Impact of Added Sugar Information of Front-of-Pack Labels on Consumers' Beverage Health Perception Changes

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Abstract

This study examined the effect of Front-of-package (FOP) labels with voluntary and mandatory disclosure of added sugar levels for beverages on consumer perceptions of how healthy the beverages are. Three groups of beverages were investigated: 1) 100% fruit juice (containing sugar but no added sugar); 2) sugar-sweetened beverages (containing sugar and added sugar); and 3) diet soft drink (containing no sugar). In general, added sugar information seems to play an important role in perception of healthfulness of beverages. FOP labels with mandatory added sugar information led to decreasing perceptions of how healthy beverages with added sugar were.

Key words: FOP labels, beverages, nutrition, added sugar

JEL classification: Q13, Q18

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Introduction

The increasing rate of obesity and related diseases are spurring high interest in the nutrition content of food from both policy makers and consumers. For example, the Food and Drug Administration (FDA) is considering requiring the use of front of package nutritional labeling. On the consumer side, some may be taking an interest in particular nutrients that they perceive to impact obesity, or that they hear about in the media. One nutrient that is getting much attention from both consumers and the government is sugar, in particular, added sugar (sugar that is not naturally occurring added to a product specifically to sweeten).

Many studies have found a positive correlation between sugar intake and weight gain or obesity in the United States (for example, Tournier and Louis-Sylvestre 1991; De Castro 1993; Mattes 1996; DiMeglio and Mattes 2000; Mattes 2006; Mourao, Bressan et al. 2007; Chen, Appel et al. 2009). In addition, obesity carries or exacerbates greater health risks associated with coronary heart disease, type 2 diabetes, and an increased incidence of certain forms of cancer (Eckel and Krauss 1998; Maggio and Pi-Sunyer 2003; Calle and Thun 2004). These health problems not only decrease nations' welfare but increase social cost.

Health concerns for and by consumers have created a demand for nutrition information of food. The FDA has required the Nutrition Facts panel (NFP) on food packages to adhere to a standardized format based on a serving size of the food or beverage and a reference diet of 2,000 calories per day since 1994. This mandatory nutrition label contributed to converting credence attributes of nutrients to search attributes (Caswell and Mojduszka 1996). The NFP provides the

following nutrition information: calories, fats, cholesterol, sodium, carbohydrate, fiber, sugar, protein, vitamins A, C, calcium and iron.

However, the NFP does not distinguish between sugar content which occurs naturally in food and those added to a food during processing or packaging. That is, the sugar content currently presented on NFPs represents all sugars found in food whether natural or added. Although not included as a required element, consumers may have some knowledge as there is a specified criteria for displaying "no added sugar" claims (FDA's 21 CFR 101). It is not uncommon to see such a label on products such as 100% juice, however, for a consumer to determine the amount of added sugar in a sugar-sweetened beverage (SSB), they would need to know the percent juice content and the sugar level of the 100% juice to calculate this number from the information on the NFP.

The Dietary Guidelines for Americans released in 2010 indicate that added sugars 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 Center for Science in the Public Interest (CSPI) has continually questioned the lack of added sugar information on food packages and argued that hidden added sugar contributes to obesity and chronic disease (CSPI, 1999, page 18). Additionally, some companies producing 100% fruit and vegetable juice have placed 'No added sugar' on food packages to distinguish

naturally occurring sugars in their products from added sugar. Juice products (100% juice) contribute nutrients and minerals to the diet, including a number of antioxidant compounds (Pereira and Fulgoni 2010) while the sugar contained in them is naturally occurring.

Front-of-package (FOP) nutrition information labels were voluntarily implemented by the beverage industry in 2010 after the FDA began consideration of whether or not the labels should be mandatory. One issue regarding the display of nutrition information is whether to include added sugar contents on FOPs. The Institute of Medicine (IOM) highlighted several flaws with displaying added sugar information on FOP labels in their phase I study of FOP labeling: 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) only displaying 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. However, in phase II of the study published in 2011, the IOM committee reconsidered added sugar based on the 2010 DGA and recommended including added sugar as one of the avoidable nutrients along with solid fats (saturated and *trans* fats) and sodium (IOM (Institute of Medicine) 2011).

While considering whether or not to include added sugar on labels, several questions are raised: 1) how knowledgeable consumers are with regards to different sugar types; 2) how concerned consumers are about various sugar types; and 3) how consumers knowledge of and concern for sugar impact their perception of how healthy beverages are. To answer these questions, the study first investigates consumers' sugar knowledge and concern for three types of

sugar: total sugar, added sugar, and natural sugar. The second objective is to determine how these variables impact the perception of how healthy a beverage is.

Weaver (2003) found that added sugar consumption is significantly related to sugar labels of the food rather than general nutrition labels, implying that consumers' eating habits are directly linked to what they are interested in monitoring.

Furthermore, the study elucidates the effect of labels with added-sugar content on beverages in three classifications: those which include no added sugar (100% juices); those with both added and naturally occurring sugar (sugar sweetened beverages); and those with no sugar (diet soft drinks), as well as how the information is presented (i.e., mandatory or voluntary labeling of added sugar). To examine consumer perceptions of different labels, labels were designed based on the format developed by the Food and Marketing Institute (FMI) and the Grocery Manufacturer' Association (GMA) called "Facts Up Front" (formerly known as "Nutrition Keys"). Facts Up Front includes both negative and positive nutrition information, therefore it provides a useful application to determine how consumers react to different information on FOPs. This study will contribute to the discussion on how different nutrition information formats impact consumer perception of beverages and provide fundamental knowledge to policy makers who are interested in the relative importance between sugar and added sugar contents on beverage perception changes.

Literature

Nutrition information on food packages contributes to improving nations' healthy food choices (Kim, Nayga et al. 2001; Driskell, Schake et al. 2008; Kiesel, McCluskey et al. 2011). Consumers who used nutrition labels tend to consume less calories from fat and saturated fat

(Kim, Nayga et al. 2000) and to eat a diet low in fat (Finke 2000). In addition, consumers evaluated food products displaying nutrition labels as more valuable than non-labeled products (Loureiro, Gracia, and Nayga, 2006). Loureiro et al (2006) found that consumers were willing to pay approximately 11% higher for a box of cookies with a nutritional label than one without such a label. A similar result can be found in the study conducted by Drichoutis, Lazaridis, and Nayga (2009), where consumers were generally willing to pay approximately 5.9% of the original price for nutritional information on the food products.

Other studies have investigated the effect of nutrition information format on consumer preferences. Generally, consumers prefer to look at short and simple nutrition information (Levy and Fein 1998; Williams 2005; Grunert and Wills 2007; Andrews, Burton et al, 2011). In the United States, Andrews, Burton, and Kees (2011) found that consumers were more favorable towards simple labels (i.e. Smart Choice) over complex labels like the traffic-light nutrition label system. Stranier, Balid, and Banterle (2010) found a high portion of consumers used nutrition claims rather than nutrition labeling and consumers who use nutrition claims did not read nutrition labels. Becker and Murphy (1993) and Berning, Chouinard, and McCluskey (2008) show that nutritional information may act as a complement to the consumption of products with unknown nutritional quality, similar to the way advertisements complement advertised goods.

Some studies have identified consumers who are more likely to consume added sugars based on demographic characters (Bowman 1999; Krebs-Smith 2001; Thompson, McNeel et al. 2009). These studies have found that: 1) the intake of added sugars was higher among males than females and inversely related to age, educational status, and family income; and 2) Asian-

Americans and Hispanics had lower intake of added sugars while African-American non-Hispanics consumed high amounts of added sugars

Weaver (2003) focused on the impact of nutrition label use on the consumption of added sugars using the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) data. In the data, added sugar consumption was measured in teaspoons. 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. He also differentiated by distinguishing use of sugar label information from the use of general label information. The author 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.

Previous research has not evaluated the impact of added-sugar information from FOP labels on consumers' perception of how healthy the food is. Even though Weaver (2003) found a negative relationship between sugar label users and added-sugar intake, his study is limited to direct interpretation of the expected impact of added sugar contents on consumer perception changes. Hence, we focus on understand the impact of added sugar information of food labels on consumer perception of how healthy a product is across differently implemented types of added-sugar information (i.e., voluntary versus mandatory). By studying perceptions of beverages, we are able to classify consumer perception of different types of sugar (naturally-occurring, total and added sugar).

Method

The data collected in this study was from a web based consumer survey in the United States. A random sample of 1,010 consumers was recruited through a national survey panel. A summary of the demographics of participants is provided in Table 1. As background information, participants were asked questions about their beverage consumption patterns, nutrition knowledge, health conditions, food label usage, and demographics.

To determine how knowledgeable consumers were about sugar, participants were asked a variety of questions. First, they were asked to select what types of sugar they believed each of the beverages contained (from choices of artificial sweeteners, sugar, added sugar, and natural sugar). To help participants' understanding of the terms, examples were provided for the types of sugar, such as Splenda® or Aspartame for artificial sweeteners and high fructose corn syrup for added sugar. Participants were also asked to select three nutritional characteristics that they were most concerned about when deciding what beverage to drink: calories, saturated fat, trans fat, cholesterol, sodium, dietary fiber, total sugar, added sugar, protein, vitamins and minerals, natural sugar, calcium, iron, caffeine, and potassium.

Additionally, participants were shown a series of beverage labels designed to control other factors influencing consumers' perception. The labels included the generic name of beverage on a gray background. Hence, the labels are not associated with a brand effect or color effect. Serving units are fixed at 8 fluid ounces for all beverages in order to provide comparable nutrition information. An example of the plain label is shown in Table 2. In addition to plain labels, labels with FOP nutrition labels (placed at the upper-right corner of the food packages) were also presented.

Beverages presented included eight representative non-alcoholic, cold beverages typically found in a grocery store and were selected to represent specific categories of sugar content. Nutrition information for the beverages is summarized in Table 3. The eight beverages can be categorized into three groups based on sugar and added-sugar content. The first group includes beverages containing sugar, but no added sugar: three 100% fruit juices (grape, apple, and orange). The second group contains beverages including added sugar: regular soft drinks, sports drinks, fruit drinks, and fruit cocktail (i.e., sugar sweetened beverages (SSBs)). The last group includes beverages containing no sugar (naturally occurring or added): diet soft drinks. Comparing between the first and second groups allows us to focus on the effect of added sugar information on perceptions. Similarly, the effect of sugar can be derived by comparing the first and the third groups.

Three FOP labels were designed for this study. The first is similar to the FOP label "Facts Up Front." This label displays four major nutritional facts: calories, saturated fat, sodium and sugars. 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 (DV) per serving of the nutrients: potassium, fiber, protein, vitamin A, vitamin C, vitamin D, calcium and iron. The two positive pieces of nutritional information are presented in columns Tab 1 and Tab 2 in Table 3. To investigate the impact of added sugar information, two scenarios were developed based on the "Facts Up Front" FOP format. In one case, added sugar was included on the mandatory sugar tab with the first four nutritional facts. In the second case, added sugar was considered voluntary and included as a positive characteristic if no added sugar was included in the beverage. Examples of the labels are shown in Table 2. For SSBs, the amount of added sugar was estimated by first determining the quantity of naturally occurring

sugar based on percent juice content, and subtracting from total sugar. (For example, in a beverage with 5% orange juice, natural sugar was calculated as 5% of sugar in 100% OJ. The difference between this and total sugar on the SSB label was used to estimate added sugar content). With the voluntary application of added sugar, manufacturers will display this information as long as it helps to encourage beverage consumption. Hence, one of positive nutrients on the right side will be replaced by 'Added sugar 0g' (i.e., no added sugar) for beverages containing no added sugar (100% fruit juices).

To reduce respondent burden, participants were first given plain labels and asked to rate how healthy each of the beverages was on a 9-point Likert scale without any FOP nutrition information, and then assigned randomly to one of the three FOP label scenarios.

Econometric Analysis

Consumers health perceptions were measured using a 9 point Likert scale (where 1 was very unhealthy and 9 was very healthy). To interpret the impact of the FOP label, the differences between the rating from the three different types of nutrition labels and the plain label were calculated. That is, the values indicate how much consumer perception of how healthy a beverage is has been changed based on nutrition information:

$$Y_{ik} = BP_{ik} - BP_{i0},\ i = 1, 2, 3 \qquad (1)$$

where BP_{ik} is the health perception for the ith beverage group given the kth type of nutrition label, with 0 indicating plain label. The subscript i indicates three beverage groups, 1 for 100% fruit juice, 2 for SSBs and 3 for Diet soft drink. Y_i is beverage perception changes for beverage group i (e.g., the change in rating for 100% fruit juice when comparing the optional or

mandatory added sugar label to the plain label), Let $k=1$ be the standard Facts Up Front design, $k=2$ adds the voluntary added sugar information, and $k=3$ adds mandatory added sugar information.

The FOP labels may change consumers' beverage perception in either a positive or negative direction. When Y_{ik} is greater than 0, the k th FOP label led to a healthier perception. When it is less than 0, the FOP nutrition label led to a less healthy perception. Y_{ik} is equal to 0 when the FOP nutrition label did not change consumer perception. As each rating could be a minimum of 1 to a maximum of 9, the difference variable has a range of –8 to 8, leaving a dependent variable with 17 categories. Thus, an ordered logit model was used to determine the influence of different implementation of added sugar labels across three beverage groups on consumers' perception changes. The underlying response model is:

$$Y_i = X_i^{'}\beta_i + \varepsilon_i \qquad (2)$$

where X_i is a linear index of observable characteristics, and ε_i is unobservable characteristics. The estimated parameter β_i is the partial effect of the corresponding observable characteristics controlling for other variables in the model.

To empirically measure the impact of added sugar information on consumers' health perception, dummy variables are created to distinguish FOP labels, L_k. Dummy variables for FOP nutrition labels are normalized using un-weighted ANOVA-type normalization (Powers and Xie 2008, p. 85). Hence, in the model in Equation (3), DL indicates the difference of FOP dummy variables between FOP labels with added sugar and FMI labels (no added sugar) i.e., $DL_2 = L_2 - L_1$ and $DL_3 = L_3 - L_1$. Hence, the parameter β_{ij} measures the partial effect of FOP

labels with added sugar (optional or mandatory) compared to FOP labels with no added sugar on the *i*th beverage category.

$$Y_i = \alpha_i + \sum_{j=2}^{3} \beta_{ij}(DL_j) + \sum_{l=1}^{4} \gamma_{il}(\text{sugar knowledge})_l + \sum_{m=1}^{2} \lambda_{im}(\text{sugar concern})_m + \sum_{n=1}^{4} \pi_{in}(\text{demographic})_n + \sum_{o=1}^{2} \rho_{io}(\text{diabetes level})_o + \varepsilon_i \quad (3)$$

Scores associated with the individual's sugar knowledge are measured by the average of answers to the questions about the types of sugar contained in each type of beverage. Consumers' concerns about total sugar and added sugar are specified with dummy variables. As previous studies have found relationships between added sugar consumption and socio-demographics, age, gender, education and income are included as demographic variables (see table 1 categories used). Additionally, variables about the individual's health condition were included as they might influence a person's beverage choices. The health variables include if the person is diagnosed with pre-diabetes or diabetes and those taking diabetes medication.

Consumer Sugar knowledge

Consumers' sugar knowledge is shown in Table 4. Over 98% of participants know that 100% fruit juice does not contain artificial sweeteners, SSBs contain sugar, and diet soft drinks do not have natural sugar. However they are relatively less knowledgeable about added sugar and natural sugar compared to total sugar. For example, about 10% of participants believe that 100% fruit juice contains added sugar. In addition, only about 76% of participants know 100% fruit juice contains natural sugar. Although the sugar contained in SSBs is largely added sugar, only 62% of participants recognize that SSBs contain added sugar. Also, although 100% fruit

juice and SSBs all contain sugar, the percent of consumers who believe 100% fruit juice contains sugar are lower than the percent of consumers who believe SSBs contain sugar. This may influence the effect of FOP nutrition labels on consumer beverage perception as the labels may provide unexpected information (sugar content) more often for the drinks containing only natural sugar (100% fruit juice) compared to those containing added sugar (SSBs).

A second measure of sugar knowledge was based on a comparison of the eight beverages. Participants were asked to identify the three beverages with the largest amount of sugar from thirteen different beverages (including the eight used in this study). The comparison between the actual sugar amount and consumers' sugar perception for thirteen beverages is shown in Figure 1. At first glance, consumers' sugar perception seems to follow added sugar amounts instead of total sugar. Generally, 100% juices contain the highest amounts of sugar, but consumers believe that SSBs contain more. The three beverages with the most sugar are 100% grape juice, fruit cocktail, and 100% apple juice while consumers believe that regular soft drinks, sports drinks, and fruit drinks are the top three. This result also appears to support the idea that the sugar information on FOP labels may surprise consumers in opposite directions – with 100% fruit juices containing more sugar than expected and SSBs containing sugar that was expected, or was less than expected.

Consumer Sugar Concerns

Over half (51%) of the respondents indicated total sugar one of their top three concerns, followed by calories and added sugar (47% and 39%, respectively). Even though the NFP does not provide added sugar information, consumers appear to react to the phrase. Only 9% of participants answered that natural sugar is one of top three nutrients that concern them. The

correlations among sugar concerns were very weak; correlation between total sugar and added sugar concern is -0.05, correlation between total sugar and natural sugar is -0.06, and correlation between added sugar and natural sugar is 0.06. All correlations are statistically significant at the 90% confidence level. This weak correlation implies that few consumers were commonly concerned all three types of sugars. In the other words, consumers who are concerned about total sugar are not likely to be concerned about added sugar or natural sugar. Interestingly, the negative correlation between total sugar and added sugar implies that consumers concerned about total sugar are less likely to be concerned about added sugar. This may indicate some consumer misunderstanding about types of sugars.

Econometric Results

Results from the three models of each beverage group are shown in Table 5. The estimated parameters can be interpreted as perception changes of how healthy the beverages are increase if covariates have positive parameters. For example, since the sign of the age parameter for 100% fruit juice is positive, the odds of increasing the perception of how healthy the juice is after seeing the label increases as the respondent's age increases.

First, perception changes of how healthy the beverages are compared with FOP nutritional labels to without FOP labels according to intercepts and covariates excluding the difference of FOP dummy variables between FOP labels with added sugar and without added sugar, *DL*. Most intercepts are statistically significant for all three models. The cumulative probability of perception change categories given no covariates effect (i.e., using intercepts) is illustrated in Figure 2. The cumulative probability of consumers' unchanged and increased perception changes (from 0 to 8) is the highest for diet soft drinks (87%) followed by SSBs

(67%) and 100% fruit juices (46%). This implies that FOP nutritional labels lead to increasing perception changes for beverages with no sugar compared to beverages with sugar.

Consumers' sugar knowledge about artificial sweeteners and added sugar is significantly related to perception changes for 100% fruit juices and SSBs. Change in perception is likely to decrease for participants that believe that 100% fruit juice or SSBs contain artificial sweeteners. Consumers who believe 100% fruit juice contains added sugar are likely to decrease perception changes compared to consumers who do not but consumer who believe that SSBs contains added sugar are likely to increase perception changes compared consumer who do not. This result implies that the misunderstanding of sugar content for 100% fruit juices leads to a decrease in health perceptions when information about sugar is given. This may be explained that sugar information for 100% fruit juice may surprise consumers leading to a negative reaction, regardless of the type of sugar. In addition, although consumers correctly understand that SSBs contain added sugar, this knowledge leads to an increase in perception of how healthy SSBs are with FOP nutritional labels. This result may verify that sugar information may not be breaking news to consumers since consumers understand that SSBs are sugary. The level of sugar knowledge does not significantly relate to perception changes of how healthy diet soft drinks are given FOP nutritional labels.

Consumers who are concerned about total or added sugar react differently to the labels across beverage groups. Consumers who are concerned with total sugar are only significantly likely to have a lower perception of 100% fruit juice while consumers who are concerned about added sugar are not significantly more or less likely to change their perception with FOP nutritional information.

The two variables related to consumers' health condition measure if the degree of perception change depends on the seriousness of their diabetes. Consumers who indicated they are at-risk for diabetes, or have diabetes but are not taking medication, did not tend to change their perception of any of the beverage groups. In contrast, consumers who are currently taking diabetes medication or insulin showed a significant decrease in perception of how healthy diet soft drinks are with FOP labels.

The effect of demographics on health perception changes vary across the beverage types. Age was only significant for the SSBs model, where older people were likely to decrease their ratings for this product with FOP labels. Education impacted perceptions of 100% fruit juice and SSBs; those with more education were more likely to increase how healthy they perceived the beverages are with FOP information. Males were more likely to increase their perception for 100% fruit juice with FOP labels than were females. Income does not differently change perception of any of the three beverage groups.

Second, perception changes of how healthy the beverages are compared FOP labels with added sugar and without added sugar. The effect of added sugar information on FOP labels varies across beverage groups. The FOP labels with voluntary added sugar where one of the positive nutrients is replaced with 'added sugar 0 gram', led only to a significant decrease in perception of 100% fruit juices, implying that the positive nutrition information about vitamins that was replaced transmitted a healthier image than including the 0 added sugar information. Including added sugar as a voluntary option does not change perception of how healthy SSBs are compared to the regular FOP labels (i.e., FMI/GMA FOP labels). This is expected as SSB labels

would not change with voluntary adoption of added sugar information (with the assumption perceived negative information – added sugar content – would not be included if not required).

However, the FOP nutrition label with mandatory added sugar information (all beverages showing total and added sugar on FOP) significantly leads to a decrease in the perception of how healthy SSBs are. This is also expected as these beverages contain added sugar, which is expected to be seen as a negative for most consumers. Even though both 100% fruit juice and SSBs display a comparable amount of total sugar, consumers seems to respond more strongly to the negative information of added sugar in SSBs rather than to positive information no added sugar in 100% fruit juice. For diet soft drinks, both FOP labels with added sugar information do not significantly impact consumers' perception changes of how healthy the beverages are compared to the FOP labels with no added sugar information. Since FMI/GMA FOP labels already display '0g of sugar', additional information about sugar (or added sugar) would not be expected to provide additional input to consumers.

Conclusions

Recently, interest in added sugar intake has been increased due to the positive relationship between sugar intake and weight gain and/or obesity and the high dependence of American diets on added sugar. However, added sugar information is limited on current beverage labels, a common source of added sugar in the American diet. To respond this issue, the discussion of introducing added sugar content on FOP labels is undergoing. Based on the authors' knowledge, there is little previous research investigating the effect of added sugar information of FOP labels on consumer perception of how healthy beverages are. It could be argued that if the goal of providing this information is to limit the consumption of added sugars,

the inclusion of this information on labels should lead to an increase in perception of how healthy beverages without added sugar are, or at the least, a decrease in perception of how healthy beverages with added sugar are. To investigate the impact of added sugar information, we classified beverages into three groups based on their sugar content: 1) 100% fruit juices (containing sugar but no added sugar), 2) SSBs (containing sugar and added sugar), and 3) diet soft drinks (containing no sugar).

First, we examined how the perception of how healthy the beverages are would change with FOP nutritional labels compared to without FOP labels. FOP nutritional labels led to increased perceptions of how healthy diet soft drinks are (beverages with no sugar). However, FOP nutritional labels led to a decrease in perception of how healthy 100% fruit juices (containing sugar, but no added sugar) are. Since many consumers do not consider 100% fruit juice as sugary drink, displaying amount of sugar for 100% fruit juice may not be what was expected, hence resulting in the decrease in perception.

We also examined the impact of including added sugar information on FOP labels, both in a voluntary position (only included if a positive) and a mandatory position (included whether positive or negative). The results generally indicate that added sugar information seems to play an important role in perception changes when the beverages contain added sugar. In other words, if a beverage does not contain added sugars (whether it contains natural sugar or no sugar), added sugar information on FOP labels does not lead to a significant change in perception of how healthy the beverage is. This implies that to get any result from including added sugar information, it would need to be included as a mandatory component of the label (so it is providing when the beverage contains added sugar). Another way of stating this is that while the

presence of added sugar was seen as a negative, the absence of added sugar was not seen as a positive.

Although our study focuses on perceptions and not purchase and consumption decisions, the result implies that FOP labels with mandatory added sugar information could be effective if the purpose was to reduce added sugar consumption. FOP labels with mandatory added sugar information led a decrease in perception of how healthy beverages with added sugar are, while not impacting the perception of other types of drinks. Further research would be needed to see if these decreases in perception result in changes to consumption.

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Table 1. Sample descriptive statistics

Variable	Variable Description	Sample (N=1,010) %	U.S. Census %
Gender	Male	44.3	48.5[1)]
Age	<40	30.6	36.7[2)]
	40-60	40.5	37.9[2)]
	>60	28.9	25.3[2)]
Household income	Under $25,000	22.2	25.7
	$25,000 to $49,999	34.2	24.7
	$50,000 to $74,999	21.3	17.7
	$75,000 or more	22.3	31.9
Education	Less than HS	2.2	12.9
	HS and some college	61.4	57.2[3)]
	College and more	36.5	29.9[3)]

1) Age 18 and over.

2) Age 20 years or more

3) Completed 4 years of high school and more and 4 years of college or more

Table 2. Examples of Food Package and Front-of-Package Nutrition Information

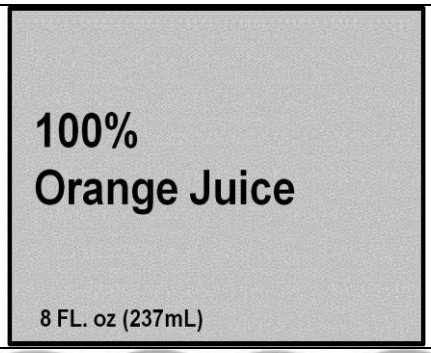
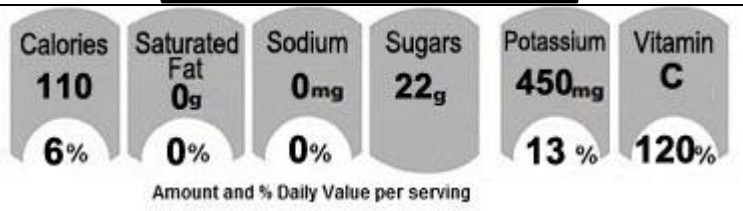
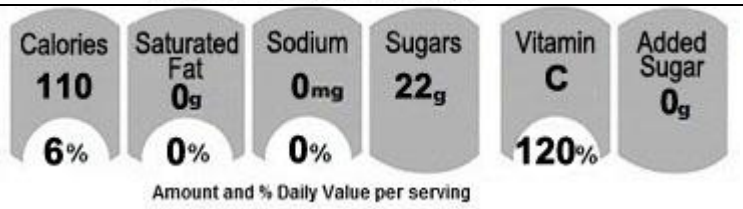
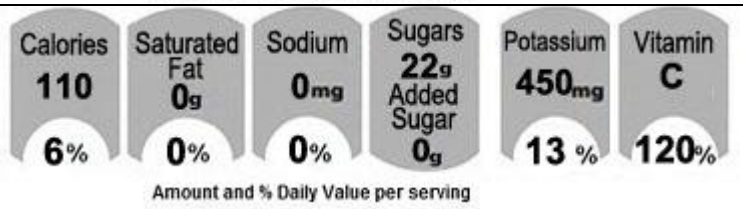
Plain Food Label	
Control FOPs (Facts Up Front)	
Experiment FOPs (Optional Added Sugar)	
Experiment FOPs (Mandatory Added Sugar)	

Table 3. Beverage nutrition contents used on the FOP label

	Calories	Sat. Fat	Sodium	Sugar	Positive Nutrients		Added Sugar
		(g)	(mg)	(g)	Tab1	Tab2	(g)
Regular Soft Drink	93	0	33	26			26
Diet Soft Drink	0	0	27	0			0
Sports Drink	50	0	110	14			14
Fruit Drinks	90	0	170	20	VIT C100%		19
Fruit Cocktail	135	0	34	34	VIT C100%		25
100% Apple Juice	120	0	10	28	VIT C 20%		0
100% Grape Juice	140	0	15	40	VIT C120%		0
100% Orange Juice	110	0	0	22	VIT C120%	Potassium 450 mg	0

Table 4. Consumers sugar knowledge

	Contain artificial sweetener (%)	No sugar contained (%)	Contains added sugar (%)	Contains natural sugar (%)
100% fruit juice	1.62	10.59	9.97	75.87
Sugar sweeten beverage (SSB)	16.41	2.15	61.73	22.50
Regular soft and sports drink	19.01	1.63	67.48	10.20
Fruit based SSB	13.81	2.67	55.99	34.80
Diet soft drink	89.70	24.26	25.15	2.28

Table 5. Estimated results of ordered logit model

Variable	100% fruit juice		SSBs		Diet Soft Drink	
	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Intercept 8	-	-	-7.600***	(0.721)	-4.368***	(0.454)
Intercept 7	-6.987***	(0.528)	-6.212***	(0.381)	-4.077***	(0.423)
Intercept 6	-	-	-4.852***	(0.229)	-3.044***	(0.354)
Intercept 5	-6.175***	(0.375)	-4.027***	(0.186)	-2.472***	(0.336)
Intercept 4	-4.898***	(0.246)	-3.132***	(0.162)	-1.820***	(0.324)
Intercept 3	-4.116***	(0.209)	-2.386***	(0.153)	-1.194***	(0.319)
Intercept 2	-3.038***	(0.185)	-1.524***	(0.148)	-0.499	(0.316)
Intercept 1	-1.977***	(0.176)	-0.712***	(0.146)	0.247	(0.316)
Intercept 0	-0.159	(0.172)	0.713***	(0.146)	1.900***	(0.322)
Intercept -1	0.766***	(0.173)	1.512***	(0.148)	2.802***	(0.332)
Intercept -2	1.543***	(0.175)	2.348***	(0.152)	3.676***	(0.355)
Intercept -3	2.224***	(0.181)	3.114***	(0.161)	5.210***	(0.472)
Intercept -4	3.078***	(0.195)	3.985***	(0.182)	6.603	(0.773)
Intercept -5	3.714***	(0.216)	4.689***	(0.215)	-	-
Intercept -6	4.556***	(0.265)	5.587***	(0.288)	-	-
Intercept -7	4.903***	(0.295)	6.164***	(0.363)	-	-
FOPs optional added sugar	-0.075*	(0.046)	0.008	(0.04)	-0.054	(0.08)
FOPs mandatory added sugar	0.067	(0.046)	-0.114***	(0.04)	0.099	(0.08)
Sugar knowledge (artificial sweetener)	-0.954***	(0.333)	-0.181*	(0.108)	-0.188	(0.188)
Sugar knowledge (total sugar)	0.080	(0.121)	0.342	(0.33)	0.090	(0.137)
Sugar knowledge (added sugar)	-0.420***	(0.131)	0.254***	(0.093)	-0.017	(0.138)
Sugar knowledge (sugars naturally occurred)	0.095	(0.095)	0.070	(0.103)	-0.546	(0.385)
Sugar concern (total sugar)	-0.252***	(0.067)	0.044	(0.057)	0.180	(0.115)
Sugar concern (added sugar)	0.105	(0.068)	-0.081	(0.058)	0.024	(0.116)
Age	0.015	(0.057)	-0.196***	(0.049)	-0.101	(0.098)
Education	0.147***	(0.045)	0.085**	(0.038)	-0.057	(0.077)
Gender	0.202***	(0.067)	-0.078	(0.058)	0.122	(0.115)
Income	-0.001	(0.032)	0.026	(0.028)	-0.017	(0.056)
Diabetes (Diagnosed)	-0.178	(0.126)	-0.069	(0.109)	0.220	(0.218)
Diabetes (Taking medication)	-0.090	(0.158)	-0.133	(0.136)	-0.473*	(0.273)
No. of obs.	3,030		4,040		1,010	
Wald Test	78.054		62.569		12.185	
(p-value)	(0.000)		(0.000)		(0.591)	

Note: *, ** and *** denotes significance at the 10%, 5%, and 1% level, respectively.

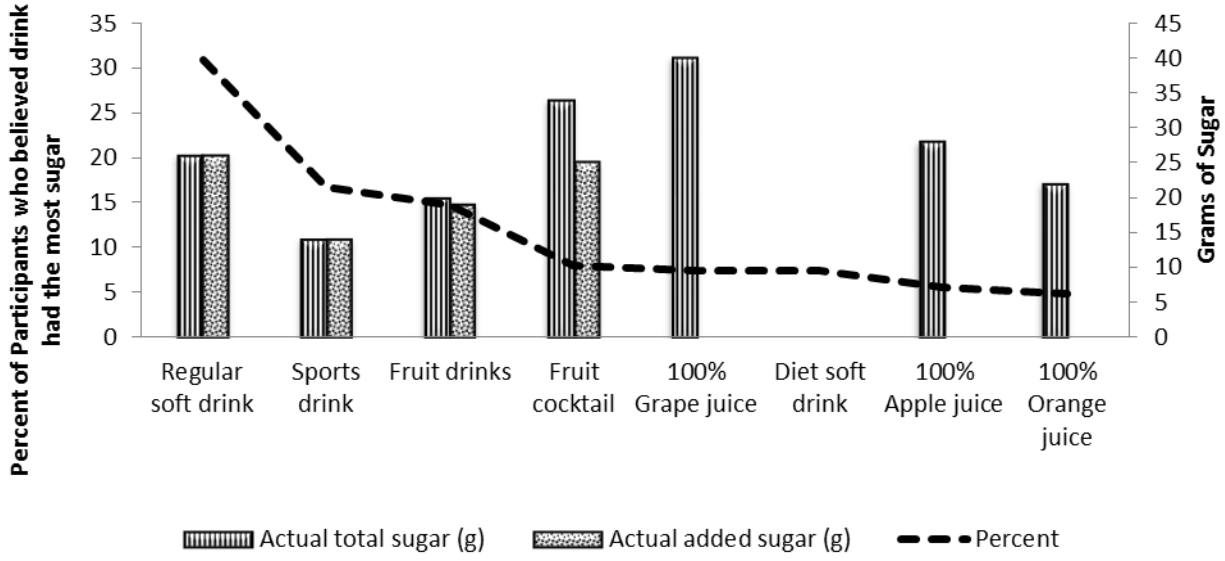


Figure 1. Conparision of consumers sugar knowledge to real sugar contents acorss beverages

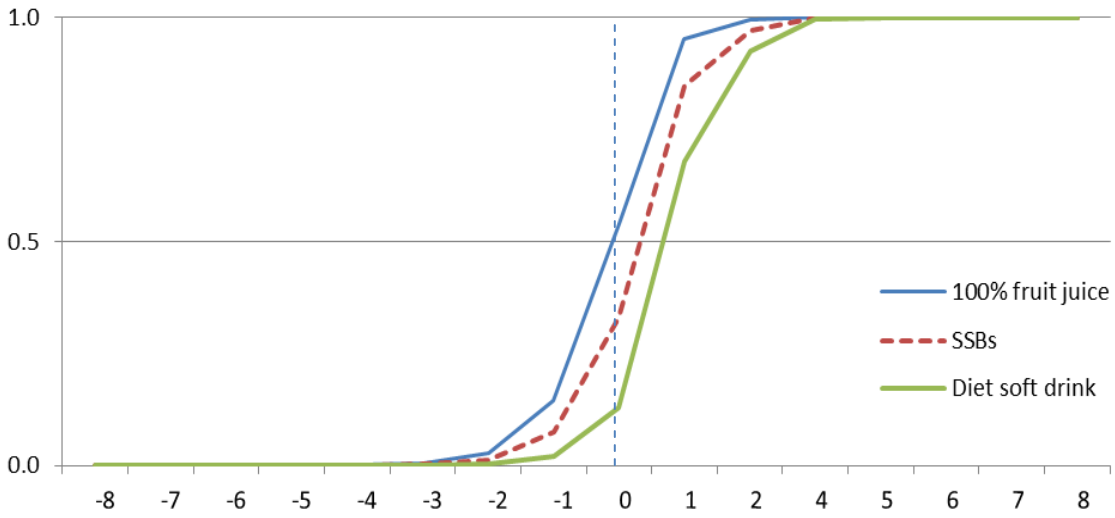


Figure 2. CDF of perception changes of how healthy the beverages are with FOP labels