivation to process nutrition information, and nutrition knowledge, may affect

¹ We examine a range of nutrients in the study. Based on the Daily Values in the Nutrition Facts Panels in the U.S., several nutrition attributes shown in the TL-GDA are low (e.g., fat and saturated fat), others moderate (e.g., calories, sugar), but others (cholesterol, sodium) are high for the category. In addition, we assess some nutrition attributes that are *not* available in the TL-GDA condition (trans fat, total carbs), but are available in the Facts Panel. For specific levels, please refer to the package stimuli in Appendices A and B.

consumers' perception, processing, and evaluation of nutrition information offered on product packages (Andrews et al. 2009; Burton et al. 1994; Keller et al. 1997; Key et al. 1996; Moorman 1996). Based on principles of the elaboration likelihood model (ELM), when a consumer's motivational intensity and knowledge level are both high, he or she is more likely to engage in effortful processing to evaluate information (Andrews and Shimp 1990; Petty and Cacioppo 1979; 1986; Petty, Unnava, and Strathman 1991). Nutrition conscious consumers are those who exhibit substantial concern, interest, knowledge, and ability regarding their interaction with and utilization of information from the environment related to nutrition (Newman 2000). Nutrition conscious consumers are willing to spend more effort processing and elaborating on information viewed as central and most relevant to a judgment task (Kemp et al. 2007). Thus, based on the ELM and other two-factor theories of persuasion (cf. Chaiken 1980), these consumers have a greater level of concern, knowledge, desire and ability needed to evaluate relevant nutrition information. Keller et al. (1997) show that favorable nutrient values have a positive effect on product attitude and purchase intentions for motivated, nutrition conscious consumers, but there is a substantially reduced effect for less nutrition conscious consumers. Due to greater in-depth processing of Nutrition Facts Panel information at the attribute level, these nutrition conscious consumers are more likely to recognize and integrate favorable levels for focal nutrients (e.g., very low levels of fat, saturated fat, or calories), while they may be somewhat less likely to overgeneralize from negative nutrients that reach the *minimum* level that qualifies as "high" for the TL-GDA icon (e.g., 20% of the daily value for sodium). Thus, for a nutritionally-mixed food item, we anticipate that consumers' nutrition consciousness will affect nutrient evaluations, general product attitudes, disease risk perceptions, and purchase intentions (H3a and H3b). We expect that:

H3a: Consumers with higher nutrition consciousness will have more favorable nutrient and overall healthfulness evaluations than will less nutrition conscious consumers.

H3b: Consumers with higher nutrition consciousness will have more favorable product attitudes and purchase intentions, and lower perceptions of the likelihood of heart disease and weight gain than will less nutrition conscious consumers.

Perhaps a more conceptually interesting question is the relative effect of nutrition consciousness in moderating nutrition information presented on the front (with more simplified FOP icons) and on the back of the package (with the Nutrition Facts Panel). Findings from several studies suggest that higher levels of motivation and knowledge may be needed to interpret and utilize the assortment of information in the Nutrition Facts Panel (Burton et al 1994; Keller et al. 1997; Howlett et al. 2008). For example, Kemp et al. (2007) report interactions between a measure of nutrition-related motivation and nutrient values in a Facts Panel on dependent measures of disease risk and purchase intentions. When nutrition-related motivation was low, the authors found little effect of the nutrient values on the dependent variables. However, when nutrition-related motivation was high, the differences in nutrient values had an impact. This suggests that for the more complex information environment presented within the Facts Panel, a higher level of nutrition consciousness allows the consumer to more appropriately utilize the information in evaluations. In contrast, the FOP nutrition symbol is designed with the aim of enhancing the simplicity and ease of understanding the nutrition information. As such, the relative need for enhanced nutrition consciousness should be reduced, suggesting that any interaction between FOP information and nutrition consciousness is less likely than it is for the more detailed Facts Panel information. Thus, we anticipate an interaction of nutrition consciousness with the Facts Panel, but not for FOP nutrition information, such that:

H4: Compared to those who are less nutrition conscious, the effects of Facts Panel information on nutrient and overall healthfulness evaluations will be stronger (i.e., more favorable) for those who are more nutrition conscious; but nutrition consciousness is less likely to moderate the effects of FOP information.

The FDA has long been interested in how various types of nutrition package information affect consumers' use and interpretation of product healthfulness within the context of a total daily diet in helping to promote healthy dietary practices (*Federal Register* 1993; *Federal Register* 2010).

Consistent with this objective, the Nutrition Facts Panel was designed to be standardized, unambiguous, and useful in daily dietary decisions, regardless of consumer demographics or nutrition knowledge. There is extensive literature that suggests that consumers are somewhat suspicious of health claims and nutrition information presented on the front of the package because they view this as information controlled by the manufacturer in an attempt to sell more of their product (e.g., Keller et al 1997; Levy 1995). However, consumers generally are more confident about nutrition information presented in “Facts” Panels due to its perceived credibility from government oversight in helping to reduce manipulation by manufacturers (Levy 1995). Thus, consumers are likely to view nutrition icons on the front of the package as less diagnostic compared to the Facts Panel.

Several experimental studies show that when exposed both to FOP nutrition / health claims and Facts Panel information, consumers can utilize the information appropriately in judgment and evaluations of product alternatives (Ford et al. 1996; Mitra et al 1999). For example, Mitra et al. conclude that, regardless of educational level, consumers can utilize information in the Facts Panel to evaluate a product appropriately, even when presented with a front-of-package health claim that is potentially misleading. These results suggest that FOP nutrition information should not have as strong an effect on the use of nutrient information in evaluating a product in the context of a daily diet *when* the Facts Panel is accessed.

However, when the Facts Panel is *not* accessed, FOP icons that vary in their diagnosticity (i.e., perceived usefulness in judgments) for evaluating daily product nutrient levels are likely to impact consumer judgments, thus suggesting an interaction between front and back of package information. A summary icon, such as the Smart Choices symbol, does not offer any direct information related to the specific nutrient levels, nor any direct information related to the performance of specific individual nutrients (unless consumers are aware of the criteria needed to qualify for the symbol within a specific category). Thus, given the lack of specific diagnostic information, the summary

symbol might lead to inferences that are not always correct. In contrast, the Traffic Light - Guideline Daily Amount icon offers diagnostic information for judgments on specific nutrients crucial to the daily diet of most consumers. Thus, it should lead to more accurate judgments than the Smart Choices summary icon, and not differ substantially from assessments made based on the Nutrition Facts Panel.

In addition, we propose that in evaluating nutrients for one's daily diet, those with higher levels of nutrition consciousness will be better able than those with lower levels of nutrition consciousness to utilize more detailed, diagnostic information from the front of the package or in the Nutrition Facts Panel. That is, these more nutrition conscious consumers have the necessary interest and knowledge to be able to better utilize the detailed information most effectively and accurately, suggesting that nutrition consciousness moderates the nutrition information available on the front or back of the package. Based on this rationale, we predict the following interactions:

H5a: When the Nutrition Facts Panel is accessed, FOP nutrition information will not have an effect on nutrient use accuracy; but when the Nutrition Facts Panel is not accessed, the Traffic Light - Guideline Daily Amount icon will have a more favorable effect on nutrient use accuracy than the control or Smart Choice icon condition.

H5b: Nutrition consciousness will have a more favorable effect on nutrient use accuracy when there is more nutrition information available (TL-GDAs and Nutrition Facts Panels) than when there is less nutrition information available.

Method

Sample and Procedure

Members of a professional, nationwide, Internet research panel served as study participants and ranged in age from 18 to 83. The sample was designed to balance gender and four age quotas (18-31, 32-44, 45-57, 58+) were used to match U.S. Census data for the United States. As such, 51% of the participants were female (49% male), and the mean and median ages were 47 years. The median household income category was \$35,000-\$50,000, and the modal education level was 'some

college.” Approximately 35% of the participants had a college degree. The total number of participants across the experimental conditions was 520. All participants were screened to ensure they had used the product category in the past six months. In addition, all data were collected prior to the appearance of the Smart Choices icon in the marketplace.

After displaying instructions encouraging participants to examine both the front and back of the mock package and respond to all questions, the mock package conditions (see below) (with realistic front and back panels in full color) were randomly presented to participants (see Appendices A and B). Because the frozen chicken dinner category on the mock package represented a complete meal, it has been used in a number of previous studies examining health and nutrient claims and nutrition information in the Facts Panel (e.g., Burton et al. 1994; Ford et al. 1996; Kemp et al. 2007; Mitra et al. 1999; Roe, Levy and Derby 1999). The front and back panels were removed from view when respondents provided initial nutrition evaluations, overall healthfulness ratings, and disease risk ratings. (See dependent measures below.) The panel stimuli were shown a second time to aid in a nutrient use accuracy task. The panels were not presented again for the remainder of the study questions and respondents then provided demographic information.

Experimental Design and Stimuli

A 3 (Front-of-package (FOP) icon: (1) no FOP icon control, (2) Smart Choices FOP icon, and (3) Traffic Light - Daily Guideline Amount FOP icon) x 2 (Nutrition Facts Panel: (1) control with no Facts Panel available and (2) Facts Panel available) x 2 (Nutrition Consciousness: (1) high and (2) low) design is used in the study. Two of the three FOP conditions are shown in Appendix A and the Nutrition Facts Panel conditions are displayed in Appendix B. The no Facts Panel control is designed to address the situation in which shoppers examine and utilize FOP information without examining the Facts Panel nutrient levels (and the inferences from FOP information that might be drawn when the Facts Panel is not utilized). All nutrient values are consistent across all experimental conditions.

When nutrient values are shown on the FOP for the Traffic Light - Daily Guideline Amount (TL-GDA) condition, they match the values in the Facts Panel. Thus, the experimental conditions are consistent with current FOP information in the marketplace. In the TL-GDA icon condition (see Appendix A), absolute nutrient amounts are given, as well as their corresponding percentages of the Daily Values (DVs). For nutrient levels that are low (e.g., fat, saturated fat), a green light is shown. In the case of moderate nutrient levels (e.g., calories and sugar), an amber light is present. Finally, for high nutrient levels (e.g., cholesterol, sodium), a red light is displayed. These three color conditions are based on nutrient level classifications drawn from the FDA's Food Labeling Rules (*Federal Register* 1993). Near the end of the survey, and as a check on the manipulations, we asked respondents to report their awareness of the FOP nutrition icons and Facts Panel. When the Facts Panel was present on the back of the package, 98% reported seeing the Panel; when it was not present, 15% reported seeing it ($\chi^2 = 372.9$; $p < .0001$). The check measuring awareness of the SC and TL-GDA front-of-package icons, showed that when an icon was present, 86% reported seeing the FOP icon, while 28% claimed they saw nutrition information in the front of package control ($\chi^2 = 234.6$; $p < .0001$). This pattern of findings indicates relatively high levels of awareness of the front and back package nutrition information when it was present.

Nutrition consciousness mirrors the 'health consciousness' construct, but focuses directly on nutritional aspects of health and its role in product evaluations and choices. This is a measured construct consisting of three items with seven-point scales drawn from prior research that tap nutrition interest, knowledge, and motivation (e.g., Andrews et al. 2009; Burton et al. 1999; Keller et al. 1997; Moorman 1996). The items include the following: "I usually am interested in looking for nutritional information on food packages" ('Strongly Disagree' – 'Strongly Agree'); "Compared to other people, how much do you feel you know about nutrition" ('Almost Nothing' – 'A Lot'); and "I would like to see additional nutritional information on food packages" ('Strongly Disagree' –

‘Strongly Agree’). Coefficient alpha for this three-item measure is .80. For use in subsequent analyses, we perform a median split and use this recoded measure as an independent variable. In the lower nutrition consciousness condition the mean level is 3.9; in the higher nutrition consciousness condition the mean level is 6.0 ($F(1,518) = 918.4, p < .0001$).

Dependent Measures

Consistent with the recent FDA request for information (*Federal Register* 2010), three different sets of dependent measures are used to test the hypotheses: (1) perceptions of overall healthfulness and specific nutrient levels, (2) product evaluations, and (3) the accuracy of utilizing nutrition information. More specifically, the first set of dependent measures examines perceptions of the overall healthfulness of the product, as well as specific calorie and nutrient evaluations. The calorie and nutrient evaluations include all six items shown in the TL-GDA front-of- package condition (i.e., calories, fat, saturated fat, sodium, cholesterol, and sugar; see Appendix A). Two of these nutrients, sodium and cholesterol, are of particular interest because their levels are low enough to qualify for the Smart Choices icon, yet are at the high level of the nutrient (20% DV) according to the FDA’s Food Labeling Rules (*Federal Register* 1993). The other values are either at moderate (calories, sugar) or low (fat, saturated fat) levels. We also examine two nutrients, trans fat and total carbohydrates, which are not offered in the TL-GDA condition, but are available in the Facts Panel. Based on prior research, and for each of these calorie and nutrient items, participants responded to seven-point, single-item scales with endpoints ranging from “high” to “low.” Overall healthfulness also was measured on a seven-point scale from “unhealthy for you” to “healthy for you.” All items were recoded so that higher values indicated more unfavorable levels of the nutrients (e.g., high calories, fat, sodium) and a less healthful product.

The second set of dependent measures assesses product evaluations that extend beyond nutrient and healthfulness evaluations. Consumers responded to long-term disease risk and weight

gain perceptions based on regular consumption of the product. Single item, seven-point, Likert-type scale measures for these perceptions are drawn from prior research (Andrews et al. 1998; Burton et al. 2006; Kozup et al. 2003) and ask participants to answer the following items: “Regularly eating Blue Ribbon chicken dinner may contribute to the risk of coronary heart disease;” and “Regularly eating Blue Ribbon chicken dinner may contribute to the risk of gaining weight” (endpoints of “Strongly Disagree (coded as a ‘1’) - Strongly Agree (‘7’) for both). The set of measures beyond nutrient and healthfulness evaluations included attitude toward the product and purchase intentions. Drawing from past attitude research, attitude toward the product is measured with three items using scale endpoints of “unfavorable-favorable,” “negative-positive” and “bad-good.” Coefficient alpha is .99 for this summated measure. Purchase intention is measured with response to the following item: “If available, how likely is it that you would buy the Blue Ribbon chicken dinner product on one of your shopping trips this month?” Endpoints include “Unlikely-Likely” and “Not Probable-Probable.” The Pearson correlation between these two items is .97 ($p < .0001$). For these multi-item dependent measures, items are summed and then divided by the number of items, and the means are used in subsequent analyses.

The third type of dependent measure uses a nutrient information usage task to determine how accurately participants can utilize nutrient information available either on the front or back of the package in answering six nutrient attribute questions. In line with the original objectives of the NLEA (*Federal Register* 1993, p. 2118), this measure is designed to evaluate how well consumers understand the relative significance of nutrition information in the context of a total daily diet. The task occurs after all nutrient evaluations are completed, and thus is distinct from the preceding dependent variable evaluations. In this nutrient use accuracy task, subjects are asked if they were to consume six servings of the product in a day (and nothing else), would they consume more or less than the recommended amount for each of nine different nutrients and vitamins. The targeted

nutrient items include fat, saturated fat, cholesterol, calories, sodium, sugar, and sodium. Data on these attributes are all available in the TL-GDA condition and in the Facts Panel. Percentage nutrient task "accuracy" scores are computed by summing the number of correct responses for the six attributes, then dividing by six and multiplying by 100. Scores ranged from 16.7% to 100%. The mean accuracy score is 70% and the modal score is 67%.

Results

Effects Associated with Front-of-Package Nutrition Icons

Hypothesis 1 examines the effects of the front-of-package (FOP) nutrition icon information on consumers' nutrient and overall product healthfulness evaluations. Table 1 (Panel A) shows results of analyses of variance for the independent variables of FOP icon information, availability of the Nutrition Facts Panel, and nutrition consciousness. Mean values for evaluations of overall product healthfulness, calories and various nutrients also are shown in Table 1 (Panel B).

[INSERT TABLES 1 AND 2 ABOUT HERE]

As shown in Table 1, the general pattern of results indicates significant effects of the FOP icon information across the product healthfulness and nutrient evaluations. H1a assesses differences between packages including any FOP nutrition icon information versus packages without any FOP nutrition information (i.e., the no FOP control). Planned contrasts comparing the Smart Choices (SC) icon to the FOP nutrition control show that across all nutrition-related dependent variables, the package conditions displaying the SC icon are significant ($p < .05$ or better) and are perceived as lower in negative nutrients (e.g., calories, fat, sodium) and more healthful. The pattern is similar, but somewhat less strong, for the packages displaying the TL-GDA icon information. When the package contains the TL-GDA information, the contrasts show significant differences from the no FOP control for six of the nine dependent variables. As shown in Table 1 (Panel B), when the TL-GDAs are provided, the product nutrient levels are generally perceived more favorably than the FOP control

(in which no nutrition information is presented). It should be noted that these significant differences extend to nutrients that are *not* listed on the TL-GDA icon (i.e., trans fat, total carbs). The overall pattern of findings for FOP nutrition information relative to the no FOP nutrition information control provides substantial support for H1a.

H1b examines differences between the provision of the Smart Choices icon versus the TL-GDA information on the front of the package. The pattern of means across the dependent variables in Table 1 (Panel B) shows that the means are significantly lower ($p < .05$) for the Smart Choices icon, indicating greater healthfulness and lower ‘negative’ nutrient evaluations, for three of the nine variables.² There is particular interest in the nutrients of sodium and cholesterol. For these attributes, the TL-GDAs and Facts Panel reveal that the levels are in the highest range of those allowed to qualify for the Smart Choices summary icon (20% of the Daily Value; see stimuli in Appendix A), but yet low enough to still qualify. Interestingly, for each of these nutrients, the Smart Choices means indicate the product is perceived as significantly more favorable ($p < .05$) than the TL-GDA package information. The other measure for which there is a statistically significant difference is for the overall healthfulness of the product. Thus, there is partial support for H1b, and it can be argued that results are significant for the measures of greatest concern for policy, in which potentially questionable inferences made from the Smart Choices icon are of particular interest.

H2a and H2b extend questions regarding the effects of FOP nutrition information to the more general measures of product attitude, purchase intentions and disease risk likelihood. Results of analyses of variance for these dependent variables are shown in Table 2. As revealed in Table 2 (Panel A), there are significant main effects ($p < .05$ or better) of the FOP information on each of the four dependent variables, offering general support for H2. (Interactions with the FOP information are nonsignificant.) Tests of a priori contrasts for H2a and H2b are shown in Panel B of Table 2.

² Main effect means relevant to predictions are shown in the tables. Cell means for each for each of the fourteen dependent variables are available upon request.

Comparisons of the Smart Choices icon to the no FOP control are all significant ($p < .05$ or better). As predicted, the presence of the SC icon leads to more favorable product attitude and purchase intentions relative to the control, and perceptions of the risk of heart disease and weight gain are reduced. Comparisons of the TL-GDA condition to the control show that the purchase attitudes and purchase intentions are higher, but there is no difference for heart disease and weight gain risk. These findings offer strong support for H2a for the SC summary icon and mixed support for the TL-GDA information. (As discussed subsequently, this pattern of results for the Smart Choices summary icon raises some concern given the higher levels of sodium and cholesterol for this product.)

[INSERT TABLE 3 ABOUT HERE]

H2b examines product evaluation differences between the Smart Choices icon and TL-GDA information. The differences for product attitude and purchase intentions between the SC and TL-GDA conditions are nonsignificant. However, exposure to the SC summary icon results in lower disease risk perceptions relative to the TL-GDA information condition ($p < .05$), offering mixed support for H2b. Because disease risk perceptions are more directly related to nutrition evaluations than are product attitudes and purchase intentions (which can be affected by taste, price, brand name, etc.), greater sensitivity to differences between two icons would be anticipated for the disease-related measures.

Effects Related to Nutrition Consciousness and the Nutrition Facts Panel (NFP)

H3 and H4 test effects of consumers' level of nutrition consciousness and the presence of the Nutrition Facts Panel. As predicted in H3a, Table 1 shows consistent effects of nutrition consciousness on the nutrition perception variables; nutritionally-conscious consumers perceive the product's nutrient and overall healthfulness more favorably for this moderately healthy product.³

These results support H3a. Also, as shown in Table 2, nutritionally-conscious consumers have more

³ Because there are significant or marginally significant interactions between nutrition consciousness and the Nutrition Facts Panel, several of these main effects need to be interpreted with caution. The pattern of the interactions are discussed on the following page and shown in Figure 1.

favorable product attitudes and purchase intentions than do less nutritionally- conscious consumers. However, in terms of weight and heart disease risk perceptions, there are no differences between more and less nutritionally-conscious consumers. The pattern of findings offer mixed support for H3b.

The purpose of H4 is to provide a test of the (relative) moderating role of nutrition consciousness for the FOP nutrition icon information versus the Nutrition Facts Panel on the back of the package. Because of the amount and relative complexity of information in the Facts Panel, it is predicted that nutrition consciousness is more likely to moderate effects of the exposure to the Facts Panel than the reduced, and more simplistic, nutrition information offered on the front of the package. Results in Table 1 (Panel A) show that there are either significant ($p < .05$) or marginally significant ($p < .10$) interactions between the Facts Panel and nutrition consciousness for seven of the nutrition attribute variables. In contrast, there is only one significant interaction (for carbohydrates) between the FOP nutrition information and nutrition consciousness. Examples of the plots of mean values for the significant interactions between the Facts Panel and nutrition consciousness are shown in Figure 1. In both plots shown (i.e., for the evaluations for fat and saturated fat), and when there is not a Facts Panel available, there is no difference ($p > .20$) in the evaluations. However, when the Facts Panel is present, and for consumers with higher levels of nutrition consciousness, the evaluations are significantly lower ($F_s=11.2$ and 9.5 , respectively, all $p < .01$), indicating more favorable perceptions of the fat and saturated fat levels. These findings offer support for the pattern predicted in H4 for the nutrient and healthfulness evaluations.

Results for the predicted interactions between nutrition consciousness and the nutrition information presentation for the attitude, intentions, and disease risk measures are shown in Table 2 (Panel A). For these variables, nutrition consciousness does not moderate either the front or back of the package nutrition information, offering no support for the moderating influence of nutrition

consciousness for Nutrition Facts Panel information. Across the range of dependent variables, the data offer mixed support for H4.⁴

Effects of Front-of-Package Nutrition Icons and Nutrition Consciousness on Usage Accuracy

To test the predicted effects on the accuracy of nutrient usage in the context of one's daily diet, we perform a 3 x 2 x 2 ANOVA with factors consisting of the FOP nutrition icon information, presence of the Nutrition Facts Panel, and nutrition consciousness. As shown in Table 3, results indicate significant main effects for both FOP information ($F(2,508) = 27.0, p < .01$) and Facts Panel availability ($F(1,508) = 26.8, p < .01$) manipulations. However, as predicted in H5a, the influence of FOP information interacts with the availability of the Facts Panel ($F(2,508) = 12.4, p < .01$). A plot of the means is shown in Figure 2. When the Facts Panel is available, the increase in accuracy associated with exposure to more detailed FOP nutrition information is nonsignificant ($F = 1.4, p < .10$). However, when the Facts Panel is *not* available, exposure to more detailed FOP nutrition information has a significant effect on accuracy in the nutrient usage task ($F = 41.3, p < .001$). Follow-up contrasts show that the more detailed TL-GDA information results in a mean accuracy level (80%) that is substantially greater than either the SC (62%) or control condition (56%; $p < .001$ for both). The contrast for the modest increase from the addition of the SC icon (62%) relative to the no information control condition (56%) is also significant ($p < .05$). This pattern of findings offers support for H5a, and it suggests one of the advantages of exposure to more detailed nutrient information on the front of the package, if the Facts Panel of the back of the package is not accessed.

⁴ We also performed a series of 14 hierarchical regressions (one for each dependent variable across all analyses) using nutrition consciousness as a continuous variable and the interaction terms between the (continuous) nutrition consciousness, FOP and Facts Panel condition measures. Results of these regressions were almost identical to the ANOVA results. We also performed analyses that included only the upper and lower quartile scores for the nutrition consciousness measure in an analysis, and again found no interaction between the nutrition consciousness and FOP condition for any of the dependent variables. These findings indicate that the FOP information is used similarly regardless of the nutrition consciousness level, but nutrition consciousness is more likely to interact with Facts Panel information.

H5b predicts that the more nutritionally-conscious consumers will be better able to utilize more detailed information available from the front or back of the package in the accuracy task, suggesting a moderating role of nutrition consciousness. However, results did not support this prediction. As shown in Panel A of Table 3, both the interactions between nutrition consciousness and the FOP icon and Facts Panel information are nonsignificant ($F_s = 0.26$ and 0.02 , all $p > .50$). Similarly, the three-way interaction is nonsignificant, suggesting that for this nutrition usage task there is not a moderating role of nutrition consciousness. Importantly, this also indicates that the stronger effects for the TL-GDA icon versus the SC summary icon and control condition on nutrition utilization accuracy hold irrespective of the consumer's level of nutrition consciousness.

Discussion and Implications

Given the dramatic increases in obesity rates and health-related consequences in the U.S. (CDC 2010), efforts to provide consumers with easy-to-use, front-of-package (FOP) nutrition symbols to aid dietary evaluations are certainly welcome (cf. *Federal Register* 2010). However, consumers have faced a confusing array of different FOP symbols and icons, including the simpler Smart Choices icon in the U.S., and the more detailed Traffic Light – Guideline Daily Amount icon in the U.K. Thus, based on the recent FDA call for consumer research on FOP symbols (*Federal Register* 2010, p. 22605), the primary purpose of this study was to assess how the Smart Choices and Traffic Light -Guideline Daily Amount FOP icons impact U.S. consumers' perceptions of nutrient levels, overall healthfulness, nutrient use accuracy, as well as more general assessments of product attitude, disease risk perceptions and purchase intentions. Secondary objectives include examining the moderating influence of nutrition consciousness on FOP nutrition icon information vis-à-vis the Facts Panel and interactions between the FOP icon and Facts Panel information. Results for each of these objectives are addressed below.

Smart Choices vs. TL-GDA Front-of-Package Icons

The Smart Choices icon met with a critical reception from a number of sources upon its introduction into the U.S. market (e.g., Center for Science in the Public Interest 2009; Nestle 2009; Neuman 2009; Ruiz 2009; State of Connecticut 2009). This criticism focused primarily on products that met the nutritional criteria for the icon, but were not necessarily low in all values for all negative nutrients (e.g., the high sugar level in Froot Loops and other cereals). The focal concern is that inferences about the product for some nutrients and its overall healthfulness would be based on the presence of this dichotomous, summary icon (i.e., any brand either qualifies or does not qualify). Results from this study offer evidence that this can occur. The moderately-healthy product used in our study met all criteria to qualify for the icon, yet it nonetheless contained 20% of the Daily Value for sodium and cholesterol. For these attributes, the evaluations of the Smart Choices (SC) summary icon are significantly more favorable (i.e., perceived lower levels of sodium and cholesterol) than either the TL-GDA icon or no FOP icon control condition. In addition, when the product contains the SC summary icon, it is perceived as more healthful overall than with either the TL-GDAs or FOP control. These results suggest that the summary icon at times may act as an implicit health claim from which positive consumer inferences can occur. Thus, to the extent that the nutrition criteria used to qualify for the Smart Choices product are *not* as restrictive as some nutritionists believe are appropriate, it can be argued from these findings that some consumers may be potentially misled in their evaluation of certain nutrients and overall product healthfulness. Similarly, when the Facts Panel is not accessed, the accuracy with which consumers can draw conclusions about product nutrient levels in the context of a daily diet is lower for the SC summary icon than for the TL-GDA.

The presence of the TL-GDA icon also has a positive influence on consumer evaluations of a number of nutrients (i.e., saturated fat, calories, cholesterol) relative to the control. Perhaps most importantly, both the product attitude and purchase intentions of the products displaying *either* nutrition icon are significantly higher than the no FOP nutrition control. These findings suggest a

potentially favorable role for any FOP information; that is, in the context of the current study, the purchase intentions increased when either of the nutrition icons was present on the front of the package. These findings support the potential usefulness of FOP nutrition icons (in a non-misleading way) in communicating useful information to consumers that may impact judgments and decisions. Moreover, our findings strengthen the relevance of IOM and FDA evaluations of various FOP alternatives (Taylor and Mande 2009).

Overall, the pattern of the results generally supports arguments made for the strengths and weaknesses for more simplistic versus somewhat more complex FOP alternatives. As indicated in the Keystone research and other studies (Fuenkes et al. 2008; Lupton et al. 2010), most consumers place substantial value on simplicity. When attempting to evaluate scores of brand alternatives at the shelf, the array of comparisons involving the diverse and “piecemeal” calorie and nutrient information in the Facts Panels is an extremely challenging task. Summarizing the information into a single, dichotomous icon allows use of simple generalized conjunctive or satisficing heuristics that may be sufficient for many consumers. The downside of this simplicity is that by *not* evaluating detailed information on various attributes (e.g., without examining the Facts Panel or the TL-GDA information), consumers may overgeneralize the favorability of the product from nutrient content in some instances (Andrews et al. 1998). Similarly, in making accurate evaluations about products in the context of a daily diet, the summary icon does not approach the level of the TL-GDA icon when the Facts Panel is not accessed. In general, it can be argued that the information disclosed by the TL-GDA icon offers the most critical nutrient attributes for most consumers, while offering a more simplistic information environment for the consumer than does the Facts Panel. Compared to SC summary icon, the TL-GDA icon reduces the likelihood of over-generalization for the specific nutrients contained in the TL-GDA. Yet, for TL-GDAs, the consumer has 5 or 6 distinct pieces of nutrition information to integrate, and the simplicity of using a satisficing heuristic for a given

attribute may be less obvious, unless the consumer focuses on a single attribute (e.g., calories, saturated fat) to drive their evaluations. In sum, from a consumer perspective, the desire for simplicity of icons is critical. Yet, from a nutrition policy perspective, the fact that icons such as the TL-GDAs offer concrete values that are not open to debate or criticism seems to be a key feature.⁵

Moderating Influence of Nutrition Consciousness

In this study, although there was not an interaction between the front and back panel nutrition conditions, future research might address the likelihood of search truncation of the Facts Panel data (e.g., Roe, Levy and Derby 1999) based on use of various types of FOP alternatives. However, it was predicted that nutrition consciousness was more likely to moderate the Facts Panel information usage than that of the more simplistic FOP information. Results offered partial support for this prediction. Although there was no evidence of a moderating influence of nutrition consciousness for FOP information, some fairly consistent support did occur for the moderating influence of nutrition consciousness on the Facts Panel in the case of several nutrients (e.g., fat, saturated fat, cholesterol, sodium). However, for the more general evaluations of product attitude and purchase intentions (i.e., evaluations beyond the nutrients conveyed in the Facts Panel), there was no support for moderation. In general, the pattern of findings suggests that FOP information is more likely to be utilized similarly regardless of the consumers' level of nutrition consciousness, but that consumers with a higher level of nutrition consciousness are more likely to utilize the more detailed information in the Facts Panel.

Implications for Public Health Policy and Food Manufacturers

Certainly, more simplistic summary icon systems (e.g., Smart Choices) may allow manufacturers to frame their products in a more favorable light (i.e., the product is either a relatively

⁵ However, determining specific nutrient levels most appropriate for the color coding used in the traffic light system (indicating low, moderate, or high levels) for the disclosed nutrients potentially would remain an issue for public health policy. Current food labeling rules (*Federal Register* 1993), in conjunction with Daily Values, could serve as one possible guide.

‘healthy’ option or the package offers no icon). However, this can present problems for consumers and raise scrutiny from public health advocates and/or regulatory agencies, if criteria for the icon are set too loosely. Also, with a simple, summary icon system, the product is never presented with an unfavorable frame or nutrient information / color coding signaling that the product is not healthy. For relatively unhealthy categories, with high levels of a negative nutrient coupled with minimal nutritional value (e.g., candy bars high in sugar, calories, and/or fat), major brand competitors are simply devoid of the icon in a summary system. In this scenario, there may be little stigma associated with any particular brand or the category as a whole. Although proactive manufacturers may attempt to obtain some differential advantage by becoming eligible for displaying the healthy icon by simply fortifying their product in terms of its positive nutrients (added fiber), this approach has been criticized as a way to meet criteria for non-nutritious products (Center for Science in the Public Interest 2009, Part III, p. 4). For example, Froot Loops, the target of much of the Smart Choices criticism, increased its fiber level while its sugar level remained at the maximum permitted for cereal. (Ironically, this attempt to improve the nutritional benefits of the product resulted in embarrassment for the parent company, and led to a very vocal criticism and ultimate demise of the Smart Choices program.)

Conversely, for less healthy categories, TL-GDAs offer concrete values and color coded evaluations (e.g., green, red) that visually signal both nutritional strengths and weaknesses. Thus, the framing presented to the consumer for a given brand or category may be positive or negative, as favorable as well as unfavorable nutritional aspects of the product are more easily scrutinized. Interestingly, it may actually be possible for a manufacturer to boost their credibility with consumers by providing both positive and negative attribute levels, similar to effects found with the use of two-sided claims in advertising (cf. Kamins and Assael 1987). Alternatively, in situations in which a product lacks any noticeable positive nutritional benefits, a consumer may become aware of the low

level of desirability of an *entire* category, and health-oriented consumers may choose to lower their evaluations and purchases in this entire category. For major manufacturers with diverse portfolios of brands across both healthier and less healthy categories, this potentially becomes a rather challenging market environment. To attract the health-conscious consumer, product modifications and improvements across several nutrients may be required (similar to the period following the implementation of the Nutrition Labeling Education Act), and R&D to reformulate products without compromising taste becomes critical. This potentially creates a highly competitive environment for manufacturers working to improve the nutrition profile of their brands, relative to their competitors. Thus, the simplicity of a singular and rigorous ‘healthy for you’ icon presents a market environment that may minimize risks (e.g., positive cues only) for food manufacturers, yet certainly may lack the opportunities and uncertainty associated with a highly competitive TL-GDA labeling program. It also should be noted that, regardless of the final FDA ruling on FOP icons, the need for maintaining consistency with existing nutrition labeling regulations is an important issue (IOM 2010, p. 133 (7-18)).

Future Research and Conclusions

Clearly, the issue of front-of-pack nutrition symbols is not going away, as the Grocery Manufacturers Association and Food Marketing Institute plan to launch the “Nutrition Keys,” a new FOP symbol in 2011 (GMA 2010; 2011). In addition, Walmart has announced plans for the introduction of a summary seal/icon for their private label brand (Skiba 2011). Yet, as noted in the recent FDA request for further consumer research on FOP nutrition symbols (*Federal Register* 2010), there are *numerous* research questions that remain unanswered. For example, the FDA raises many issues on the most appropriate FOP symbol *design characteristics* (e.g., color, contrast, location; number of nutrients; competing package information; shapes; sizes; formats to aid consumer understanding); *consumer processing issues* (e.g., exposure, notice, comprehension, attitudes, use;

literacy and other demographic effects), and the *influence of other nutrition information* (e.g., presence/absence of Nutrition Facts Panels; nutrient content and health claims). Unfortunately, no one study will be able to assess all of these issues, especially in the context of an experimental design, which provides relatively strong causal insight into the effects of many of the issues noted above. As such, our controlled, experimental study focused on consumer evaluation of specific nutrient levels, overall healthfulness, disease perceptions, nutrition comprehension (accuracy), product evaluations and purchase intentions. We also examined variations of realistic FOP icons used in practice (with controls), as well as the effect of the presence/absence of Nutrition Facts Panel information. An important moderator, i.e., nutrition consciousness, also was examined. Yet, given the multitude of issues raised by the FDA, this leaves considerable room for future research. For example, research may be needed on spontaneous consumer inferences and cognitive responses about nutrients as compared to the structured nature of questions used in this and most experimental studies. Also, consumer field testing conducted in home or retail environments assessing package search behaviors, food selection, and choice may be warranted (cf. previous work by Balasubramanian and Cole 2002; IOM 2010; Roe et al. 1999). In addition, research is needed to move closer to an “optimum” FOP format and values to be considered and tested across different product category stimuli using varying nutrition levels (cf. McLean, Hoek, and Mann 2010). No doubt, different variations of the TL-GDA front-of-package icon (e.g., adding adjectival descriptors to colors, other color options, or no color versions such as the proposed “Nutrition Keys”) might warrant future research attention (Center for Science in Public Interest 2009, Part III, p. 10). Finally, literacy and processing challenges from vulnerable populations certainly come into play in assessing the ultimate effectiveness of the FOP symbols and icons (cf. Gau et al. 2010).

To our knowledge, this study is among the first to provide a controlled test of front-of-package nutrition symbols, such as the Smart Choices icon against the more complex TL-GDA icon

type and a FOP control condition (Taylor and Mande 2009). We believe that it can contribute to a better understanding of how icons of different levels of complexity may impact consumers' evaluations and purchase intentions. From a public policy standpoint, results suggest that there are potential benefits of more detailed, FOP nutrition icons, as well as cautionary findings for simple, summary icons that are of potential concern. Taken in sum, the findings indicate that continued examination of possible FOP systems by the FDA, food manufacturers, and/or public health community is warranted (Taylor and Mande 2009). Hopefully, our findings, in conjunction with future FOP research, will eventually lead to standardized front-of-package labeling that best communicates important nutrition information in helping to improve the long-term health of consumers.

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Table 1

**Effects of Front-of-Package Nutrition Information, Nutrition Facts Panel, and Nutrition Consciousness
on Nutrient and Product Healthfulness Evaluations**

PANEL A: ANOVA Results		Univariate F-values							
Independent Variables	Overall Healthfulness	Calories	Fat	Sat. Fat	Cholesterol	Sodium	Sugar	Trans Fat	Total Carbs
Main Effects									
Front of Package Icon (FOP)	3.29 ^b	9.08 ^a	1.73	2.91 ^c	6.41 ^a	3.89 ^b	4.12 ^b	2.93 ^c	4.57 ^c
Nutrition Facts Panel (NFP)	0.00	1.64	8.64 ^a	2.82 ^c	0.01	0.84	0.02	4.48 ^b	0.49
Nutrition Consciousness (NC)	5.78 ^b	12.73 ^a	9.13 ^a	14.84 ^a	18.62 ^a	4.59 ^b	21.09 ^a	24.33 ^a	14.51 ^a
Interaction Effects									
FOP*NFP	0.04	1.41	0.28	0.75	0.32	0.32	0.37	0.85	0.01
NFP*NC	1.68	0.50	4.22 ^b	8.03 ^a	7.71 ^a	5.18 ^b	2.82 ^c	2.96 ^c	3.43 ^c
FOP*NC	0.27	2.25	0.87	0.27	0.23	0.17	1.80	1.46	6.01 ^a
PANEL B: Means		Front of Package Information			NFP Condition		Nutrition Consciousness		
Dependent Variables	No FOP Icon (a)	SC FOP Icon (b)	TL-GDA FOP Icon (c)	NFP Absent (a)	NFP Present (b)	Low NC (a)	High NC (b)		
Healthfulness	2.64 ^b	2.25 ^{a,c}	2.60 ^b	2.48	2.53	2.66 ^b	2.34 ^a		
Calories	3.21 ^{b,c}	2.54 ^a	2.76 ^a	2.9	2.77	3.08 ^b	2.56 ^a		
Fat	3.03 ^b	2.74 ^a	2.81	3.05 ^b	2.70 ^a	3.06 ^b	2.63 ^a		
Sat. Fat	3.19 ^{b,c}	2.84 ^a	2.87 ^a	3.06	2.87	3.22 ^b	2.66 ^a		
Cholesterol	3.45 ^{b,c}	2.86 ^{a,c}	3.15 ^{a,b}	3.14	3.17	3.45 ^b	2.82 ^a		
Sodium	3.82 ^b	3.34 ^{a,c}	3.63 ^b	3.51	3.68	3.76 ^b	3.41 ^a		
Sugar	3.06 ^{b,c}	2.65 ^a	2.77 ^a	2.81	2.83	3.11 ^b	2.50 ^a		

Table 1, continued

Trans Fat	3.09 ^{b,c}	2.72 ^a	2.83 ^a	2.99	2.78	3.19 ^b	2.52 ^a
Total Carbs	3.51 ^{b,c}	3.08 ^a	3.23 ^a	3.19	3.33	3.54 ^b	2.97 ^a

Note for Panel A: Numbers shown in Panel A of the Table are univariate F-values for analyses of variance. Degrees of freedom for NFP, NC, and NFP*NC = (1,508). Degrees of freedom for FOP, FOP*NC and NFP*FOP = (2,508). All three way interactions are nonsignificant. ^a $p < .01$; ^b $p < .05$; ^c $p < .10$.

Note for Panel B: Means shown in Panel B are based on seven-point scales. Higher values indicate higher perceptions of calories, fat, and other nutrients and a less healthful product. Superscripts adjacent to the means in Panel B indicate significant differences ($p < .05$ or better) according to contrasts based on predictions. For example, the superscript for the “b” cell (Smart Choices icon) indicates that the product healthfulness mean is significantly different from the means for the cells labeled “a” and “c.” A complete set of cell means for all dependent variables is available upon request.

Table 2

Effects of Front-of-Package Nutrition Information, Nutrition Facts Panel, and Nutrition Consciousness on Product Attitude, Purchase Intentions and Risk Perceptions

PANEL A: ANOVA Results		Univariate F-Values		
Independent Variables	Product Attitude	Purchase Intentions	Likelihood of Heart Disease	Likelihood of Gaining Weight
Main Effects				
Front of package information (FOP)	4.96 ^a	3.02 ^b	4.99 ^a	5.55 ^a
Nutrition Facts Panel (NFP)	4.91 ^b	3.05 ^c	0.48	3.29 ^c
Nutrition Consciousness (NC)	8.20 ^a	6.56 ^b	0.00	0.14
Interaction Effects				
FOP*NFP	0.59	0.66	0.92	0.22
NFP*NC	0.45	1.28	1.02	0.71
FOP*NC	0.91	0.02	0.56	0.10

PANEL B: Means	Front of Package Information			NFP Condition		Nutrition Consciousness	
	No FOP Icon (a)	SC FOP Icon (b)	TL-GDA FOP Icon (c)	NFP Absent (a)	NFP Present (b)	Low NC (a)	High NC (b)
Product Attitude	4.96 ^{b,c}	5.50 ^a	5.23 ^a	5.10	5.34	5.05 ^b	5.43 ^a
Purchase Intention	4.54 ^{b,c}	5.08 ^a	4.74 ^a	4.64	4.90	4.58 ^b	5.00 ^a
Heart Disease	3.29 ^b	2.73 ^{a,c}	3.19 ^b	3.12	3.05	3.08	3.09
Weight Gain	3.26 ^b	2.69 ^{a,c}	3.18 ^b	3.19	2.95	3.08	3.05

Note for Panel A: Numbers shown in Panel A of the Table are univariate F-values. Degrees of freedom for NFP, NC, and NFP*NC = (1,508). Degrees of freedom for FOP, FOP*NC and NFP*FOP = (2,508). All three way interactions are nonsignificant. ^a $p < .01$; ^b $p < .05$; ^c $p < .10$.

Note for Panel B: Means shown in Panel B are based on seven-point scales. Higher values indicate more favorable product attitudes and stronger purchase intentions. Higher means for weight gain and heart disease indicate a stronger likelihood of developing the disease. Superscripts adjacent to the means in Panel B indicate significant differences ($p < .05$ or better) according to contrasts based on predictions. For example, the superscript for the “b” cell (Smart Choices icon) indicates that the product attitude mean is significantly different from the mean for the cell labeled “a.” A complete set of cell means for all dependent variables is available upon request.

Table 3

**Effects of Front-of-Package Nutrition Information, Nutrition Facts Panel, and
Nutrition Consciousness on Nutrient Use Accuracy**

PANEL A: Analysis of Variance Results

Independent Variables	Univariate F-values
Main Effects	
Front-of-package information (FOP)	27.0 ^a
Nutrition Facts Panel (NFP)	26.8 ^a
Nutrition Consciousness (NC)	0.6
Interaction Effects	
FOP*NFP	12.4 ^a
NFP*NC	0.26
FOP*NC	0.02

**PANEL B: Mean Percentages for
Nutrient Use Accuracy**

	Nutrition Facts Panel Absent		Nutrition Facts Panel Present	
	<u>Low NC</u>	<u>High NC</u>	<u>Low NC</u>	<u>High NC</u>
Control (No FOP Icon)	58.7%	52.7%	70.6%	74.1%
Smart Choices FOP Icon	61.9	61.4	77.0	71.8
TL-GDA FOP Icon	78.8	80.8	78.1	76.5

Note: The three-way interaction is nonsignificant.

^a $p < .01$.

Figure 1

The Moderating Impact of Nutrition Consciousness on the Effect of Facts Panel Information on Nutrient Evaluations

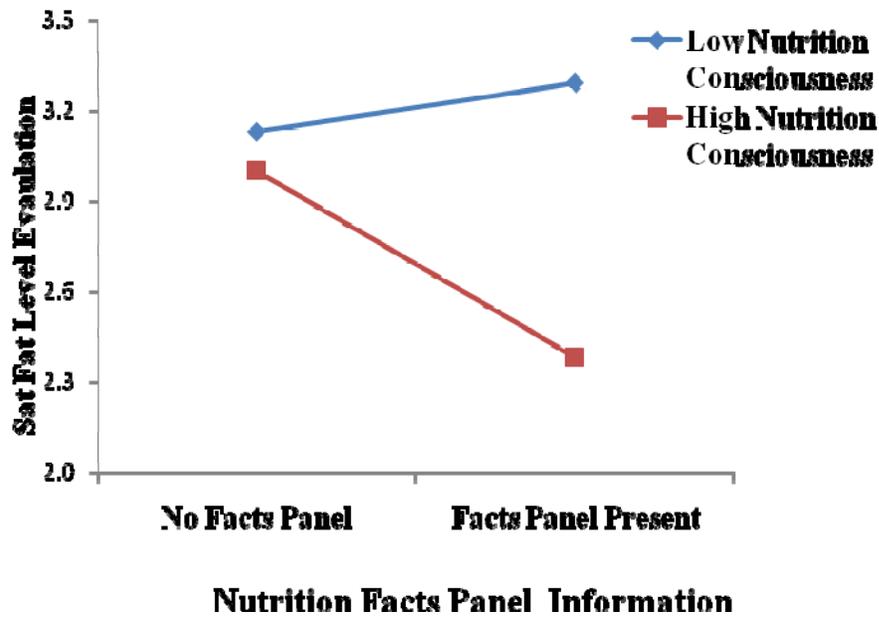
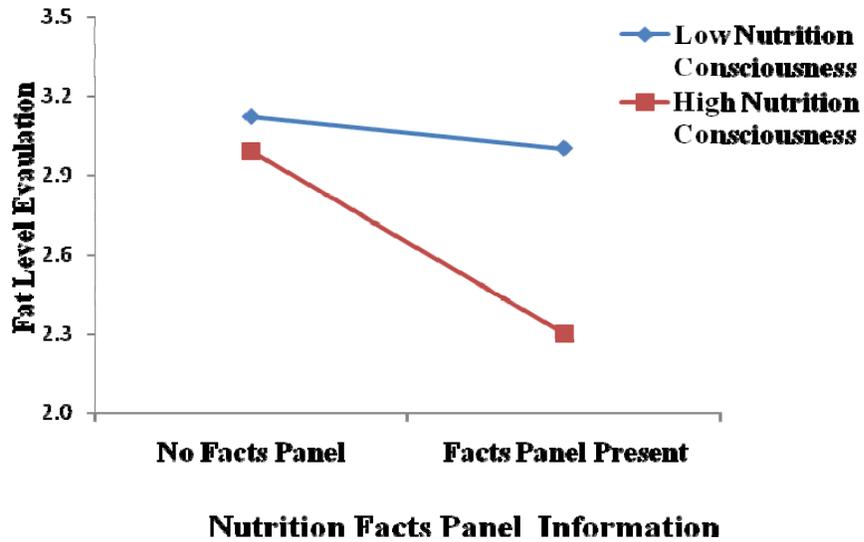
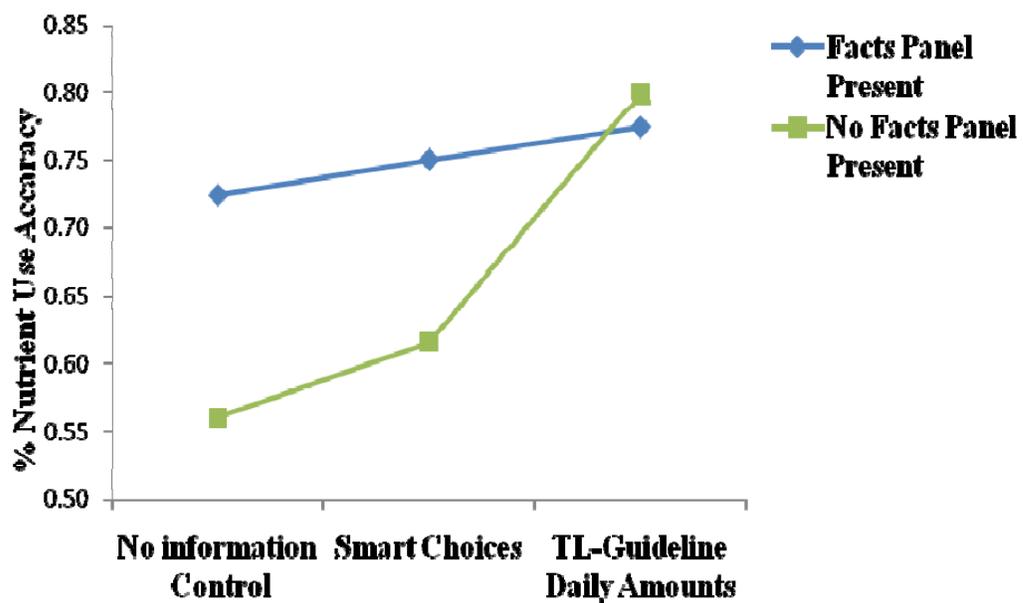


Figure 2

Nutrient Use Accuracy in the Context of a Daily Diet: Interaction of Front-of-Package Nutrition Icons and Availability of the Facts Panel



Appendix A

Smart Choices Condition:



Traffic Light - Guideline Daily Amounts Condition:



Appendix B

Back Panel Nutrition Facts Panel Condition:

Nutrition Facts
Serving Size 1 Package (280g)
Servings Per Container 1

Amount Per Serving	
Calories 170	Calories from Fat 15
% Daily Value*	
Total Fat 2 g	3%
Saturated Fat 0.5 g	3%
Trans Fat 0 g	
Cholesterol 60 g	20%
Sodium 480 mg	20%
Total Carbohydrate 29 g	10%
Dietary Fiber 1 g	4%
Sugars 6 g	
Protein 9 g	
Vitamin A 25% • Vitamin C 25%	
Calcium 10% • Iron 4%	

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:
Calories: 2,000 2,500

Total Fat Less than 65g 80g
Sat. Fat Less than 20g 25g
Cholesterol Less than 300mg 300mg
Sodium Less than 2,400mg 2,400mg
Total Carbohydrate 300g 375g
Dietary Fiber 25g 30g

*This entrée provides 2 servings of vegetables. The USDA Food Guide Pyramid suggests 3-5 one-half cup servings of vegetables a day.

IMPORTANT: Keep frozen until ready to serve.

Microwave instructions

- ✓ Easy to prepare.
- ✓ Cook on high 3 to 4 minutes.
- ✓ After cooking let stand for 1 to 2 minutes.

Blue Ribbon

TO OPEN Push Here

0 33800 3451 2 0

Back Panel No Facts Panel (Control) Condition:

IMPORTANT: Keep frozen until ready to serve.

Microwave instructions

- ✓ Easy to prepare.
- ✓ Cook on high 3 to 4 minutes.
- ✓ After cooking let stand for 1 to 2 minutes.

Blue Ribbon

TO OPEN Push Here

0 33800 3451 2 0