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Research report

# The Smart Choices front-of-package nutrition label. Influence on perceptions and intake of cereal ☆

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ABSTRACT

Numerous front-of-package (FOP) nutrition labeling systems exist, but it is unclear if such labels influence behavior. A single-summary label called Smart Choices (SC) appeared briefly on products in the United States in 2009. The current study aimed to evaluate (1) the influence the SC symbol has on the serving and consumption of cereal; and (2) the impact of providing calorie and serving size information on a FOP label. Two hundred and sixteen adults were randomized to a high-sugar breakfast cereal that had either (1) no label; (2) the SC symbol; or (3) a modified SC symbol with serving size information. Participants rated perceptions of healthfulness, taste, and purchase intent, estimated calories per serving and poured and ate the cereal for breakfast. Participants in the SC label conditions were better able to estimate calories per serving, but there were no differences across groups on perceptions of healthfulness, taste, purchase intent, and levels of vitamins, and sugar or amount of cereal poured or consumed. These results suggest that calories per serving information on FOP labels can increase knowledge, but the SC symbol had little impact on behavior. Studies examining FOP label influence on purchasing, consumption, and product reformulation are greatly needed to determine label utility.



## Introduction

Front-of-package (FOP) food labeling has been at the forefront of current food policy discussions in the United States. The US Food and Drug Administration (FDA) (2009) and the Institute of Medicine (IOM) (2009) have undertaken efforts to provide science-based guidance for a uniform FOP labeling system. Some countries have recommended labeling systems like the Multiple Traffic Light (MTL) developed by the United Kingdom's Food Standards Agency (FSA) (2010), while other countries such as the Netherlands, have adopted the "Choices" logo (Choices Programme, 2010; Dotsch-Klerk & Jansen, 2008). However, in most countries, including the US, many different labeling systems exist (Schor, Maniscalco, Tuttle, Alligood, & Kapsak, 2010) leading to consumer confusion (US Government Accountability Office, 2008).

The Keystone Food and Nutrition Roundtable was formed in 2007 to address the problem of varied FOP labels with different nutrition criteria in the US. The group, composed of "scientists, academicians, nutrition educators, public health organizations, food manufacturers, retailers, and government observers," (Lupton et al., 2010) developed the Smart Choices Program. As part of the program, nutrition criteria were specified to classify products within a food or beverage category as a "better-for-you" choice. Products meeting the nutrition standards earned a Smart Choices label that contained a green checkmark and text that read "Smart Choices Program Guiding Good Choices" in addition to calories per serving and servings per package information (Lupton et al., 2010).

The Smart Choices Program was introduced in the US in August 2009 and was instantly met with skepticism over products like Kellogg's® Froot Loops and General Mills® Cookie Crisp cereals bearing the Smart Choices logo (Neuman, 2009). Following media suspicion as well as pressure from the FDA (Taylor & Mande, 2009), a Connecticut congresswoman, (Delauro, 2009) and the Connecticut Attorney General (2009), the Smart Choices Program announced it would postpone operations (Metcalfe, 2010). Prior to the announcement, the FDA (2009) also indicated it would begin its FOP labeling initiative.

The FDA has identified a need for FOP studies on consumer understanding of FOP symbols and the ability of these symbols

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to guide consumer behavior. One important research question is whether a single-summary symbol like the Smart Choices logo, which identified certain foods as being "better-for-you," are easier to understand and use than a more complex symbol like the traffic light system, which provides information about different nutrient levels in a food. Some research finds that consumers want simple labels, (Lando & Labiner-Wolfe, 2007; Malam, Clegg, Kirwin, & McGinigal, 2009; van Kleef, van Trijp, Paeps, & Fernandez-Celemin, 2008), but the MTL label has been shown in several studies to effectively help consumers identify the healthier of two products (Borgmeier & Westenhoefer, 2009; Gorton, Ni Mhurchu, Chen, & Dixon, 2009; Kelly et al., 2009).

While the Smart Choices nutrition criteria were called into question, the actual FOP symbol created for the program might be a useful way to convey nutrition information. The only study to our knowledge that has examined the Smart Choices label found that a frozen chicken dinner bearing the logo (despite containing high levels of certain nutrients to limit), led to increased perceptions of the product's healthfulness and reduced beliefs that eating the food regularly would lead to heart disease or weight gain. In addition, compared to a no logo control group, participants who saw the Smart Choices label on the meal viewed it as having fewer negative nutrients. The symbol also promoted favorable product attitudes and purchase intentions. These findings suggest that the appearance of a Smart Choices symbol on a food containing high levels of specific nutrients to limit can increase perceptions of product healthfulness (Andrews, Burton, & Kees, 2011).

A number of studies have evaluated different FOP labels and their influence on perceptions and knowledge, but there are very few studies examining the impact FOP labels have on food intake. Such studies are especially important to conduct given findings that health claim labels such as "low-fat" can lead to the overconsumption of foods carrying those labels (Chandon & Wansink, 2007). The potential "health halo" effect (Nesbett & Wilson, 1977) that might be caused by FOP labels could be problematic if it promotes overconsumption of foods, even if they are healthier than other choices within a food category. One study investigating the Choices logo found that it did not increase consumption of chocolate cake bearing the symbol (Steenhuis et al., 2010), but few studies have examined the influence FOP labels have on consumption of healthy and less healthy foods. Another important, but understudied consideration, is how FOP labels impact taste perceptions. Several studies have found that health claim labels can negatively bias individuals' taste perceptions, (Kahkonen & Tuorila, 1998; Wansink & Park, 2002) suggesting that FOP labels might do the same.

In addition to examining how FOP labels impact food intake and perceptions, another key question is how kilocalorie (calorie) and serving size information should be presented on the label, if at all. Consumers report that calorie information is one of the most frequently examined elements on nutrition labels (Malam et al., 2009; van Kleef et al., 2008), particularly for those trying to lose weight (Malam et al., 2009). Calorie information appears on FOP labels like the MTL, but other single-summary indicator systems do not include this information. The Smart Choices symbol, however, included calories per serving and servings per package information, but few studies have examined the influence of serving size information alone or in conjunction with calories.

Given these unanswered questions, the aims of the current study were to examine whether the Smart Choices label appearing on a high-sugar cereal impacted (1) consumer knowledge of calories per serving information; (2) consumer perceptions of healthfulness, taste, and purchase intentions; and (3) the amount of cereal poured and consumed in one sitting.

## Methods

The study took place between June and August of 2009 prior to the release of the Smart Choices labeling system. Participants were recruited from the New Haven, CT community for a 30-min consumer market research study about cereal preferences via flyers, word of mouth, and craigslist.com postings. They were told they would be asked to taste a cereal and provide feedback. There were no exclusion criteria for study participation. The study took place in a building on the Yale University campus not affiliated with eating or weight research. Upon arrival at 8 am, participants were seated behind a divider to prevent them from being able to see other participants in the room and informed consent was obtained. To standardize hunger levels, participants were asked to abstain from eating after midnight the evening before the study. All participants were presented with the same cereal, which was a well-known New England supermarket's store brand version of General Mills® Lucky Charms called Rainbow Treasures. A less familiar cereal was used to allow for the testing of the Smart Choices labeling system without the confounding variable of brand familiarity.

The cereal's nutrition information was taken from the Nutrition Facts Panel on the packaging and entered into the Nutrient Profile Model (NPM) developed by Rayner, Scarborough, Boxer, and Stockley (2005). The NPM model is used to classify amounts of saturated fat, salt, and sugars as high, medium or low for the UK FSA traffic light labeling system (2010). Food products overall NPM score is also used by the UK government to identify healthy foods that can be advertised during children's television programming (Lobstein & Davies, 2009) and by the Australian government's *Food Standards Code*, which used a version of this model to determine which products can carry health claims (Food Standards Agency, 2011). The NPM has received support for its validity (Arambepola, Scarborough, & Rayner, 2007; Scarborough, Boxer, Rayner, & Stockley, 2007). Based on the NPM model, the cereal tested in this study was high in total sugars (13 g) and had an overall NPM score of 15, indicating it was a food of poor nutritional quality. The original cereal box contained a FOP label providing information about *trans* fat, cholesterol, and vitamins, which was covered over with a sticker that read "New" to ensure we were only testing the effect of the Smart Choices label. In addition, the supermarket logo was covered up with a sticker to match the box's background (see Table 1 for the cereal nutrition information).

Randomization lists, stratified by gender, were used to assign participants to one of the following FOP label conditions:

1. **No label (control):** A cereal box that did not have a FOP label
2. **Original Smart Choices label (SC with servings per package):** A cereal box that had the original Smart Choices logo which included a green check mark, the statement "Smart Choices Program Guiding Food Choices," and the following information appearing at the bottom of the label: 120 calories per serving and 11 servings per package.
3. **Modified Smart Choices label (SC with serving size)**: A cereal box that had the original Smart Choices logo which included a green check mark, the statement "Smart Choices Program Guiding Food Choices," and the following information appearing at the bottom of the label: 120 calories per ¾ cup serving and 11 servings per package (see Fig. 1 for pictures of each label).

After randomization, participants were told they would be taking part in a focus group about the cereal in front of them and would have a chance to eat the cereal. They were then asked to provide their milk preference (skim, 1%, 2%, whole, soy, Lactaid or no milk) to accompany their cereal. A focus group was con-

**Table 1**
Nutrition facts for stop & shop.

| | | |
|---|---|---|
| Serving size ¾ cup (30 g) | | |
| Servings per container about 11 | | |
| *Amount per serving:* | | |
| Calories | 120 | |
| Calories from fat | 10 | |
| | | % Daily value |
| Total fat | 1 g | 2% |
| Saturated fat | 0 g | 0% |
| Trans fat | 0 g | |
| Polyunsaturated fat | 0 g | |
| Monounsaturated fat | 0 g | |
| Cholesterol | 0 g | 0% |
| Sodium | 160 mg | 7% |
| Potassium | 50 mg | 1% |
| Total carbohydrate | 27 g | 9% |
| Dietary fiber | 1 g | 5% |
| Sugars | 13 g | |
| Other carbohydrate | 13 g | |
| Protein | 2 g | |
| Vitamin A | | 10% |
| Vitamin C | | 10% |
| Calcium | | 10% |
| Iron | | 25% |
| Vitamin D | | 10% |
| Thiamin | | 25% |
| Riboflavin | | 25% |
| Niacin | | 25% |
| Vitamin $B_6$ | | 25% |
| Folic acid | | 50% |
| Vitamin $B_{12}$ | | 25% |
| Zinc | | 25% |

**Smart Choices Front-of-Package Label with Serving Per Package Information**


**Smart Choices Front-of-Package Label with Serving Size Information**


**Fig. 1.** Smart Choices labels.

ducted, during which participants were asked to record their answers on a questionnaire in front of them without talking to the other participants. The questions included key outcome measures as well as filler questions about participants' opinions regarding different aspects of the cereal (e.g. name, color of the box, character on the box) to conceal the study purpose. Once these initial questions were completed, participants were asked to imagine they were in a supermarket shopping for cereals and to examine the cereal box in front of them as they might if they were at the store and thinking of buying it. Participants were then given one minute to inspect the box, during which time they received a large cup (370 ml) of milk based on their preference. They were then instructed to pour cereal for their breakfast and eat as much of it as they liked. After participants finished eating the cereal, the cereal box, bowl, and leftover milk were removed and participants completed a final set of post-meal questionnaires containing questions about the cereal as well as different psychological and demographic variables. Once complete, participants were paid $15 and debriefed about the study's purpose. The Yale University Human Subjects Committee approved this study.

### *Study outcomes*

#### *Accuracy of calories per serving estimate*

After the breakfast meal was complete and the cereal box was removed, participants were asked to provide an estimate of the calories per serving for the cereal. Answers were coded as correct if participants identified the cereal as having 120 calories and incorrect for all other values.

#### *Estimate of total sugars*

After the cereal box was removed, participants were asked to indicate whether the cereal had low, moderate or high amounts of sugar. Based on the NPM criteria, answers were coded as "correct" if participants identified the cereal as high in sugar.

#### *Perception of vitamin amounts*

After the cereal box was removed, participants were asked to indicate whether the cereal had few, moderate or many vitamins.

#### *Perceptions of healthfulness*

Prior to and after eating the cereal, participants were asked to rate how good they thought the cereal would or did taste, using a 9-point Likert scale anchored from "not at all good to very good."

#### *Perceptions of taste*

Prior to and after eating the cereal, participants were asked to rate how good they thought the cereal would taste using a 9-point Likert scale anchored from "not at all good to very good."

#### *Intention to purchase*

Prior to eating the cereal, participants were asked to rate how likely they would be to buy the cereal in the future if they saw it in the store using a 9-point Likert scale anchored from "not at all likely to very likely." After the breakfast meal, participants were also asked how likely they would be to buy the cereal for themselves or for their children if they had any.

#### *Total grams of cereal poured*

Each participant's cereal box was weighed before and after the study using a digital scale accurate up to ±0.1 g. The difference between the pre-breakfast and post-breakfast cereal box weight was used to determine how much cereal was poured for breakfast.

**Table 2**
Outcome measures for lab-based cereal study by front-of-package label condition.[a]

| Study outcome | Front-of-package label conditions | | | | | |
|---|---|---|---|---|---|---|
| | No label control ($N = 69$) | Smart Choices label with servings per package ($N = 76$) | Smart Choices label with serving size ($N = 71$) | Test statistic ($\chi^2$ or $F$) | $p$ | $\eta^2$ |
| Correctly identified 120 calories per serving | 24 (35%) | 46 (61%)[b] | 44 (62%)[b] | 13.20 | .001 | – |
| Correctly identified cereal as high in sugar | 46 (67%) | 46 (61%) | 43 (61%) | .67 | .717 | – |
| Many vitamins | 8 (12%) | 4 (5%) | 11 (16%) | 4.16 | .125 | - |
| Healthfulness[c] | | | | | | |
| Pre-healthfulness | 3.01 ± 1.91 | 3.83 ± 1.88 | 3.43 ± 1.78 | 3.49 | .032 | .032 |
| Post-healthfulness | 3.25 ± 2.17 | 3.79 ± 1.82 | 3.73 ± 1.93 | 1.60 | .204 | .015 |
| Taste[c] | | | | | | |
| Pre-taste | 5.22 ± 1.89 | 5.84 ± 1.78 | 5.43 ± 1.96 | 2.10 | .125 | .019 |
| Post-taste | 5.49 ± 1.88 | 5.83 ± 1.92 | 5.92 ± 2.01 | .930 | .396 | .009 |
| Intent to purchase[c] | | | | | | |
| Pre-intent | 2.57 ± 2.09 | 2.99 ± 2.18 | 3.18 ± 2.20 | 1.49 | .228 | .014 |
| Post-intent | 3.13 ± 2.50 | 3.62 ± 2.46 | 3.80 ± 2.49 | 1.37 | .256 | .013 |
| Buy for children | 3.32 ± 2.84 | 4.00 ± 2.90 | 3.87 ± 2.69 | .37 | .690 | .011 |
| Cereal poured (grams) | 52.78 ± 29.19 | 51.01 ± 27.86 | 57.16 ± 35.30 | .76 | .468 | .007 |
| Total cereal + milk eaten (grams) | 219.86 ± 127.08 | 219.21 ± 133.44 | 232.61 ± 143.68 | .22 | .803 | .002 |

[a] Table values are mean ± SD and $F$ values for continuous variables and $n$ (column %) and $\chi^2$ for categorical variables.
[b] Significantly different than no label control based on Benjamini–Hochberg false discovery rate procedure for multiple tests.
[c] Healthfulness, taste and purchase intent were measured on 9-point Likert scales.

*Total grams consumed*

In addition to weighing each participant's cereal box, the cup of milk was weighed before and after the breakfast meal. Any leftover milk and cereal in the participant's bowl at the end of the breakfast meal was also weighed. Total grams of cereal and milk consumed were then calculated by subtracting the grams of cereal and milk left in the box and cup respectively, as well as the leftover milk and cereal in the bowl, from the original box and milk weights.

*Other assessments*

After the breakfast meal, participants rated, using a 7-point Likert scale, the extent to which nutrition labels generally influence their food and drink choices. They also provided ratings of their hunger prior to the breakfast meal. Participants then indicated if they saw a FOP label on their cereal box, if they looked at the Nutrition Facts Panel on the box and if either influenced how much they ate. Finally, participants were asked a variety of demographic questions regarding age, gender, race/ethnicity, educational level, and height and weight (used to calculate body mass index (BMI)).

*Dietary intent scale*

At the end of the study, participants completed this 9-item self-report measure of dietary restraint, which assesses whether individuals engage in behaviors to lose or maintain weight (i.e. "I eat diet foods in an effort to control my weight" (Stice, Fisher, & Lowe, 2004). This scale has shown internal consistency ranging from .93 to .94 and test–retest reliability (1-month test–retest .92) in past research (Stice et al., 2004). Research has found that existing measures of dietary restraint do not correlate strongly with food intake in lab studies, suggesting that these measures reflect an intention to restrain eating, rather than actual restrained eating behavior (Kral, Roe, & Rolls, 2002; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007; Stice, Sysko, Roberto, & Allison, 2010; Stice et al., 2004). Nonetheless, such measures have been found to moderate response to nutrition information (Aaron, Evans, & Mela, 1995; Chapelot, Pasquet, Apfelbaum, & Fricker, 1995; Kral et al., 2002; Miller, Castellanos, Shide, Peters, & Rolls, 1998; Ogden & Wardle, 1990).

*Study hypotheses*

We hypothesized that participants would be more accurate at estimating calories in the FOP label conditions compared to the no label control condition because calorie information was provided on the label. We also hypothesized that those in the Smart Choices label conditions would perceive the cereal to be lower in sugar, higher in vitamins and healthier overall than the cereal without a FOP label. However, we anticipated that prior to eating the cereal, participants would expect it to taste worse than the no label control cereal, but there would be no difference in taste perceptions after eating the cereal. Despite the possible decrease in taste ratings, we hypothesized that those receiving a cereal with a Smart Choices logo would express greater future purchase intentions. Finally, we expected that participants in the original Smart Choices label condition would pour and eat more cereal than the no label control. Given the serving size information on the modified Smart Choices symbol, we predicted that participants in that group would pour and eat the least amount of cereal.

*Statistical analyses*

Data analysis was performed using SPSS 18.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were calculated for sociodemographic sample characteristics and psychological variables. One-way ANOVAs and chi square tests were conducted to examine potential group differences on these variables.

All continuous study outcomes were compared using one-way ANOVAs and significant differences were followed with post hoc Tukey tests. Eta squared effect sizes were reported for ANOVA analyses and interpreted based on Cohen's guidelines (1998) (small = 0.01, medium = 0.06, large = 0.14). Cohen's $d$ was also calculated as a measure of effect size for post hoc group comparisons and interpreted based on Cohen's guidelines (1998) (small = 0.2, medium = 0.5, large = 0.8). Chi square tests were used to examine categorical outcome variables.

Exploratory interactions were conducted to examine possible moderators of label comprehension. First, a series of two-way ANOVAs were performed to examine possible interactions between FOP label condition and weight status (normal weight versus overweight/obese (defined as a BMI >25 kg/m$^2$)) for all primary out-

comes. Given previous research indicating that dietary restraint (Kral et al., 2002) and nutrition consciousness can moderate the response to nutrition claims (Andrews, Netemeyer, & Burton, 1998) a series of regression models were tested to examine possible interactions between FOP label condition and dietary restraint or reported influence of nutrition labels on food choices. The no label control group was used as the reference category for all analyses. The Benjamin and Hochberg (1995) procedure to control the false discovery rate was applied to determine whether the 12 outcomes tested were statistically significant.

## Results

### *Participant characteristics*

Two hundred forty-three participants completed the study. Twenty-seven participants were excluded because they correctly identified that the study was testing the influence of nutrition information on their perceptions and/or behavior. Therefore, the final sample included 216 participants. The proportion of individuals excluded did not differ significantly across study conditions ($\chi^2(2) = 1.59$, $p = .451$).

Sixty-three percent of the survey respondents were female and the racial/ethnic distribution was: 59% Caucasian, 22% Asian, 11% African American, 4% Hispanic, and 4% reporting "Other." The mean age of the study sample was 26 ± 10 years [range 18–72 years] and the mean BMI was 23.2 ± 4.52 kg/m.$^2$ The following education levels were reported: 42% had attended some college, 27% had a four-year college degree, 22% had a graduate degree, 4% had a two-year college degree, 4% had a high school/GED degree only and 1% did not complete high school. Twenty-two percent of the sample was classified as overweight or obese. The mean reported influence of nutrition labels on food choices was 5.53 ± 1.56 (out of seven), indicating a high level of nutrition label awareness among the sample. The mean pre-meal hunger rating for the sample was 6.88 ± 1.73 (out of nine), suggesting that participants were fairly hungry for breakfast. Ninety-one percent of the sample reported eating cereal at least once per week, with only 9% reporting they ate cereal less than once per month or never.

The study groups did not differ significantly by age ($F(2198) = 2.50$, $p = .085$), BMI ($F(2207) = .71$, $p = .491$), pre-meal hunger levels ($F(2213) = 1.04$, $p = .357$), influence of nutrition labels on food choices ($F(2213) = .822$, $p = .441$), gender ($\chi^2(2) = 1.15$, $p = .563$), race/ethnicity ($\chi^2(8) = 3.82$, $p = .873$), education ($\chi^2(10) = 18.06$, $p = .054$), weight status ($\chi^2(2) = 1.25$, $p = .535$) or frequency of cereal eating ($\chi^2(12) = 9.20$, $p = .686$). As expected, there was a significant difference among groups on reported noticing of a FOP label on the cereal ($\chi^2(2) = 59.21$, $p = .000$), with 80% and 85% of participants indicating they noticed a FOP label in the SC with servings per package group and SC with serving size group, respectively. Thirty percent of the control group also reported noticing a FOP label, suggesting some consumer confusion about what constitutes a FOP label. Overall, 92% of study participants reported looking at the Nutrition Facts Panel on the cereal box and there were no significant differences among groups ($\chi^2(2) = .80$, $p = .572$). Thirty-nine percent reported that the Facts Panel influenced how much of the cereal they ate, which did not differ based on label condition ($\chi^2(2) = 1.40$, $p = .498$).

### *Study outcomes*

#### *Accuracy of calories per serving estimate*

As expected, there was a significant difference among label conditions on the accuracy of calories per serving estimate. Almost twice as many individuals were able to accurately identify the number of calories per serving in the Smart Choices label conditions relative to the no label control.

#### *Estimate of total sugars*

Contrary to our hypotheses, there were no significant differences among label conditions on ability to identify the cereal as being high in sugar. Overall, 63% of participants identified the cereal as high in sugar. Thirty-four percent of participants identified the cereal as having moderate amounts of sugar and only 3% identified the cereal as being low in sugar.

#### *Perception of vitamin amounts*

Inconsistent with our hypotheses, there were no significant differences among label conditions on perceived amounts of vitamins in the cereal. Fifty-five percent of participants viewed the cereal as having moderate levels of vitamins, 34% identified the cereal as having few vitamins and 11% believed the cereal was high in vitamins.

#### *Perceptions of healthfulness*

Initial analyses indicated a significant difference among label conditions on perceptions of cereal healthfulness prior to eating the cereal. While overall pre-healthfulness ratings were relatively low (3.44 ± 1.88), those in the SC Servings per Package group perceived the cereal as healthier than the no label control ($d = .43$, $p = .024$), but there was no difference between the control and the SC serving size label groups ($d = .23$, $p = .379$) or between the two Smart Choices labels ($d = .22$, $p = .305$). However, after applying the Benjamin–Hochberg procedure to control for multiple tests, this finding no longer met the threshold for significance. After eating the cereal, there were no significant differences on perceived healthfulness (overall mean 3.60 ± 1.98, $p = .204$).

#### *Perceptions of taste*

There were no significant differences among label conditions on perceptions of taste prior to or after eating the cereal. Overall, participants believed the cereal would taste reasonably well before trying it (5.51 ± 1.88 out of nine) and also gave it a fairly high taste rating after eating it (5.75 ± 1.94). While this was consistent with our hypothesis that taste ratings would not differ after the cereal was eaten, the hypothesis that the Smart Choices labels would impact pre-meal taste ratings was not supported.

#### *Intention to purchase*

Counter to our expectations, there were no significant differences among groups for intention to purchase the product prior to or after eating the cereal or intention to purchase the product for one's children. Overall, participants reported being unlikely to buy the cereal in the future prior to (2.92 ± 2.17 out of nine) and after eating it (for self: 3.52 ± 2.49; for children: 3.74 ± 2.77).

#### *Total grams of cereal poured*

Unexpectedly, there were no significant differences among label conditions on total grams of cereal poured. Overall, participants served themselves 53.60 ± 30.87 g of cereal.

#### *Total grams consumed*

There were no significant differences among label conditions on total grams of cereal and milk consumed, which failed to support our initial hypotheses. Overall, participants ate 223.88 ± 134.52 g of cereal and milk combined.

There were no significant interactions between label conditions and weight status, dietary restraint, or influence of nutrition labels for any of the outcomes (see Table 2 for results).

## Discussion

As anticipated, the results from this study indicated that both Smart Choices labels were able to increase participant's ability to accurately estimate calories per serving. This finding suggests that calories per serving information coupled with a single FOP summary symbol can improve consumer knowledge of calorie information. Given the high prevalence of obesity, such information is arguably the most critical to include on a label and educate consumers about.

Contrary to our hypotheses, participants did not perceive the cereal as having greater amounts of vitamins or lower levels of sugar. However, while statistically significant differences did not emerge regarding perceptions of cereal healthfulness, the data suggest that more research on single-summary symbols' ability to influence overall health perceptions is warranted. In the case of the Smart Choices program, the potential ability of the symbol to increase perceptions of healthfulness was problematic from a public health perspective because many of the foods carrying the labels were of nutritionally poor quality (Roberto et al., 2011). In contrast, when 294 parents and caregivers in New Zealand viewed pictures of cereals, those who saw a cereal of poor nutritionally quality with the MTL label reported significantly lower health scores compared to a control condition, (Maubach & Hoek, 2008), suggesting that a labeling system such as the MTL might provide more protection against perceiving less healthy foods in a more favorable light. However, if more rigorous nutrition criteria were used as the basis for a FOP labeling system, then a single-summary label like Smart Choices might be useful for promoting healthier foods. Additional research is needed to understand the influence single-summary symbols have when placed on healthier foods and the additional effect of including serving size information. Similarly, neither version of the Smart Choices labels impacted taste perceptions prior to or after eating the cereal. However, given findings that health claims like "reduced fat" (Kahkonen & Tuorila, 1998) or the highlighting of ingredients like soy (Wansink & Park, 2002) can negatively impact taste perceptions, more research is needed regarding how such a label might change perceptions of foods of better nutritional quality.

In contrast to the Andrews et al. (2011) study, we did not observe any differences in purchase intentions for the cereal for oneself or one's children. The disparate study findings might be explained by the differences in the products tested and the samples studied. We examined a generic cereal that generated low purchase intentions across study groups. This highlights the need for more studies examining how FOP labels impact purchase intentions. If a single-summary symbol does not influence purchasing patterns, then a primary goal of a FOP labeling system would not be met.

In terms of consumer behavior, the results from this study indicated that the amount of cereal participants served themselves for breakfast was not influenced by either of the Smart Choices labels. The original Smart Choices label informed consumers that there were eleven servings in the box of cereal. However, such information is likely difficult to translate to a meaningful serving size amount. In contrast, we tested a label that informed consumers that a serving size was ¾ of a cup, which we hypothesized would be easier for consumers to visualize and therefore more likely to influence the amount of cereal poured. However, there were no differences in the amount of cereal poured based on label conditions. Interestingly, across the groups, participants served themselves almost two times the specified serving amount. Currently, the FDA is considering whether to update serving sizes on food products given the mismatch between listed serving sizes and what consumers typically eat (Neuman, 2010). The results from this study confirm these concerns and suggest that altering serving sizes to reflect typical portion sizes might be more useful than including existing serving size information on the FOP label.

Finally, the amount of cereal and milk consumed by participants did not vary as a function of label condition, suggesting that a single-summary FOP logo such as the Smart Choices symbol might have minimal impact on consumer behavior. It is possible that FOP labels, regardless of kind, might minimally impact behavior, but more research is needed to test different labeling systems with different food products. Importantly, the presence of the FOP labels did not reduce frequency of examining the Nutrition Facts Panel. However, the sample reported being very label conscious and was given time to examine the box as part of the study, suggesting that this finding might not generalize well to the larger population. In addition, responses to the two different labeling systems were not moderated by dietary restraint, influence of nutrition information on food choices or weight status indicating that such a label can be interpreted equally across these different groups.

This study has several limitations including a selection bias due to the use of a convenience sample. It is possible that health conscious consumers were more likely to respond to a study about food research, which could explain the greater nutrition knowledge and consciousness in our sample relative to the general population. Therefore, it is possible that the Smart Choices label would have a greater impact on perceptions of health, sugar, and vitamin levels, taste perceptions, and intent to purchase as well as actual consumption among a group of individuals with less nutrition education. The conclusions of this study are also limited by the use of a single, generic cereal product. It is likely that FOP labels interact with different kinds of foods and with familiar brand name products differently. Another limitation is that this study only captured one meal occasion and therefore it remains unknown whether repeated exposure to such a label would influence behavior over time. In addition, because it was difficult to separate the leftover milk from the cereal, we could not determine the breakdown of total cereal versus milk consumed or total calories eaten. Finally, this study was conducted prior to the release of the Smart Choices symbol. It is possible that a consumer education campaign about any FOP labeling system would bolster the impact of the label on consumer behavior.

Despite these limitations, this study contributes to the literature in important ways. First, it is one of the few studies testing the inclusion of easy to understand serving size information on a FOP label. Second and most important, it is one of the few studies examining the impact of FOP labels on the actual portioning and consumption of food. Third, it provides evidence that current cereal serving sizes might not map on well to the portions consumers serve themselves.

It remains unknown whether the Smart Choices program would have impacted sales of products bearing the symbol or consumer consumption, although findings from this study suggest that it would have likely had a limited impact on cereal consumption. One potential positive effect is that such a label would likely improve consumers' ability to estimate calories per serving. Overall, more research is needed comparing single-summary symbols with more complex FOP symbols and the ways in which they impact nutrition knowledge, healthfulness, and taste perceptions as well as purchase intentions. In addition, more studies examining the impact FOP labels might have on actual purchases and food consumption are greatly needed. Finally, research on FOP labeling systems' ability to stimulate product reformulation by the food industry would be immensely useful. Data from one study, for example, has found that the Choices logo used in the Netherlands,

has promoted industry reformulation since its introduction (Vyth, Steenhuis, Roodenburg, Brug, & Seidell, 2010). These data are encouraging, but it will also be important to test how a label such as the MTL impacts industry reformulation since the highlighting of nutrients to limit might provide even greater incentive for industry to alter their products.

## References


Aaron, J. I., Evans, R. E., & Mela, D. J. (1995). Paradoxical effect of a nutrition labeling scheme in a student cafeteria. *Nutrition Research, 15*, 1251–1261.

Andrews, J. C., Burton, S., & Kees, J. (2011). Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. *Journal of Public Policy and Marketing, 30*, 175–190.

Andrews, J. C., Netemeyer, R. G., & Burton, S. (1998). Consumer generalization of nutrient content claims in advertising. *The Journal of Marketing, 62*, 62–75.

Arambepola, C., Scarborough, P., & Rayner, M. (2007). Validating a nutrient profile model. *Public Health Nutrition, 11*, 371–378.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate. A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society, 57*, 289–300.

Borgmeier, I., & Westenhoefer, J. (2009). Impact of different food label formats on healthiness evaluation and food choice of consumers. A randomized-controlled study. *BMC Public Health, 9*, 184.

Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims. Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research, 34*, 301–314.

Chapelot, D., Pasquet, P., Apfelbaum, M., & Fricker, J. (1995). Cognitive factors in the dietary response of restrained and unrestrained eaters to manipulation of the fat content of a dish. *Appetite, 25*, 155–176.

Choices programme (2010). Healthy choices made easy. Retrieved September 2010 from: <http://www.choicesprogramme.org/en>.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). USA: Lawrence Erlbaum Associates.

Connecticut Attorney General. (2009). Attorney general investigates "Smart Choices" food labels that endorse mayonnaise and sugary cereals. Retrieved August 2010 from <http://www.ct.gov/ag/cwp/view.asp?Q=448878&A=3673>.

Delauro, R. (2009). DeLauro calls for FDA investigation into "Smart Choices" labeling. Retrieved August 2010 from <http://delauro.house.gov/release.cfm?id=2653>.

Dotsch-Klerk, M., & Jansen, L. (2008). The Choices programme. A simple, front-of-pack stamp making healthy choices easy. *Asia Pacific Journal of Clinical Nutrition, 17*(S1), 383–386.

Food and Drug Administration. (2009). New front-of-package labeling initiative. Retrieved October 2010 from <http://www.fda.gov/food/labelingnutrition/ucm202726.htm>.

Food Standards Agency, Australia, New Zealand. Health claims nutrient profiling calculator. Retrieved January 2011 from <http://www.foodstandards.gov.au/consumerinformation/nutritionhealthandrelatedclaims/nutrientprofilingcal3499.cfm>.

Gorton, D., Ni Mhurchu, C., Chen, M. H., & Dixon, R. (2009). Nutrition labels. A survey of use, understanding and preferences among ethnically diverse shoppers in New Zealand. *Public Health Nutrition, 12*, 1359–1365.

Institute of Medicine. (2009). Examination of front-of-package nutrition rating systems and symbols. Retrieved March 2011 from <http://www.iom.edu/Activities/Nutrition/NutritionSymbols.aspx>.

Kahkonen, P., & Tuorila, H. (1998). Effect of reduced-fat information on expected and actual hedonic and sensory ratings of sausage. *Appetite, 30*, 13–23.

Kelly, B., Hughes, C., Chapman, K., Louie, J. C. Y., Dixon, H., Crawford, J., King, L., Daube, M., & Slevin, T. (2009). Consumer testing of the acceptability and effectiveness of front-of-pack food labeling systems for the Australian grocery market. *Health Promotion International, 24*, 120–129.

Kral, T. V. E., Roe, L. S., & Rolls, B. J. (2002). Does nutrition information about the energy density of meals affect food intake in normal-weight women? *Appetite, 39*, 137–145.

Lando, A. M., & Labiner-Wolfe, J. (2007). Helping consumers make more healthful food choices. Consumer views on modifying food labels and providing point-of-purchase nutrition information at quick-service restaurants. *Journal of Nutrition Education and Behavior, 39*, 157–163.

Lobstein, T., & Davies, S. (2009). Defining and labeling 'healthy' and 'unhealthy' food. *Public Health Nutrition, 12*, 331–340.

Lupton, J. R., Balentine, D. A., Black, R. M., Hildwine, R., Ivens, B. J., Kennedy, E. T., Packard, P. T., Sperber, B. R., Steffen, D., & Story, M. (2010). The smart choices front-of-package nutrition labeling program. Rationale and development of the nutrition criteria. *American Journal of Clinical Nutrition, 91*, 1078–1089S.

Malam, S., Clegg, S., Kirwin, S., & McGinigal, S. (2009). *Comprehension and use of UK nutrition signpost labelling schemes*. United Kingdom: BMRB Social Research. Retrieved October 2010 from <http://www.food.gov.uk/multimedia/pdfs/pmpreport.pdf>.

Maubach, N., & Hoek, J. (2008). *The effect of alternative nutrition information formats on consumers' evaluations of a children's breakfast cereal* Paper presented at: EParternships, Proof and Practice. International Nonprofit and Social Marketing Conference 2008, July 15–26, 2008. New South Wales, Australia: University of Wollongong.

Metcalfe, K. (2010). Smart Choices program postpones active operations. Retrieved August 2010 from <http://www.smartchoicesprogram.com/pr_091023_operations.html>.

Miller, D. L., Castellanos, V. H., Shide, D. J., Peters, J. C., & Rolls, B. J. (1998). Effect of fat-free potato chips with and without nutrition labels on fat and energy intakes. *American Journal of Clinical Nutrition, 68*, 282–290.

Nesbett, R. E., & Wilson, T. (1977). The halo effect. Evidence for unconscious alteration of judgments. *Journal of Personality and Social Psychology, 35*, 250–256.

Neuman, W. (2009). For your health, Froot Loops. *New York Times*. Retrieved October 2009 from <http://www.nytimes.com/2009/09/05/business/05smart.html>.

Neuman, W. (2010). One bowl = 2 servings. FDA may fix that. *New York Times*. Retrieved March 2011 from <http://www.nytimes.com/2010/02/06/business/06portion.html>.

Ogden, J., & Wardle, J. (1990). Cognitive restraint and sensitivity to cues for hunger and satiety. *Physiology & Behavior, 47*, 477–481.

Rayner, M., Scarborough, P., Boxer, A. & Stockley, L. (2005). Nutrient profiles. Development of final model. Retrieved September 2009 from <http://www.food.gov.uk/multimedia/pdfs/nutprofr.pdf>.

Roberto, C. A., Bragg, M. A., Livingston, K. A., Harris, J. L., Thompson, J. M., Seamans, M. J., & Brownell, K. D. (2011). Choosing front-of-package food labeling nutrition criteria. How smart were "Smart Choices"? *Public Health Nutrition, 16*, 1–6.

Scarborough, P., Boxer, A., Rayner, M., & Stockley, L. (2007). Testing nutrient profile models using data from a survey of nutrition professionals. *Public Health Nutrition, 10*, 337–345.

Schor, D., Maniscalco, S., Tuttle, M. M., Alligood, S., & Kapsak, W. R. (2010). Nutrition facts you can't miss. The evolution of front-of-pack labeling. Providing consumers with tools to help select foods and beverages to encourage more healthful diets. *Nutrition Today, 45*, 22–32.

Steenhuis, I. H., Kroeze, W., Vyth, E. L., Valk, S., Verbauwen, R., & Seidell, J. C. (2010). The effects of using a nutrition logo on consumption and product evaluation of a sweet pastry. *Appetite, 55*, 707–709.

Stice, E., Cooper, J. A., Schoeller, D. A., Tappe, K., & Lowe, M. (2007). Are dietary restraint scales valid measures of moderate- to long-term dietary restriction? Objective biological and behavioral data suggest not. *Psychological Assessment, 19*, 449–458.

Stice, E., Fisher, M., & Lowe, M. R. (2004). Are dietary restraint scales valid measures of acute dietary restriction? Unobtrusive observational data suggest not. *Psychological Assessment, 16*, 51–59.

Stice, E., Sysko, R., Roberto, C. A., & Allison, S. (2010). Are dietary restraint scales valid measures of dietary restriction? Additional objective behavioral and biological data suggest not. *Appetite, 54*, 331–339.

Taylor, M. & Mande, J. (2009) Letter to the smart choices program. Retrieved August 2010 from <http://www.fda.gov/Food/LabelingNutrition/LabelClaims/ucm180146.htm>.

United Kingdom Food Standards Agency. (2010). Traffic light labeling. Retrieved October 2010 from <http://www.eatwell.gov.uk/foodlabels/trafficlights>.

US Government Accountability Office (2008) *Food labeling. FDA needs to better leverage resources, improve oversight, and effectively use available data to help consumers select healthy foods*. Report to the Chair, Sub-committee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies, Committee on Appropriations, House of Representatives. Washington, DC: GAO-08-597 FDA Labeling Oversight.

van Kleef, E., van Trijp, H., Paeps, F., & Fernandez-Celemin, L. (2008). Consumer preferences for front-of-pack calories labeling. *Public Health Nutrition, 11*, 203–213.

Vyth, E. L., Steenhuis, I. H., Roodenburg, A. J., Brug, J., & Seidell, J. C. (2010). Front-of-pack nutrition label stimulates healthier product development. A quantitative analysis. *International Journal of Behavior, Nutrition and Physical Activity, 7*, 65–72.

Wansink, B., & Park, S. (2002). Sensory suggestiveness and labeling. Do soy labels bias taste? *Journal of Sensory Studies, 17*, 483–491.