

# Comparison of two front-of-package nutrition labeling schemes, and their explanation, on consumers' perception of product healthfulness and food choice

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## ABSTRACT

**Objective:** Front-of-package (FOP) nutrition labels are increasingly used to present nutritional information to consumers. A variety of FOP nutrition schemes exist for presenting condensed nutrition information. The present study directly compared two symbolic FOP labeling systems – traffic light and star-based schemes – with specific regard to healthfulness perception and purchase intention for a variety of products. Additionally, this study investigated which method of message framing (gain, loss, gain + loss) would best enable individuals to effectively utilize the FOP labels.

**Method:** College students ( $n = 306$ ) viewed food packages featuring either star or traffic light FOP labels and rated the healthfulness of each product and their likelihood of purchasing the product. Within each label type, participants were presented with differently-framed instructions regarding how to use the labels.

**Results:** Participants who viewed the star labels rated products with the lowest healthfulness as significantly less healthful and rated products with the highest healthfulness as significantly more healthful compared to participants who viewed those same products with traffic light labels. Purchase intention did not differ by label type. Additionally, including any type of framing (gain, loss, or gain + loss) assisted consumers in differentiating between foods with mid-range vs. low nutritional value.

**Conclusions:** Star-based labels led more healthful foods to be seen as even more healthful and less healthful foods to be seen as even less healthful compared to the same foods with traffic light labels. Additionally, results indicate a benefit of including framing information for FOP nutrition label instructions; however, no individual frame led to significantly different behavior compared to the other frames. While ratings of product healthfulness were influenced by the framing and the label type, purchase intention was not impacted by either of these factors.

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## 1. Introduction

In spite of known health risks associated with poor nutrition, most Americans consume more than the recommended amounts of added sugar, saturated and trans fats, and sodium (Dall, Fulgoni Zhang, Reimers, Packard, & Astwood, 2009). This pattern of consumption is associated with obesity and preventable chronic diseases (Malik, Popkin, Bray, Després, & Hu, 2010). Although most Americans have trouble adhering to the recommended dietary guidelines, they report an interest in – and acknowledge the

importance of – healthy eating (e.g., Nielsen, 2015).

To help consumers make food choices in accordance with dietary recommendations, the Nutrition Facts Label (NFL) was added to most food and beverage packages starting in 1990 (FDA, 2015). Although some consumers report using the NFL, it is underutilized, in part because many consumers pay little attention to it (Graham & Jeffery, 2011; 2012; Graham, Heidrick, & Hodgins, 2015). For many, the label is also hard to understand and interpret (Rothman, Bartels, Wlaschin, & Salovey, 2006). For this reason, many consumers assess the healthfulness of a product based on factors other than the NFL, such as product appearance (Aikman, Min, & Graham, 2006).

In an effort to increase nutrition label use, policymakers worldwide are interested in new, simpler labeling approaches

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(Wartella, Lichtenstein, Yaktine, & Nathan, 2011). A number of countries have implemented front-of-package (FOP) nutrition labels that quickly communicate key nutrition information on the front of food and beverage packaging (Feunekes, Gortemaker, Willems, Lion, & Van Den Kommer, 2008; Hawley et al., 2013). Such labels require less cognitive effort than reading the nutrition facts label (Bialkova & van Trijp, 2010; Mejean, Macouillard, Peneau, Hercberg, & Castetbon, 2013; van Herpen & van Trijp, 2011) and are also more likely to draw consumer attention, therefore making them more likely to be used by consumers (Feunekes et al., 2008; Graham et al., 2015).

There has also been interest in the United States in identifying an easy-to-understand FOP labeling system that could be used on most food products. In 2011, the Food and Drug Administration convened an Institute of Medicine (now called the National Academy of Medicine) task force to evaluate the research on existing labeling systems and to issue recommendations for the design of an FOP label. This task force recommended an FOP system that would rate foods on a 0–3 point scale, where points are awarded based on levels of specific nutrients to limit (i.e., saturated and trans fat, sodium, and added sugars) (IOM, 2011). The IOM report suggested that the 0–3 point scale could be visually displayed using stars similar to the Health Stars system recently voluntarily adopted by Australia and New Zealand (MPI, 2014) and the “Guiding Stars” shelf-tag labeling system used by Hannaford supermarkets (Hannaford, 2016). These systems depict product healthfulness by assigning more stars for more healthful products and fewer stars for less healthful products, and they have shown promise in assisting consumers to recognize more healthful products compared to text-based or numeric-based FOP labeling systems (e.g., Feunekes et al., 2008).

Although FOP nutrition labels appear to offer clear advantages compared to traditional NFLs, a variety of FOP designs are being used (Hawley et al., 2013), and we do not have a good understanding of which designs are most effective and why. Some designs use a single symbol like a checkmark to indicate that a food meets a particular nutrition threshold (e.g., the Choices Programme, 2014), while others provide more specific information about individual nutrients (e.g., saturated fat, sodium). This individual nutrient information is often accompanied by percentages that place the amount in the context of an individual’s overall diet (Wartella, Lichtenstein, Yaktine, & Nathan, 2011). One popular FOP labeling scheme is traffic light labels in which red, amber, and green lights appear on products that are less healthful, moderately healthful, and most healthful, respectively. Compared to variations of labels that present specific nutrient levels and percentages (e.g., guideline daily amounts), traffic light labels may be easier for consumers to understand and use (Hawley et al., 2013; Malam et al., 2009). However, studies of their impact on consumer purchases are mixed (Thorndike, Riis, Sonnenberg, & Levy, 2014; Sonnenberg et al., 2013; Sacks, Tickellis, Millar, & Swinburn, 2011; Sacks, Rayner, & Swinburn, 2009). It is possible, however, that complementary interventions can increase the impact of front-of-pack nutrition labels. For example, one study found that in-aisle signage increased consumer attention to labels (Graham et al., 2015), but there are very few studies comparing theoretically-informed messages to increase front-of-pack labels’ effects.

Health messages can be framed in a way that accentuates either the positive benefits of engaging in a particular action (i.e., a *gain frame*) or negative consequences of failing to engage in a particular action (i.e., a *loss frame*) (e.g., Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999; Rothman & Salovey, 1997). For example, informing consumers of the health benefits associated with consuming more nutritious foods would be a gain-framed message, while alerting consumers of the health consequences associated with

failing to consume nutritious foods would be a loss-framed message.

There is debate as to whether gain and loss frame messaging matters for health behavior change (O’Keefe & Jensen, 2011). O’Keefe and Jensen’s meta-analysis reports no effect of message framing, while individual research studies have suggested that the efficacy of each framing technique depends on the target behavior. Some studies find that gain-framed messages tend to be more successful for illness *prevention* behaviors (e.g., engaging in physical activity), whereas loss-framed appeals tend to be more effective for *detection* behaviors (e.g., electing to complete a cholesterol screening) (Rothman & Salovey, 1997). Researchers have also argued that individuals process and internalize gain-framed and loss-framed messages differently based on the perceived risk or benefit associated with performing an action (or failing to perform an action) (Block & Keller, 1995). In the case of prevention behaviors, a gain-framed appeal is more likely to influence attitudes and, in turn, inspire changes in behavior. However, for detection behaviors, a loss-framed message is more likely to be carefully processed, thereby leading to increased behavioral intentions (Rothman & Salovey, 1997).

Although many health behaviors are easily classifiable as prevention (e.g., using sunscreen) or detection behaviors (e.g., undergoing mammography), distinctions between prevention and detection are considerably murkier for diet behaviors. For example, individuals who are already in good health may use nutrition labels to prevent chronic diseases and maintain their current health, while individuals who have already detected health consequences associated with a poor diet may use nutrition labels to improve their health by changing their diet. Thus, both gain and loss framing could successfully encourage use of FOP nutrition labels.

### 1.1. Present study

The first aim of the present study was to compare the degree to which two popular FOP labeling systems (a traffic light label versus a star-based system) influence purchase intentions and perceptions of healthfulness for a variety of food products (see Fig. 1 for examples of these labeling systems) for United States consumers. While some studies have evaluated these types of FOP labeling systems in the international context (e.g., Hodgkins et al., 2015), research in the United States remains limited, and the present study seeks to address the dearth of empirical testing for these FOP labeling systems in the United States. The second aim was to determine whether gain, loss, or a combination of gain and loss (gain + loss) message framing would best enable customers to understand and use FOP labeling schemes to discriminate between more and less healthful food options and increase purchase intentions for more healthful foods. See Table 1 for study conditions.

### 1.2. Hypotheses

**Hypothesis 1.** Based on prior research (Graham & Mohr, 2014), we hypothesized that those viewing the star-based system would be less able to accurately assess the healthfulness of products compared with the traffic light system, because of participants’ tendency to incorrectly perceive products with zero stars as being healthier than is the case.

**Hypothesis 2.** We also hypothesized that all three framing conditions would lead to better accuracy when judging the healthfulness of products and healthier choices when compared to both control groups.



Fig. 1. Label descriptions presented to participants in the Star (left) and Traffic Light (right) label conditions.

**Table 1**  
Randomly assigned study conditions.

Condition	FOP Label Described <sup>a</sup>	Message Framing Type	Message Framing Language
1. Gain Frame	Yes	Gain only	Consumers are encouraged to choose foods that have a green light/2-3 stars because these foods are the most beneficial for your health
2. Loss Frame	Yes	Loss only	Consumers are encouraged to avoid foods that have red light/0-1 stars because these foods are least beneficial for your health
3. Gain & Loss Frames	Yes	Both Gain+Loss	Consumers are encouraged to choose foods that have a green light/2-3 stars because they are the most beneficial for your health and avoid foods that have a red light/0-1 stars because these foods are least beneficial for your health
4. Informed Control	Yes	Neither Gain nor Loss	No additional information
5. Uninformed Control	No	Neither Gain nor Loss	No additional information

<sup>a</sup> Conditions 1–4 all contained the following description of the FOP labels:

For Star labels, "Introducing the Institute of Medicine Stars System. This fact-based icon right on the front of food and beverage packages summarizes important nutrition information from the Nutrition Facts Panel in a clear, simple and easy-to-use format. This makes it fast and easy to choose nutritious foods and beverages.

For Traffic Light labels, "Introducing the *Traffic Light Program*. This fact-based traffic light icon right on the front of food and beverage packages summarizes important nutrition information in a clear, simple and easy-to-use format. This makes it fast and easy to choose nutritious foods and beverages.

**Hypothesis 3.** We hypothesized that the group exposed to public service advertisements explaining how to interpret the labeling system that had both gain and loss-framed messages (condition 3; see Table 1) would have the highest purchase intentions for healthful foods and the lowest purchase intentions for unhealthy foods. The rationale for this hypothesis is that the combined messaging would be more likely to resonate with a range of health goals. We also hypothesized that the gain + loss group would produce more polarized ratings of product healthfulness (i.e., higher scores for healthful foods, and lower scores for unhealthy foods compared to the other framing conditions), as both healthful and unhealthy foods were expected to be salient for this group.

## 2. Method

### 2.1. Participants

Participants (n = 306) were undergraduate students enrolled in an introductory psychology course at a large western university in the United States. Students received course credit for participating.

### 2.2. Materials and procedures

This study employed a 2 (FOP label) x 5 (message framing) design. Participants were randomly assigned to view products with either a single traffic light (red, amber, or green, with red lights indicating the least healthful foods and green lights indicating the most healthful foods) or a star-based labeling scheme (0–3 stars, with more stars signifying more healthful products). The products were assigned their respective healthfulness ratings (i.e., traffic light color or number of stars) based on the IOM's (2011) recommended FOP system that rates foods on a 0–3 point scale based on levels of key nutrients-to-limit, specifically saturated and trans fats, sodium, and added sugars. Products with low levels of all three of these nutrient groups were assigned 3 stars and were also labeled with a green light in the present study; products with low levels of two of these nutrient groups were assigned 2 stars and were also labeled with an amber light in this study. Products with low levels of just one of these nutrient groups received one star, and products that exceeded the recommended levels of all three groups of nutrients-to-limit received 0 stars. Both 1- and 0-star foods were also labeled with a red light in the present study.

Prior to viewing food products, participants were also randomized to view a public service advertisement explaining the labels they were about to see based on one of the following message framing conditions: 1) gain-frame; 2) loss-frame; 3) gain + loss; 4) informed control (participants were informed of the presence of the FOP labels and the information they contained [see Table 1], but they were not provided with information regarding how they should interpret the FOP labels to inform their food choices); or 5) uninformed control (participants did not view any public service announcement before completing the task). Therefore, participants were randomly assigned to one of ten study conditions (five per label type – see Table 1).

Participants completed an online questionnaire in the Fall of 2012 or the Spring of 2013. The survey began by presenting one of two types of public service advertisements describing the front-of-pack label that participants were about to see (either stars or traffic lights) (see Fig. 1). The advertisements were adapted from a real food industry advertisement that was released to promote an industry front-of-pack labeling system, and the advertisements included text based on the assigned message framing condition (see Table 1 for text). Instructions were presented with the advertisements that read: “The following survey will ask questions about the nutrition label described in this Public Service Announcement (PSA). Please carefully read the entire PSA before proceeding to the first question.” Participants read the PSAs at their own pace and, upon reading the PSA, advanced the survey to view ten food products displaying either the star or traffic light FOP labels (see Fig. 1) on the packaging and rated their perceived healthfulness of each product (from 1 = not at all healthful to 9 = very healthful) and their likelihood of purchasing the product this month from 1 = not at all likely to 9 = very likely). These were the study’s two primary outcome measures.

After rating individual food products, participants then rated the label type specific to their randomized condition on several characteristics by responding to statements such as “I feel well informed by this food label!” and “This food label can help me in choosing foods” from 1 = strongly disagree to 5 = strongly agree (adapted from Möser, Hoefkens, Van Camp, & Verbeke, 2010).

Lastly, participants self-reported their demographic information (age, sex, race, ethnicity). As previous research has shown that individuals who are more concerned about their health are most likely to use FOP labels to inform their food choices (e.g., Campos, Doxey, & Hammond, 2011), we also asked participants to indicate their level of health concern by responding to statements such as “I care about eating healthful foods” and “I care about living a healthy lifestyle” (from 1 = strongly disagree to 9 = strongly agree). The measure of health concern was adopted from the health consciousness scale (for HCS as well as scale reliability and validity, see Gould, 1990).

Institutional Review Board approval was obtained at Colorado State University (protocol # 124-13H). Data analyses were conducted in 2017.

### 2.3. Statistical analyses

To assess our primary hypotheses, we used SPSS to conduct repeated measures Analyses of Variance (ANOVAs) to compare the two label types and the five framing conditions across the four levels of product healthfulness (0-star, 1-star, 2-star, and 3-star). Significant differences were established at  $p < 0.05$ .

#### 2.3.1. FOP label analyses (testing Hypothesis 1)

The two FOP labels were directly compared for both outcome variables: participants’ ratings of perceived healthfulness and purchase intentions for the various food products.

#### 2.3.2. Framing analyses (testing Hypotheses 2 and 3)

To determine the influence of message framing, the five framing conditions were directly compared for both outcome variables (perceived healthfulness and purchase intention).

### 2.4. Exploratory analyses

**Perceived Healthfulness:** Because participants in framing conditions 1–4 were all presented with the same description of the FOP labels (i.e., the manner in which they convey product healthfulness; see Table 1), conditions 1–4 were collapsed for the perceived healthfulness analyses and were compared to the uninformed control condition that did not present participants with a description of the FOP labels.

**Purchase Intention:** While participants in framing conditions 1–4 received the same information with regard to the meaning of the labels in terms of healthfulness (thereby warranting the consolidation across conditions 1–4 for the healthfulness analyses), participants in framing conditions 1–4 were presented with different information relevant to purchase intention (i.e., language that encouraged the selection of products and/or the avoidance of products; see Table 1). Therefore, conditions 1–4 were compared to each other as well as to the uninformed control condition (condition 5) for the purchase intention analyses.

#### 2.4.1. Supplemental analyses

To test the added value of the symbolic elements of the FOP labeling systems (i.e., the colors and stars), paired t-tests were conducted to compare perceived healthfulness of products with the same number of calories per serving but differing levels of healthfulness. Holding the calories per serving constant for these comparisons ensured that participants were not simply basing healthfulness ratings on the number of calories listed on the FOP label, a concern given consumers’ demonstrated preference for calorie information when using nutrition labels (e.g., Graham & Jeffery, 2011; Van Kleef, Van Trijp, Paeps, & Fernandez-Celemin, 2008). Two pairs of products contained the same number of calories per serving (two contained 110 calories and two contained 200 calories). Four paired t-tests were conducted to compare the two 110-calorie foods and the two 200-calorie foods separately for both types of labels (stars and traffic lights).

We also performed a t-test to evaluate the extent to which participants felt informed and helped by the two different FOP labels collapsed across framing conditions. Additionally, we conducted a one-way Analysis of Variance (ANOVA) to determine if the framing conditions influenced the participants’ perceptions of the labels’ informativeness and helpfulness. Lastly, we conducted a linear regression to determine if health concern influenced individuals’ intention to purchase unhealthful and healthful products.

## 3. Results

### 3.1. FOP labels

#### 3.1.1. Perceived healthfulness by FOP label type

First, we saw no main effect for label type on ratings of perceived healthfulness ( $F(1, 301) = 0.742, p = 0.390$ ). As expected, there was a main effect of product healthfulness ( $F(3, 299) = 143.98, p < 0.001$ ) such that products with higher healthfulness (i.e., more stars) were rated as healthier than products with lower healthfulness.

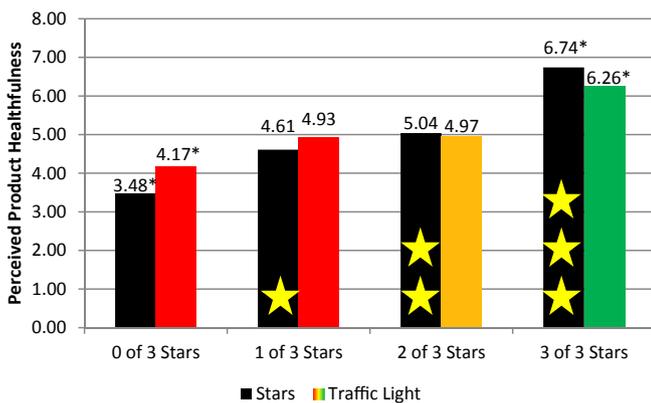
To further assess the effect of the front-of-package label type on perceptions of product healthfulness, we conducted a 2 (label type) X 4 (product healthfulness) repeated measures ANOVA. The four

product healthfulness categories represent one of the four star ratings of healthfulness, and we examined the 9-point likert scale of healthfulness ratings as the dependent variable. This analysis revealed a significant interaction between label type and product healthfulness ( $F(7, 295) = 5.847, p < 0.01$ ), indicating that participants who viewed the star labels rated products with the lowest healthfulness (i.e., 0-star foods) as significantly less healthful than did participants who viewed those same products with the red traffic light label ( $F(1, 301) = 8.89, p < 0.01$ ) (see Fig. 2). Furthermore, participants who viewed the star labels rated products with the highest healthfulness (i.e., 3-star foods) as significantly more healthful than did participants who viewed those same products with green traffic light labels ( $F(1, 301) = 6.20, p < 0.05$ ).

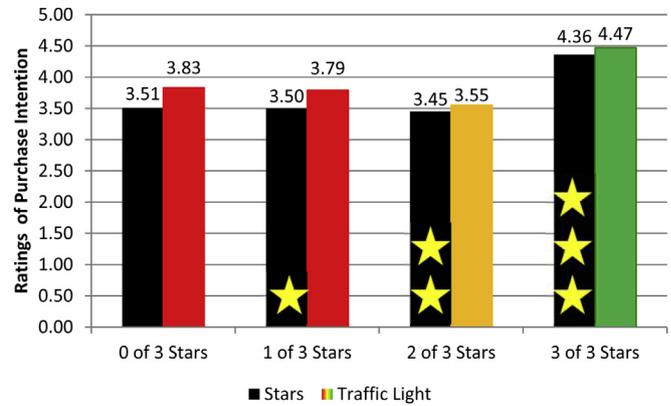
To determine if the interaction between label type and product healthfulness was a byproduct of the star-based scale containing four levels for product healthfulness compared to traffic light scale's three levels, we also conducted a 2 (label type) X 3 (product healthfulness) repeated measures ANOVA in which the star-based scale's 0 and 1-star food products were collapsed into one group to directly mirror the red light condition in the traffic light labeling system. This analysis also revealed a significant interaction between label type and product healthfulness ( $F(5, 304) = 16.202, p < 0.01$ ), indicating that participants who viewed the star labels rated the least healthful items (0 and 1-star items) as less healthful than the same items with red traffic light labels. Likewise, they rated the 3-star items as more healthful than participants who saw those products with the green traffic light label.

### 3.1.2. Purchase intention by FOP label type

As determined by a 2 (label type) X 4 (product healthfulness) repeated measures ANOVA, there was no main effect for front-of-pack label type on purchase intentions ( $F(1, 303) = 1.34, p = 0.25$ ), suggesting the two label types had similar effects on purchase intentions. There was, however, a significant main effect for product healthfulness on purchase intention ( $F(7, 297) = 33.70, p < 0.001$ ). As displayed in Fig. 3, for both label types participants were more likely to indicate they would purchase the healthiest foods (i.e., 3-star/green light foods) compared to all other food options (i.e., 0, 1, and 2-star/red and amber light foods),  $F(1, 304) = 92.03, p < 0.001$ .



**Fig. 2.** Rated product healthfulness for products earning zero or one stars (red light), two stars (amber light), and three stars (green light) by label type. Statistically significant ( $p < 0.05$ ) ratings of perceived healthfulness for the same products with different labels denoted by asterisks. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)



**Fig. 3.** Rated purchase intention for products earning zero or one star (red light), two stars (amber light), and three stars (green light) by label type. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

## 3.2. Message framing conditions

### 3.2.1. Perceived product healthfulness by framing condition

As revealed by the 5 (framing condition) X 4 (product healthfulness) repeated measures ANOVA, there was no main effect for framing condition on perceived product healthfulness ( $F(4, 298) = 0.145, p > 0.05$ ). The type of message framing did not influence participants' ratings of product healthfulness.

### 3.2.2. Purchase intention by framing condition

Similarly, there was no main effect for framing condition on purchase intention ( $F(4, 300) = 1.72, p > 0.05$ ), indicating that the different message framing types did not affect participants' intention to purchase food products with differing levels of nutrition.

## 3.3. Exploratory analyses

### 3.3.1. Perceived product healthfulness by framing condition

Because participants in conditions 1–4 were presented with the same description of the FOP labels (i.e., how product healthfulness was conveyed in the FOP labels), those 4 conditions were collapsed and compared to condition 5 (control), which received no descriptive information for the FOP labels. A 2 (PSA framing condition: uninformed control vs. all other conditions) X 4 (product healthfulness) repeated measures ANOVA yielded a significant main effect of framing condition on ratings of perceived product healthfulness ( $F(7, 295) = 2.60, p < 0.05$ ). For 2-star/amber light products, participants who were presented with information regarding the meaning of labels – i.e., participants in conditions 1–4 – rated products as healthier than did participants who were not given information regarding the meaning of the labels – i.e., participants in the uninformed control condition 5, ( $M_{1-4} = 5.07$  and  $M_5 = 4.74$ ).

### 3.3.2. Purchase intention by framing condition

Because participants in framing conditions 1–4 were exposed to different information related to purchase intention (e.g., some participants were encouraged to pursue healthful foods, while others were instructed to avoid unhealthy foods), conditions 1–4 were kept separate for the purchase intention analyses (rather than consolidating them as we did for the healthfulness analyses). However, a 5 (framing condition) X 4 (product healthfulness) repeated measures ANOVA indicated no significant effect for framing condition on purchase intention ( $F(4, 300) = 1.72, p = 0.15$ ).

Note that discrepancies in degrees of freedom are due to missing data for ratings of purchase intention.

### 3.4. Supplemental analyses

#### 3.4.1. Perceived healthfulness of same calorie products

Paired t-tests revealed that participants were not simply relying on calorie count to make assessments of product healthfulness, as products with the same number of calories were rated as significantly different from one another in terms of healthfulness. For both star and traffic light labels, participants correctly identified the less healthful 110 and 200-calorie foods within each pair (see Fig. 4).

#### 3.4.2. Participants' health concern

As expected, a regression determined that participants who reported higher health concern indicated less intention to purchase the least healthful products compared to participants with lower health concern ( $F(2,302) = 7.43, p < 0.01, R^2 = 0.047$ ). This difference held across label type and framing condition.

#### 3.4.3. Perceived label informativeness

Participants in both labeling conditions – star and traffic light – indicated feeling equally informed and helped by the labels ( $t_{304} = 0.313, p = 0.754; t_{304} = 0.976, p = 0.330$ ). The mean helpfulness ratings were 2.69/5 ( $SD = 1.27$ ) for the star label and 2.83/5 ( $SD = 1.27$ ) for the traffic light labels. Similarly, the star and traffic light labels did not differ in their ratings of informativeness ( $M_{\text{star}} = 2.45, SD = 1.26; M_{\text{TL}} = 2.41, SD = 1.17$ ). While participants found the two labeling systems to be equally informative and helpful, ratings of informativeness and helpfulness of the labels differed based on the framing condition. Participants felt more informed ( $M = 2.66, SD = 1.20$ ) by labels when they were accompanied by gain + loss framing (condition 3) compared to the uninformed control condition (condition 5;  $M = 2.05, SD = 1.08$ ) that received no information regarding how the labels should be utilized ( $F(1, 304) = 2.43, p < 0.05$ ). Additionally, participants indicated feeling more helped by labels when they were accompanied by loss framing (condition 2;  $M = 2.98, SD = 1.36$ ) or both gain + loss framing messaging (condition 3;  $M = 2.98, SD = 1.27$ ) compared to the uninformed control (condition 5;  $M = 2.30,$

$SD = 1.24, F(1,304) = 3.00, p < 0.05$ .

## 4. Discussion

The goal of this study was to directly compare the impact of two different policy-relevant FOP labeling systems on healthfulness ratings and purchase intentions and to investigate various methods of message framing for explaining these two labeling schemes.

It was hypothesized that the traffic light labeling system would lead to more internally consistent healthfulness assessments compared to the star-based system. This hypothesis was based on prior research demonstrating that the 0–3 star scale has the potential for people to perceive 0-star items as healthier than is the case (Graham & Mohr, 2014). This hypothesis was not supported, however, as participants who viewed the star labels rated products with the lowest healthfulness (i.e., 0-star foods) as significantly less healthful than did participants who viewed those same products with the red traffic light label. Likewise, participants who viewed the star labels rated products with the highest healthfulness (i.e., 3-star foods) as significantly healthier than did participants who viewed those same products with green traffic light labels. This might be due to methodological differences between the Graham and Mohr (2014) study and the current paper. Graham and Mohr's participants saw and rated only one product whereas participants in the present study viewed ten items in succession and these items were presented in random order. That meant each of the ten products only appeared first approximately 10% of the time and therefore only approximately 10% of participants saw the single 0-star product first, when they would have been most subject to misinterpreting the 0-star label. Viewing other products with 1, 2, or 3 stars prior to seeing a 0-star product likely protected against people thinking 0 stars meant the product was healthful by making it clear that some labels contained stars.

In terms of purchase intentions, both labels led to similar outcomes; participants in both the star-based and traffic light labeling conditions indicated that they would be most likely to purchase the healthiest foods (i.e., 3-star/green light foods) compared to all other food options (i.e., 0, 1, and 2-star/amber and red light foods). Although participants who viewed the star-based labels were more likely to rate less healthful foods as being less healthful compared to participants who viewed the traffic light labels, they did not report less intention to purchase those items of lower healthfulness. This finding is in line with previous research suggesting that nutrition is just one of many factors, and not the most influential factor, contributing to food choice (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Pollard, Kirk, & Cade, 2002).

For both FOP label systems, it was hypothesized that all three framing conditions (gain, loss, gain + loss) would lead to greater ease of distinguishing between more- and less-healthy choices compared to two control conditions (no gain or loss frame). This hypothesis was not supported, as all participants – across the five framing conditions – were able to correctly identify the less nutritious zero and one-star (or red light) foods as less healthful and the more nutritious three-star (or green light) foods as healthier. However, participants who received information regarding the meaning of the labels (i.e., participants in framing conditions 1–4) rated 2-star (or amber light) products as healthier than participants who were not given information regarding the meaning of the labels, suggesting that the framing of the labeling systems can be particularly influential with regard to rating products having mid-range nutritional value by aiding in the differentiation between foods with mid-level nutritional content and less healthful options.

While our study did not provide support for a particular method of framing instructions for FOP nutrition label use, our results do

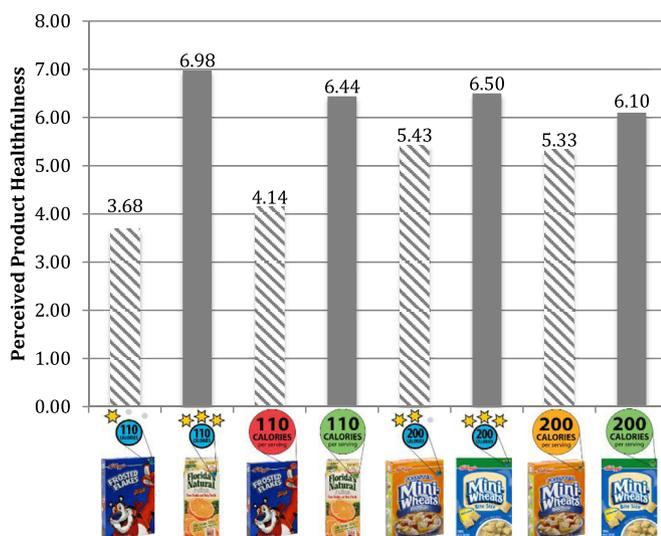


Fig. 4. Perceived product healthfulness, by label type, of products with equal caloric content, but different healthfulness levels.

identify a potential advantage for the star-based labeling system compared to the traffic light labeling system; specifically, a greater ability to differentiate the most vs. the least-nutritious products. Participants in the star-based labeling condition rated the most nutritious foods in this set of products as healthier than did participants in the traffic light labeling condition, and individuals who viewed the star-based labels also rated the least nutritious foods in this set as less healthful compared to participants in the traffic light labeling condition. This result was surprising, as traffic light labeling systems have been identified as being most consistently able to assist consumers in identifying healthier products (see [Hawley et al., 2013](#) for review). Furthermore, past research has demonstrated that star-based systems that utilize a 0–3 scale can mislead participants, as 0-star products are liable to be perceived as more healthful than 1-star products because of a lack of comparative information ([Graham & Mohr, 2014](#)). However, for participants in our study, the star-based labels seemed to help participants do a better job of differentiating between the least healthful and most healthful foods.

Many factors could explain why the star-based system seemed to better assist our study's participants in discriminating between the least nutritious and most nutritious products compared to the traffic light system. First, the star-based system and traffic light system differed in the number of healthfulness "levels" in which products were grouped, as the traffic light system only included three levels (red, amber, and green), while the star-based system contained four levels (0, 1, 2, and 3 stars). As the star-based scale had more levels for product healthfulness, participants may have been more polarized in their responses for products of the lowest and highest healthfulness as the difference between the two ends of the healthfulness scale may have appeared greater compared to the three-level traffic light system. However, when the star-based scale's 0 and 1-star food products were collapsed into one group and compared directly to the red light condition in the traffic light system, the polarization trend was still present, suggesting that the additional healthfulness level in the star-based system was not driving that effect.

Notably, participants in our study viewed multiple products (rather than a single product), which may have increased the usefulness of the star-based labeling system by providing additional – and important – contextual cues and guarding against the zero-comparison effect. Because participants viewed multiple products, they were likely better prepared to recognize that seeing 0 stars on the FOP label indicated that products were less healthful because they had already seen products with 1, 2, or 3 stars and, therefore, anticipated seeing some number of stars on all products. In this case, seeing 0 stars could alert consumers to a nutritional deficit rather than mislead consumers.

In addition to supplying different contextual factors, our study also directly compared the star-based system to the traffic light system, which had yet to be done. The traffic light labeling system has demonstrated efficacy compared to variants of Guideline Daily Amounts (GDA) labels and the "Facts up Front" system, both of which provide numeric nutritional information in FOP form (e.g., [Roberto et al., 2012](#)), but few studies have compared the traffic light system to other symbol-based FOP nutrition labeling systems (see [Hawley et al., 2013](#)). Although the traffic light system has demonstrated efficacy at helping consumers identify healthful foods, it has not been adequately tested against other systems that present nutrition information in a symbolic form.

#### 4.1. Strengths

Our research has direct policy relevance, as the star-based labels are under consideration by the US Food and Drug Administration

(FDA), which convened the Institute of Medicine's expert panel to help inform their decision regarding the efficacy of various FOP labeling schemes ([IOM, 2011](#)). Likewise, traffic light labels have already been implemented in some locations (e.g., the UK), thereby increasing the need for experimental testing of the traffic light labeling system and other symbol-based FOP labeling systems to determine which system is most advantageous in helping consumers identify and select healthful food products. Furthermore, our research is the first to test framing of instructions for using these labels, which is a crucial component in the implementation of a new labeling system that warrants further investigation. Lastly, our study tested the impact of the IOM-recommended star-based labeling system not only on product healthfulness but also on purchase intention. While assisting consumers in discriminating between unhealthy and healthful foods is undoubtedly an important step in promoting healthful food choices, few studies have tested the influence of FOP labeling systems on purchase intention, and, furthermore, those studies that have included purchase intention outcomes have not revealed an impact of FOP labels on purchase intention. Therefore, continuing to investigate factors that could potentially inspire change not only in consumers' ability to recognize healthful foods but also in their desire to pursue those healthful foods is imperative.

#### 4.2. Limitations

While our study directly and experimentally compared two policy-relevant FOP nutrition labeling systems and multiple message framing formats, we did rely on a relatively small sample of college students who completed this study online and may not have attended to or comprehended the advertisements thoroughly. Additionally, although it was valuable to assess purchase intention in addition to perceived healthfulness, measuring consumption behaviors would be even more beneficial than measuring reported intention to purchase healthful products, as intention may not always predict healthful eating behavior (e.g., [Povey, Conner, Sparks, James, & Shepherd, 2000](#)). Furthermore, because we opted to present the FOP explanatory information in the form of a public service announcement (PSA) in order to promote realism, there was no guarantee that participants understood – or even read – the framing information.

#### 4.3. Future directions

Although the loss-framing language included in this study did indeed highlight potential benefits of healthy eating that would be lost by pursuing low-star/red light foods, the language intentionally avoided implicating specific disease states as has been previously done in some effective loss-framing interventions (e.g., [Brug, Ruiters, & Van Assema, 2003](#); [Van Assema, Martens, Ruiters, & Brug, 2001](#)), as our goal was to represent a more likely eventual PSA that might introduce a new FOP labeling system. However, it is possible that loss-framing that more directly links eating unhealthy foods with undesirable losses in health or with disease states may be more efficacious compared to the loss framing that was utilized in our study. Therefore, future studies should consider testing various types of loss frames to determine whether a different frame would be more efficacious.

Additionally, to ensure that participants are both attending to and comprehending the framing information, a manipulation check could be added in which participants respond to questions designed to verify that they understood the framing information. Alternatively – or additionally – eye-tracking could be incorporated so that we could objectively measure whether and how participants attended to the framing information. Furthermore, we could

test different methods of distributing the framing information (e.g., audio or visual representation) in addition to the text-based delivery method we utilized in this study to determine if presenting the framing information in different manners would increase attention and comprehension.

## 5. Conclusions

Understanding which FOP labeling systems most effectively enable consumers to detect – and encourage consumers to select – the most healthful food options is imperative for encouraging overall health and reducing diet-related diseases. The purpose of this experiment was to directly compare the traffic light and star-based FOP labeling systems and to determine which message framing method would best enable consumers to make use of the FOP labels to both identify and select healthier food products. Our research demonstrated that the star-based labeling system promoted greater polarity than the traffic light labeling system, as participants who viewed the star labels rated the least healthful foods as less healthful and the most healthful foods as more healthful compared to participants who viewed the traffic light labels. Additionally, while all participants were able to identify the least healthful foods as least healthful and the most healthful foods as most healthful, our results suggest that including any type of framing (gain, loss, or gain + loss) of the labeling systems assisted consumers in differentiating between foods with mid-range nutritional value and foods with little nutritional value (i.e., 1-star foods vs. 2-star foods or red light vs. amber light foods). While ratings of perceived healthfulness were influenced by the label type and framing, purchase intention was not impacted by framing or label factors. Future research should further investigate the influence of these policy-relevant labeling systems and seek to determine factors that influence consumers' intention to *pursue* healthier foods in addition to simply *identifying* healthier options.

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