Beverage Front of Package Nutrition Labels and Consumer Perception of Nutrition Information

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Introduction

The pressure to find solutions for the high rates of obesity and overweight in the U.S. population has led policy makers to investigate nutrition information provided to consumers, with the goal of helping consumers make healthier choices. As part of her "Let's Move!" campaign, First Lady Michelle Obama has asked the food and beverage industry to work with the FDA and USDA's Food Safety and Inspection Service to develop and implement a standard system of nutrition labeling for the front of food and beverage packages (Recommendations from Let's Move – http://www.letsmove.gov/sites/letsmove.gov/files/TFCO_Summary_of_Recommendations.pdf).

In response, the American Beverage Association (ABA) started "Clear on Calories," a labeling program in February 2010. This program provides calorie information on the front of beverage packages, dependent on the size of the container and type of beverage. For containers 20 fluid ounces or smaller, total calories are shown on the front of the package. For larger containers, calories per 12 fluid ounces (or 8 fluid ounces for 100% juice) are shown. In addition, the Food Marketing Institute (FMI) and Grocery Manufacturer' Association (GMA) jointly developed a new front-of-package system called "Nutrition Keys" for food and beverages in January 2011. Nutrition Keys displays four major nutritional facts: calories, saturated fat, sodium and sugars; on the front of packages. In addition, manufacturers can add up to two "positive" pieces of nutritional information to encourage consumption as long as the product contains more than 10% of the Daily Value per serving of

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the nutrient. The following nutrients may be included as positive information: potassium, fiber, protein, vitamin A, vitamin C, vitamin D, calcium and iron. The Nutrition Keys is very similar to the front of package labels used in the United Kingdom, the Guideline Daily Amount (GDA). Both Clear on Calories and the Nutrition Keys are voluntary.

The Food and Drug Administration (FDA) currently requires the Nutrition Facts panel (NFP) on the back-of-package (BOP) which provides information on the following nutrients: calories, fats, cholesterol, sodium, carbohydrate, fiber, sugar, protein, Vitamins A, C, calcium and iron. The NFP has been modified over time, and is currently being considered for revision again. Among the topics to be considered, the Center for Science in the Public Interest (CSPI) has continually raised a question about the lack of added sugar information and argued that hidden added sugar contributes to obesity and chronic disease (CSPI, 1999, page 18). In the newly released Dietary Guidelines for Americans (DGA, 2010) added sugars are shown to contribute, on average, 16 percent of total calories in American diets (DGA, 2010, page 27). In fact, the DGA focuses heavily on the concept of reducing added sugars in the diet because "many foods that contain added sugars often supply calories, but few or no essential nutrients and no dietary fiber" (DGA, 2010). Although the body responds in the same way to naturally-occurring and added sugars, it is the concept that no other nutrients come with added sugars that makes this an item to focus on. The sugar content currently present on NFPs represent those sugars found naturally in food as well as those added. Typically, added sugars are extracted from natural ingredients such as corn and sugar cane. Artificial sweeteners such as Splenda® and Aspartame can replace sugar and may be preferred by consumers watching calories. The beverage industry has many offerings that use artificial sweeteners to reduce or eliminate calories from their products.

The Institute of Medicine (IOM) published their first study on front-of-package

labeling systems in 2010. They presented several reasons why including added sugar information on FOP labels is not appropriate at this time: 1) insufficient scientific evidence and agreement on the adverse health effects of added sugar; 2) a relatively small number of food categories provide more than 70% of added sugars; 3) displaying only information on added sugar may mislead or under-represent the sugar content and 4) introducing added sugar information may create conflicts with the Nutrition Facts panel, which contains total sugar only. Currently, the only way a consumer would be aware of added sugar content in a beverage would be by seeing a claim of "no added sugar," or if they check the percent of juice and the ingredients list, or compare the sugar level to 100% juice.

The 100% juice industry is particularly concerned with front-of-package nutrition labels and the added sugar issue. Though 100% juices are considered nutritious and healthy, the level of calories and sugar they contain are comparable to regular soft drinks. As pointed out by the DGA, the concern with added sugar is that no additional nutrients are gained with the added sugar. This is not the case with 100% fruit juice, which, though containing sugars and calories, has considerable nutritional content. The beverage industry, in particular, companies producing 100% fruit and vegetable juice are concerned how the new labeling systems developed by ABA and FMI/GMA will impact consumer understanding of beverage nutrition. Specifically, they are concerned that only showing calories or including total sugar instead of added sugar on FOP labels could be misinterpreted by consumers.

The objective of this study is to investigate the effect of new FOP labeling systems on consumers' perceptions of thirteen beverages. Additionally this research will examine how the front-of-package nutritional information impacts consumer perceptions of health and nutrition in beverages using the two labeling systems proposed by the ABA and FMI/GMA. Consumer ratings of how healthy or nutritious they perceive products after viewing labels

with the two different front-of-package systems will be compared to base-line labeling without FOP nutrition labels. Finally, a comparative analysis of diet soft drink and 100% fruit juice will be used to test whether the FOP labeling system leads to a change in consumer perception, with a specific focus on the impact of calories and sugars.

Domestic and International Front-of-Package labeling Systems

In 1990, the FDA (21 CFR 101) and the Nutrition Labeling and Education Act (NLEA) (Public Law 101-535) established a mandatory nutrition labeling system for most food packages including the NFP and at the same time, stipulated regulations about nutrient content claims, health claims, and other labeling statements. The NFP is placed on the back of food packages in a standardized format based on a serving size of the food or beverage and a reference diet of 2,000 calories per day. Nutrient, health, or other labeling claims in text type and symbols can be displayed voluntarily by food manufactures on the front-of-package to accentuate positive nutritional characteristics of the product. FDA's 21 CFR 101 specified criteria for displaying these claims. For example, to display the statement "no added sugar" the food must contain no amount of sugar, or any other ingredient that contains sugars that functionally substitute for added sugars, included during processing or packaging (21 CFR 101 (C)(2)(i)). The American Heart Association (AHA) initiated a symbol to announce "heart friendly" food in 1987 called the Heart Guide symbol. Many symbols and statements have been added since that time.

In the United Kingdom (UK), the Food Standards Agency (FSA) implemented a front-of-pack traffic-light nutrition label system as a voluntary scheme in 2007. The traffic light (TL) system alerts consumers to the level of fat, saturates, sugars, and salts using red, amber and green colors to indicate high, medium and low levels of these nutrients

respectively. Many UK supermarkets adopted the traffic-light labeling system followed by FSA guidelines due to consumer demand. While it quickly announces the healthiness of a food, it had been criticized on its simplicity of categorizing food as either good or bad. In 2010, members of the European Parliament (MEP) rejected the UK's traffic-light labeling system for the European Union. Food manufacturers were hesitant to use a red colored label on food because of its strong statement. Compared to the simplistic format of the TL system, the Guideline Daily Amounts (GDA) system developed by food manufacturers displays the total amount of sugar, salt, saturates, and fats an average adult should eat in one day depending on activity level. GDA does not evaluate foods using colors.

The Australia and New Zealand Food Regulation Ministerial Council recommended the introduction of front-of-pack traffic-light systems to Australia and New Zealand and agreed to share food standards that are administered by the Food Standards Australia New Zealand (FSANZ) in 2011. Professional researchers have supported implementing a traffic-light system in Australia and New Zealand (Gorton et al, 2009; Kelly et al, 2008). However, agents such as non-governmental organizations and the food industry are still discussing whether to implement the traffic-light system as either mandatory or voluntary.

Previous Research on Food Label Use

Studies on nutritional labeling have been widely conducted in both domestic and international settings, though the focus has been on food products over beverages. Most papers have attempted to understand demographic characteristics related to the use of nutritional labels and how use of nutritional labels impacts eating habits. For example, Zhang, You, and Nayga (2010) explored the socio-economic profiles of nutrition label users and compared the differences between two time periods using the National Health and Nutrition

Examination Survey (NHANES) conducted in 2005-06 by the National Center of Health Statistics (NCHS), the Centers for Disease Control and Prevention (CDC) and the Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) covering 1994-96 conducted by the USDA. Ordered probit models showed similar profiles of nutrition label users over the two periods. The findings show that elder, educated, higher-income females from small families tended to check the nutrition labels more often. Additionally, nutrition knowledge about MyPyramid and Dietary Guidelines had a large impact on those who never use nutrition labels and those who always check the label. In another study using the NHANES data, Drichoutis, Nayga, and Lazaridis (2009) found there was no significant relationship between nutritional label use and body weight outcomes.

In another study, Weaver and Finke (2003) investigated the impact of nutrition label use on the consumption of added sugars using the DHKS data. Added sugar consumption (as a percent of total energy intake) was determined by dividing calories contributed from added sugars by the amount of total calories consumed. They also differentiated by distinguishing use of sugar label information from the use of general label information. The authors found that individuals who always use labels for sugar information on average consume 1.1% less of their total energy from added sugars compared to all other individuals. However, the general use of the nutrition label was not shown to significantly impact the consumption of added sugar. Education, region, gender, income, and age were also significantly related to the density of added sugar. However, this study may not count the amount of added sugar consumption from processed food which already contains sugars during processing because current NFPs don't provide added sugar information.

Kim, Nayga, and Capps (2001) and Asirvathan, McNamara, and Baylis (2010) showed the relationship between nutritional label uses (DHKS data) and healthy eating

(healthy eating index, HEI) or diet quality. They found that consumer label use increased the average HEI and diet quality. The amount of improvement in average HEI and diet quality were related to the type of label information used. For example, they found that when consumers used healthy claims among different FOP claims, improvement in the diet was highest (Kim et al, 2001). However, Wardle and Huon (2000) and Berning, Chouinard, and McCluskey (2011) found that healthy claims on food labels did not always lead to healthy choices.

Similar studies have also been conducted in European countries using consumer survey data. Gracia, Loureiro, and Nayga (2007) examined whether consumers consider the provision of mandatory nutritional labeling to be beneficial in Spain. A multivariate probit model showed that consumers who have good nutritional knowledge frequently used nutritional labels when they shop and these consumers who frequently used nutritional labels consider mandatory nutritional labeling as beneficial. Loureiro, Gracia, and Nayga (2006) investigated the evaluation of a box of cookies with nutritional labels in Spain by using a double-bounded probit model. Their results showed that consumers were willing to pay approximately 11% higher for a box of cookies with a nutritional label than one without such a label. There was a noticeable difference in willingness-to-pay between consumers' healthiness with/without suffering from diet-related health problems; those who were less healthy were willing to pay more for the product with the nutritional label.

As various types of nutritional labels have developed, some studies focused on the effectiveness of the nutritional label in transferring health information to consumers. Studies examining the effect of traffic-light nutritional labeling on healthy choices have been conducted in Europe and Oceania. Consumer surveys by Kelly et al (2008) in Australia and Gorton et al (2009) in New Zealand both found that the TL labeling system provides a clear

understanding and higher levels of acceptance for healthier food choices. However, two studies conducted by Sacks, Rayner, and Swinburn (2009) and Sacks et al (2011) showed no significant effect of the relative healthiness of choices after introducing TL nutrition system. They used data on the change of sales of ready-meals and sandwiches in the UK (Sacks, Rayner, and Swinburn, 2009) and 53 products from online stores in Australia (Sacks et al, 2011) before and after implementing TL nutrition system. Moeser et al. (2009) showed that consumers of different nationalities preferred different types of FOP labeling systems; consumers in Belgium preferred the TL system while German consumers preferred the GDA system. In the U.S., Andrews, Burton, and Kees (2011) found that consumers were more favorable simple labels (the Smart Choice) than the complex TL.

In 2010, the International Food Information Council Foundation (IFIC) conducted an online consumer survey to investigate different FOP label options: calories only, calories with 3 negative nutrients (saturated fat, sodium, total sugars) and calories with 3 negative nutrients and 3 positive nutrients (protein, iron, vitamin A, vitamin C, fiber or folate). Four food categories were used in this research including: breakfast cereals, frozen entrees, salad dressing, and savory snacks. Three unbranded products in each category were selected to represent relatively high, medium, and low level of calories and nutrients and this study provided an option to look at NFP on the back of the food package. One of the key findings was that the third FOP label with negative and positive nutrients helped consumer decision-making and understanding but the positive nutrients did not interfere with the consumer's findings of negative nutrient content.

Survey Design and Methods

A consumer survey was designed to understand consumers' nutrition knowledge, health conditions, label usage, beverage consumption patterns, demographics, and perception

of health and nutrition associated with different beverages under the two FOP nutritional labels. Previous research focused on consumer perception or evaluation of health food products based on food labels and label claims (Roe, Levey, and Derby, 1999; Kim, Nayaga, and Capps, 2001; Kelly el al, 2008). In addition to collecting information on how healthy consumers perceived thirteen different beverages, this study also examined how nutritious they believe the products are[2]. To control other factors influencing consumers' perception of the beverages, the beverage labels tested are designed using only the generic name of beverage (such as milk and regular soft drink) in place of brand names and serving units for example, 8 FL OZ (237mL). Gray backgrounds and no color were used to avoid bias associated with colors. Example labels are shown in Figure 1.

The two front-of-package labels that would fit under the ABA and FMI/GMA guidelines were designed for each of thirteen beverages. Examples of the label contents are shown in Table 1. The first has calories only and is similar to the ABA's "Clear on Calories" program. The second label is similar to the FMI/GMA's "Nutrition Keys". As mandatory nutrients, calories, saturated fat, sodium, and sugars are placed on the left side, and up to two optional "positive" nutrients are listed on the right side. To be included as a positive nutrient, there must be a minimum of 10% of the recommended Daily Value in one serving of the beverage.

Thirteen representative non-alcoholic, cold beverages were used in this research. The thirteen beverages were selected to represent different types of nutrition and commonly consumed products and included: water, 2% reduced-fat milk, non-fat (skim) milk, regular soft drink, diet soft drink, sports drink, fruit drink (defined as less than 10% fruit juice), fruit cocktail (defined as more than 10% fruit juice, but less than 100%), 100% apple juice, 100%

[2] IFIC asked participants to select the best choice for nutritional value among three products that contain same nutritional contents but different products within a same food category.

grape juice, 100% orange juice, 100% vegetable juice, and 100% fruit and vegetable juice blend. Two milks were used to represent different fat levels and two soft drinks were included to understand the impact of label changes based on the sugar and calorie content. Of particular interest is how diet soft drinks are evaluated as they have very low (to no) level of the negative nutrition characteristics, but also no positive characteristics. A number of juice products are included to ascertain the impact of labels on juices with a variety of combinations of natural and added sugars. The 100% juice products do not contain added sugars, while the blends and drinks do. Finally, vegetable juice and vegetable-fruit juices are included to determine if the impact of the labels differs when vegetables are introduced. Detailed nutrition contents for the selected beverages are shown in Appendix 1.

In March, 2011, a random sample of 1,350[3] consumers in the United States was recruited for an online survey through a national survey panel hosted by Toluna/Greenfield Online. Participants were randomly assigned to one of two treatments, focusing on rating how they perceived either the health or nutrition of each beverage. Upon completing background information on beverage consumption habits, label usage, and general nutrition knowledge, each participant was shown a plain label for each of the thirteen beverages and asked to rate how healthy or nutritious it was on a 9-point Likert scale. By including the plain labels, a baseline understanding of the participants' perceptions is determined. Following the plain labels, participants answered another series of background questions, then were randomly assigned to rate either a label with calorie information or a label similar to the FMI/GMA Nutrition Keys information. A summary of the demographics of participants is provided in Table 2.

[3] There were 1,350 valid responses. Participants were removed from the study if they worked in as a marketing consultant or in the food and beverage processing industry. Additionally, there were two validation questions used approximately 1/3 and 2/3 of the way through the survey to remove participants that were not reading the questions.

Model

Ordered multinomial models are used to determine the influence of different FOP nutritional labels across beverages on consumer's relative perception changes. The underlying response model is:

$$Y_i^* = X_i^{`}\beta + \varepsilon_i \quad i = 1, 2, \cdots, N \qquad (1)$$

Where Y_i^* is a latent variable for individual *I*, X_i is a linear index of observable characteristics, and ε_i is unobservable characteristics. The estimated parameter β is the partial effect of corresponding observable characteristics controlling for other variables in the model. The latent variable is tied to the observed ordered Y_i with an *m* alternative ordered model

$$Y_i = j \quad if \quad a_{j-1} < Y_i^* \le a_j, \quad j = 1, 2, \cdots, m \qquad (2)$$

where thresholds a are assumed to be strictly increasing ($a_j < a_{j+1} \forall j$) and $a_0 = -\infty$, $a_m = \infty$. Then probability of selected *j*th categories is defined as

$$\Pr(Y_i = j) = F(a_j - X_i^{`}\beta) - F(a_{j-1} - X_i^{`}\beta) \qquad (3)$$

where *F* is the cumulative distribution function of ε_i following logistic distribution with $F = 1/(1 + e^{-(a_j - X^{`}\beta)})$. To specify the log-likelihood function shown in equation (4), let Z_{ij} be 1 if Y_i belong to *j*th category and 0 otherwise.

$$\ln L = \sum_{i=1}^{N}\sum_{j=1}^{m} Z_{ij}\{F(a_j - X_i^{`}\beta) - F(a_{j-1} - X_i^{`}\beta)\} \qquad \ldots.(4)$$

The regression parameter β and the threshold parameters $a_{1,} \cdots, a_{m-1}$ are obtained by maximizing the likelihood function.

The underlying beverage perception change function is specified as

$$Y_i^* = a_j + \gamma FMI + \sum_{l=2}^{13} \varphi_l DB_l + \sum_{l=2}^{13} \lambda_l (FMI * DB_l) + \varepsilon_i . \quad (5)$$

where Y_i^* is the changed beverage perception for all thirteen beverages by different nutritional FOP labels and two dummy variables created to indicate types of nutritional labels, FMI and kinds of beverages, DB_l. $FMI = 1$ if the FOP label follows FMI/GMA's "Nutrition Keys" and $FMI = 0$ otherwise (the ABA's "Clear on Calories"). The beverage is identified as $DB_l = 1$ if the beverage is l and $DB_l = 0$ if otherwise. The model has non-homogenous association with the interaction term which allows the differentiation of the odds ratio of label effects across beverages and vice versa. Label effects can be calculated $\exp(\gamma + \lambda_l DB_l)$ for $l = 2, \cdots, 13$ which is equivalent to the odds ratios for FMI/GMA and ABA of the l th beverage. Similarly, beverage effects are determined with $\exp(\varphi_l + \lambda_l FMI)$ for $l = 2, \cdots, 13$. When FMI=0, the value indicates the odds ratios for the l th beverage and base line beverage (i.e. diet soft drink) under the ABA FOP label. When FMI=1, the odds ratios implies how likely it is for the l th beverage perception to be positively changed compared to the change in the diet soft drink within FMI/GMA FOP labels. Combining two label and beverage effects allows us to compare how the perception of the FMI/GMA FOP label of l th beverage will change when compared to the ABA FOP label for a diet soft drink.

To apply this model to beverage perception changes, differences of each rating were calculated between one of two nutritional labels ABA and FMI/GMA and without labels (or plain labels). As each rating could be a minimum of 1 to a maximum of 9, the difference variable has a range of -8 to 8. This distribution was then categorized into five alternative groupings such that:

$Y_i = 1$ $\quad$ $Y_i^* \leq -4$

$$
\begin{aligned}
Y_i &= 2 \qquad -4 < Y_i^* \le -1 \\
Y_i &= 3 \qquad -1 < Y_i^* \le 0 \\
Y_i &= 4 \qquad 0 < Y_i^* \le 3 \\
Y_i &= 5 \qquad 3 < Y_i^* \,.
\end{aligned}
$$

Results

Consumer Beverage Perception

Before testing how front-of-package nutritional labels impact consumers' perceptions of beverages, each participant was asked to rate how healthy (or nutritious) they thought each of the thirteen beverages was without FOP information (Table 3). At this stage, participants rated water as the healthiest drink, but not the most nutritious. The average health and nutrition ratings for the two milks and all 100% fruit and vegetable juices were high, while the ratings for soft drinks, sports drinks, and the fruit drinks and cocktails (less than 100% fruit juice) were seen as less healthy and nutritious. These results suggest that consumers generally understand the relative health and nutrition attributes of the tested beverages. For example, they rate milk, water, and 100% juices higher than soft drinks.

Following the initial rating, participants were presented with one of the two FOP labels (ABA or FMI/GMA) and asked to rate the products again (Table 3). Relatively speaking, when looking at the beverage ratings in order of those rated healthiest to least healthy (or nutritious to least nutritious), there were no changes. However, the actual ratings did change, and in different ways depending on the beverage. These impacts did differ depending on the label. With the ABA label, there were little changes in perceptions. This may imply consumers' expectations for calories in a product are accurate, thus their initial rating included their perception of calorie content. However, the FMI/GMA FOP nutritional label did lead to different beverage perceptions. In general, consumers rated 100% fruit and vegetable juices lower with the FMI/GMA label than with no label, while they rated soft

drinks and fruit drinks as healthier (or more nutritious).

To better view the changes in perceptions, the difference between the ratings before and after the two labels are shown in Figures 2 and 3. When considering all beverages and both labels, just over 40% of the participants did not change their perception with the FOP label added. Changes to perceptions for the FMI/GMA FOP label were more varied than from the ABA label. On average, the rating for health for soft drinks improved with the ABA label, while the rating for juices decreased. Water, milk, fruit drinks and sports drinks were relatively unchanged. The average changes, however, are relatively small. The largest positive change in perception from the ABA (FMI/GMA) label was an improvement in the average health rating of diet soft drinks and nutrition rating for water by 0.31 (0.81) (on a 9 point scale). The largest negative change from the ABA label was a decrease of 0.55 for the health rating of 100% fruit and vegetable blends and a decrease of 0.46 for the nutrition ratings. On the other hand, the largest negative change from the FMI/GMA label was d decrease of 0.96 for the health ratings of 100% vegetable juice and a decrease of 0.93 for the nutrition ratings of 100% grape juice.

Relative Changes of Consumer Perceptions

To investigate the changes in perceptions based on the labels in more detail, equation 5 was estimated using maximum likelihood estimation. Consumer's perception has positively changed for diet soft drinks with the FMI/GMA label in comparison to the ABA label in both the healthy and nutritious ratings, while their perceptions of other beverages have negatively changed in comparison to diet soft drinks (Table 4). Results of a Wald test indicate most estimated parameters are significantly different from zero at the 10% significance level. Odds ratios are calculated to investigate the effect of the FOP labels considering different beverages.

In Figure 4, the effects of the FMI/GMA label compared to the ABA label are shown. If the odds ratios are greater than 1, it implies that the FMI/GMA FOP label is more likely to lead to a positive beverage perception compared to the ABA FOP label. When examining the ratings for how healthy consumers perceive the beverages to be, the odds ratio for diet soft drinks, water, regular soft drinks, fruit drinks and fruit cocktail are greater than one, indicating the FMI/GMA FOP label is more likely to lead to a positive perception than the ABA FOP label. The highest ratio is seen for diet soft drinks, followed by fruit cocktail and fruit drink. Compared to the ABA's "Clear on Calories", the FMI/GMA "Nutrition Keys" label increased consumer perception of the health and nutrition benefits of diet soft drinks by 1.6 times. In contrast, compared to the ABA label, the FMI/GMA label increased the likelihood consumers would decrease the ratings of the two milks, sports drinks, and all 100% fruit and vegetable juices. Even though the effect of the FMI/GMA FOP label was nearly zero for orange juice (odds ratios of 0.99), compared to the ABA label, the FMI/GMA FOP label seemed to fail to lead to positive healthy perceptions for 100% juice products. The same can be said for the perception of the nutritiousness of these products.

Though it is interesting to compare the two label possibilities, another item of interest is comparing a diet soft drink to a 100% juice. The reason this is of interest is because a diet soft drink does not have the "negative" nutritional characteristics shown on the left side of the Nutrition Keys type labels. In particular, a diet soft drink will be able to show 0 calories and sugars. This compares to 100% juice, which has some nutritional benefits, but also shows positive amounts of calories and sugars. A concern is that a new label might mislead consumers to believe a diet soft drink is relatively healthier or more nutritious than 100% juice for this reason. To examine this, odds ratios are calculated comparing twelve beverages to a diet soft drink given the two labels (Figure 5). Like in Figure 4, if the odds ratio is

greater than 1, the FOP label is more likely to lead to positive perceptions of that beverage compared to a diet soft drink. For the ratings on how healthy a beverage is, no beverages were likely to have a more positive change than the diet soft drink with either the ABA or FMI/GMA labels. For ratings on how nutritious the beverage is, water and the two milks were likely to have a higher positive response with ABA FOP labels compared to the diet soft drink and the fruit drink was likely to have a higher positive reaction than diet soft drinks with the FMI/GMA FOP label. Furthermore, the odds ratios shown in Figure 6 present the likelihood 100% fruit juice with the FMI/GMA FOP label will have less positive perceptions compared to diet soft drinks with the ABA FOP label. The baseline effect of diet soft drink with ABA FOP labels is 1. In this case, the FMI/GMA FOP labels lead to changes in consumer perceptions of 100% fruit juices of less than half of diet soft drink. This result implies that the effect of no negative information of diet soft drinks is viewed as positive and overwhelms 100% juice which contains information viewed as both negative and positive.

Implications and Conclusions

Increasing health problems, such as obesity, have put the issue of healthy eating on policy agendas, and have increased interest in government policy requiring nutrition information the front of food packages. Even though the Nutritional Facts panel currently provides nutrition information on the back of food packages, concerns that few consumers carefully look at the information have increased pressure to introduce FOP nutrition labels. Issues about what nutrients will be shown on the front-of-package have been discussed by the food industry and government agencies. In response to this attention, various organizations within the food and beverage industry have begun including or developing front-of-package labeling systems. In the beverage industry, ‘Clear on Calories’ and ‘Nutrition Keys’ have

been developed by the American Beverage Association and the Food Marketing Institute and Grocery Manufacturers Association, respectively. Although there exists a growing body of research on the impact and interpretation of FOP labels, most of this research does not focus specifically on the beverage industry. Within the beverage industry, there is some concern about the impact of new FOP labels on consumer understanding of nutrition information.

In this study, we examined consumer perceptions of the healthfulness and nutrition of thirteen beverages without FOP labels to develop an understanding of consumers current perception of beverages. As expected, beverages from 100% natural ingredients were considered as healthy and nutritious drinks while beverages that were not 100% natural and carbonated beverages were perceived as less healthy and nutritious drinks. When we asked participants to rate the beverages for a second time, but with a label similar to "Clear on Calories" (calories only FOP), there were no large changes in consumer perceptions. Though the changes were not large, beverages with 100% natural ingredients such as milk and 100% juices did tend to be rated lower than originally rated, and soft drinks and fruit drinks tended to be rated higher (though the 100% juices and milk were still rated higher on a raw score, the relative difference between the product ratings decreased). If the purpose of FOP labels is to encourage healthier choices, these changes seem to be at odds with the goal. In addition, many people did not change their perception (over 40% of participants), indicating they did not derive new information from the labels.

Compared to the ABA label, the results were even more dramatic for the proposed FMI/GMA "Nutrition Keys" label. Again, the gap between rating 100% juices and milks as healthier (or more nutritious) and rating soft drinks and fruit drinks as less healthy (or nutritious) decreased even more in this case. Comparing 100% fruit juices to diet soft drinks suggests that the negative information (sugar content) may be outweighing the positive

information (nutrient content) on the FOP labels.

This study focused on changes in beverages perceptions, so a limitation is that it says little about food purchase and consumption decisions. However, even without the link to consumption, one would hope labels would generate increased ratings for beverage products such as 100% juices and milks. The labels used in this study focused only on the name of the product and the FOP label information. In the actual market, the beverage industry competitively accentuates positive nutrition information using text and symbol claims such as "heart healthy" and "100% vitamin C". When this information is on the label in addition to FOP labels, the impact on consumers becomes more complicated. As many previous studies found consumers' with high level of nutrition knowledge tend to use labels more, including nutrition knowledge and health status in future studies may further aid our understanding of the on expected effect of the new FOP labels.

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Table 1. Front-of-packages labels of nutritional label for consumer survey

	Front-of-package of nutritional label
ABA's "Clear on Calories"	
FMI/GMA "Nutrition Keys"	

Table 2. Sample descriptions

Variable	Variable Description	% (N=1,350)
State	Northeast	18.6
	Midwest	24.8
	South	33.4
	West	23.1
Gender	Female	57.5
	Male	42.5
Age	<40	29.0
	40-60	39.2
	>60	31.8
Children in household	Yes	72.3
	No	27.7
Number of children	1	47.9
	2	31.3
	3+	20.9
People living in household	1	22.0
	2-3 People in HH	55.7
	4+ People in HH	22.3
Household income	Under $25,000	22.3
	$25,000 to $34,999	16.7
	$35,000 to $49,999	18.3
	$50,000 to $74,999	20.7
	$75,000 or More	22.1
Education	Less than HS	1.6
	HS	20.4
	Some college	40.4
	College degree	24.4
	Post graduate	13.3
Employment	Full-time	31.8
	Part-time	12.3
	Unpaid family worker	9.0
	Unemployed	16.6
	Student	5.0
	Retired	25.4
Primary shopper	Yes	90.1
	No	9.9

Table 3. Average consumer health and nutrition ratings of beverages with FOP labels

	Healthy rating			Nutritious rating		
	Plain	ABA	FMI/GMA	Plain	ABA	FMI/GMA
Water	8.5	8.6	8.5	5.9	6.3	5.7
2% Milk	6.7	6.8	6.5	6.6	6.6	6.5
Skim Milk	7.3	7.5	7.1	6.8	6.9	6.8
Regular Soft Drink	2.3	2.4	2.7	1.9	1.9	2.0
Diet Soft Drink	3.2	3.6	4.0	2.2	2.2	2.6
Sports Drink	4.6	4.5	4.5	4.0	3.9	3.5
Fruit Drink	4.0	3.9	4.4	3.6	3.7	4.1
Fruit Cocktail	5.4	5.0	5.3	5.2	4.9	4.9
100% Apple Juice	7.4	7.1	6.5	7.3	7.2	6.2
100% Grape Juice	7.3	6.9	6.4	7.3	7.1	6.3
100% Orange Juice	7.7	7.5	7.3	7.7	7.6	7.1
100% Vegetable Juice	8.0	8.0	6.9	8.0	7.9	7.0
100% Fruit/Veg. Juice	7.8	7.3	6.9	7.8	7.4	6.9
N	679	341	338	671	336	335

*Plain = no label; ABA = calorie only label; FMI/GMA = Nutrition Key label

** Ratings on a 1-9 scale where 1 = least healthy (nutritious) and 9 = very healthy (nutritious)

Table 4. Estimated results of ordered logit model of beverage perception changes

	Healthy Ratings		Nutritious Ratings	
Parameter	Estimate	SE	Estimate	SE
Intercept1	-3.280*	(0.122)	-3.469*	(0.117)
Intercept2	-0.699*	(0.104)	-0.999*	(0.098)
Intercept3	1.309*	(0.105)	1.049*	(0.098)
Intercept4	3.802*	(0.117)	3.420*	(0.110)
FMI/GMA	0.484*	(0.146)	0.276*	(0.140)
Water	-0.248*	(0.137)	0.241*	(0.137)
2% Milk	-0.202	(0.145)	0.017	(0.140)
Skim Milk	-0.253*	(0.142)	0.120	(0.140)
Regular Soft Drink	-0.086	(0.143)	-0.120	(0.136)
Sports Drink	-0.403*	(0.145)	-0.281*	(0.143)
Fruit Drink	-0.236	(0.146)	-0.011	(0.143)
Fruit Cocktail	-0.807*	(0.146)	-0.438*	(0.144)
100% Apple Juice	-0.703*	(0.143)	-0.321*	(0.138)
100% Grape Juice	-0.875*	(0.144)	-0.332*	(0.139)
100% Orange Juice	-0.756*	(0.141)	-0.248*	(0.137)
100% Vegetable Juice	-0.620*	(0.140)	-0.211	(0.136)
100% Fruit/Veg. Juice	-0.908*	(0.143)	-0.532*	(0.139)
FMI/GMA×Water	-0.386*	(0.195)	-0.545*	(0.197)
FMI/GMA×2% Milk	-0.724*	(0.206)	-0.364*	(0.202)
FMI/GMA×Skim Milk	-0.665*	(0.203)	-0.488*	(0.202)
FMI/GMA×Regular Soft Drink	-0.304	(0.203)	0.017	(0.195)
FMI/GMA×Sports Drink	-0.618*	(0.208)	-0.496*	(0.205)
FMI/GMA×Fruit Drink	-0.253	(0.209)	0.464*	(0.207)
FMI/GMA×Fruit Cocktail	-0.128	(0.209)	0.073	(0.207)
FMI/GMA×100% Apple Juice	-1.076*	(0.205)	-0.999*	(0.200)
FMI/GMA×100% Grape Juice	-0.885*	(0.206)	-0.904*	(0.201)
FMI/GMA×100% Orange Juice	-0.499*	(0.202)	-0.613*	(0.197)
FMI/GMA×100% Vegetable Juice	-1.062*	(0.203)	-0.917*	(0.198)
FMI/GMA×100% Fruit/Veg. Juice	-0.765*	(0.204)	-0.736*	(0.199)
N	8,827		8,723	
Log Likelihood	-10,904		-10,850	

"*" indicates that the Wald test results are significant at 10% of significance level.

A. No FOP Label (Control) B. ABA FOP C. FMI/GMA FOP

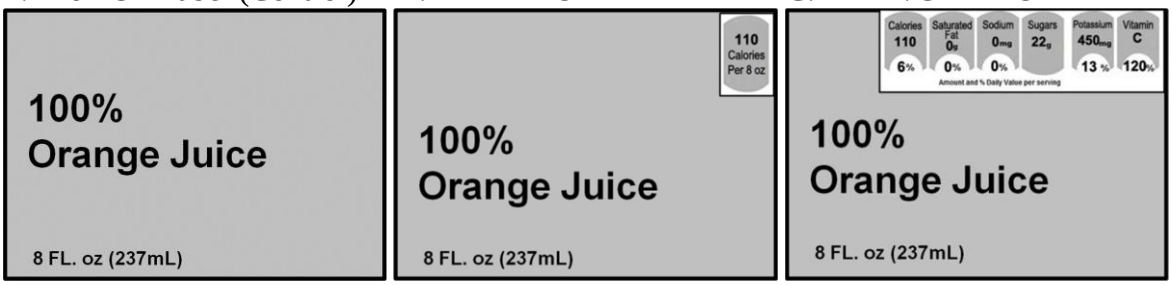

Figure 1. Examples of front-of-package labels

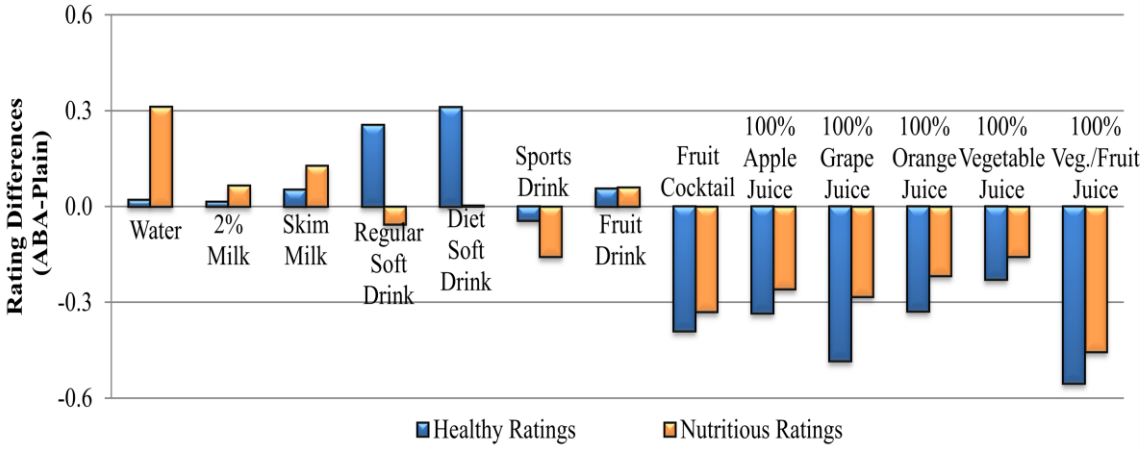

Figure 2. Average beverage perception changes between ABA and without label

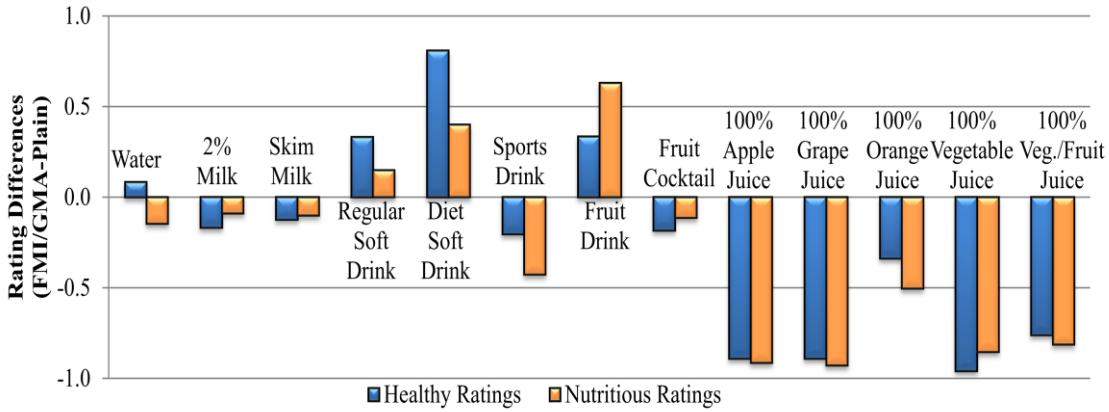

Figure 3. Average beverage perception changes between FMI/GMA and without label

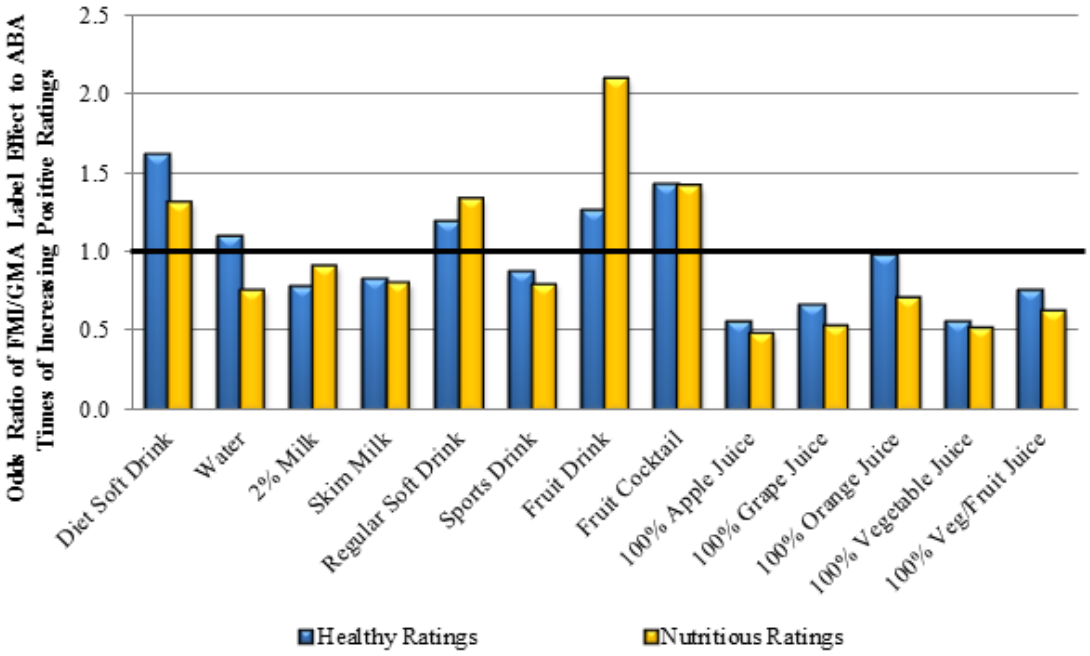

Figure 4. FOP nutritional Labeling effect across beverages

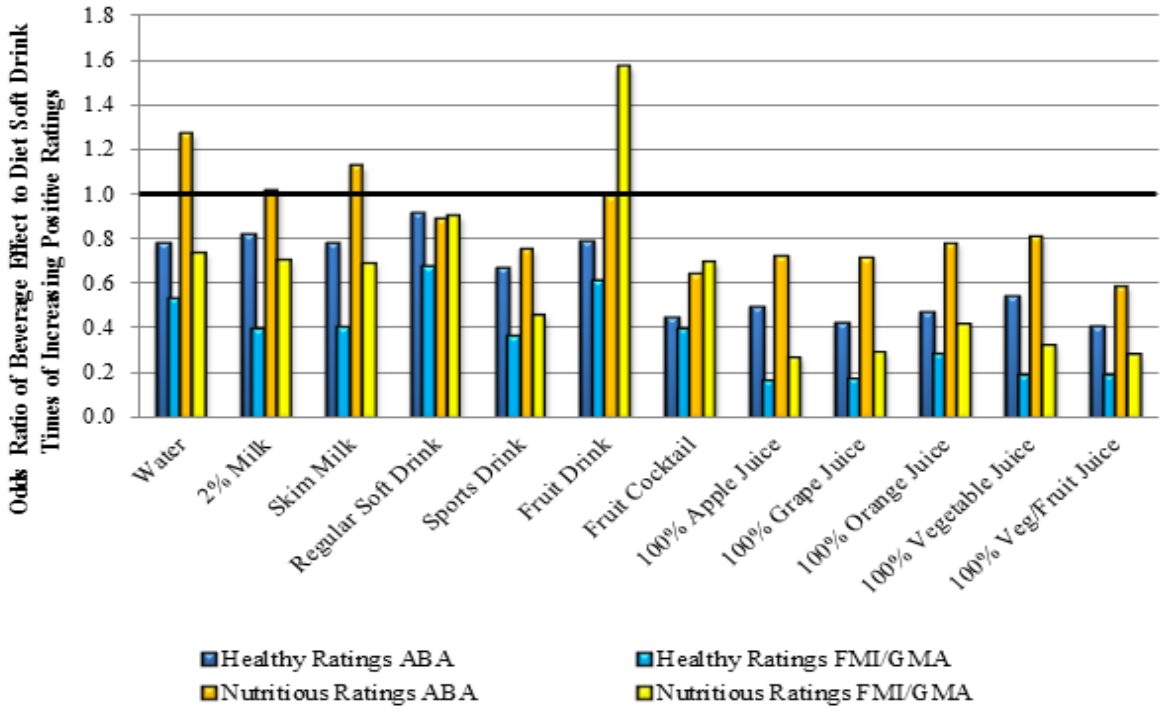

Figure 5. Beverage Effect over nutritional labels

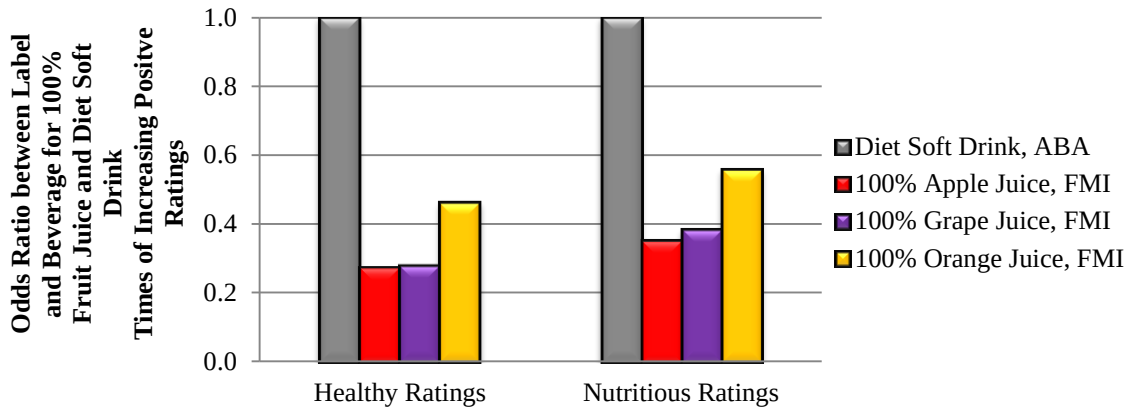

Figure 6. FOP Label and 100% fruit juice effect to ABA's diet soft drink

Appendix 1. Beverage nutrition contents used on the FOP label

	Calories	Sat. Fat (g)	Sodium (mg)	Sugar (g)	FMI/GMA Tab1	FMI/GMA Tab2
Water	0	0	0	0		
2% Milk	130	3	110	11	VTT D 25%	Ca 30%
Skim Milk	90	0	115	12	VIT D 25%	Ca 30%
Regular Soft Drink	93	0	33	26		
Diet Soft Drink	0	0	27	0		
Sports Drink	50	0	110	14		
Fruit Drinks	90	0	170	20	VIT C 100%	
Fruit Cocktail	135	0	34	34	VIT C 100%	
100% Apple Juice	120	0	10	28	VIT C 20%	
100% Grape Juice	140	0	15	40	VIT C 120%	
100% Orange Juice	110	0	0	22	VIT C 120%	K 450 mg
100% Vegetable Juice	50	0	420	8	VIT C 120%	VIT A 40%
100% Veg./Fruit Juice	120	0	70	25	VIT C 100%	VIT A 70%