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The Impact of Traffic Light Color-Coding on Food Health Perceptions and Choice

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Government regulators and consumer packaged goods companies around the world struggle with methods to help consumers make better nutritional decisions. In this research we find that, depending on the consumer, a traffic light color-coding (TLC) approach to product labeling can have a substantial impact on perceptions of foods' health quality and food choice. Across 3 lab experiments and a field experiment, we find that TLC labels provide nondieters with an information processing cue that directly influences evaluations in a manner that is consistent with the "stop" and "go" logic behind the traffic light labels. In contrast, we find that dieters do not simply adopt the red, yellow, and green cues into their health quality evaluations. Instead, regardless of the color, the TLC approach increases the depth at which dieters process label information. Dieters tend to focus on the costs of consumption and, as a result, lower their health quality evaluations. In a field study, measuring actual behavior in a grocery store, health quality evaluations predicted consumption and consistent with the color coding of the labels nondieters consumed the most when they were presented with a predominantly green label.

Keywords: health, nutrition, information processing, label, public policy

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In the domain of food products, policymakers have focused on nutritional labels as a central tool in an effort to educate and assist people in making healthier choices. This approach has potential as prior work demonstrates that product labels are an important point-of-purchase information source capable of both assisting and influencing consumer decision making (Bettman, Payne, & Staelin, 1986; Bloch, Brunel, & Arnold, 2003; Caswell & Padberg, 1992; Schoormans & Robben, 1997). However, research also indicates that the current back-of-package nutritional labels are so complex that the majority of people find them difficult to understand (Héroux, Laroch, & McGown, 1988; Kristal, Levy, Patterson, Li, & White, 1998; Wansink, Sonkab, & Hasler, 2004). In addition, prior work has indicated that calorie labeling has little effect on people's choices and may even reduce the ability of people to self-regulate their eating behavior (Bollinger, Leslie, & Sorensen, 2010; Chandon, 2013; Downs, Loewenstein, & Wisdom, 2009; Downs, Wisdom, Wansink, & Loewenstein, 2013).

This is especially troubling in light of the global obesity epidemic, which to a large extent has been attributed to poor nutritional choices and the overconsumption of calories (Abelson & Kennedy, 2004). The consequences of such choices are widespread and have substantial economic impact. In the United States, for example, it is estimated that 35% of adults are obese (Flegal, Carroll, Kit, & Ogden, 2012) and that the health care costs related to obesity are nearly $150 billion per year (Centers for Disease Control & Prevention, 2012). Similar patterns are evident in other countries around the world (Caballero, 2007; Morrill & Chinn, 2004). Research has clearly demonstrated that most people find it difficult to self-regulate food consumption (Baumeister, 2014; Baumeister & Heatherton, 1996; Kemps & Tiggemann, 2010; Metcalfe & Mischel, 1999).

There is growing evidence, however, that it is possible for people to improve their self-control and effectively regulate their behavior in ways that are consistent with their long-term goals (Muraven & Slessareva, 2003; Schmeichel & Vohs, 2009; Tice, Baumeister, Shmueli, & Muraven, 2007). Particularly relevant to the current research is the recent finding that the type of information consumers process can have a substantial impact on their food choices and even amplify the strength that they need to resist making poor choices (Trudel & Murray, 2011, 2013).

In this article, we build on prior work and examine the impact that a simple decision aid—traffic light color-coded (TLC) labels—can have on evaluations of the health quality of food and eating behavior. TLC labels use the colors of red, yellow, and green to highlight nutritional facts in the hope that people will be able to easily and efficiently evaluate the relevant information; green means "go ahead," whereas yellow and red signal increasing levels of caution and limits on consumption (Genschow, Reutner, & Wänke, 2012; Grunert & Wills, 2007; Malam, Clegg, Kirwan, & McGinigal, 2009). Additionally, rather than measuring the aggregate effects of the TLC labels on all people, we examine whether the impact differs according to people's dietary goals and demonstrate that this distinction is crucial when investigating

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responses to label information (Burton & Kees, 2012; Trudel & Murray, 2011, 2013).

Across four experiments, we document the different psychological mechanisms that determine people's unique responses to TLC labels based on their self-regulatory goals. We also explain why dieters process relevant information differently than nondieters. In doing so, we demonstrate the powerful effect that simple color-coding can have on evaluations and consumption. The article concludes with a discussion of the implications of our results for theory and practice, as well as limitations and future directions for this research.

Helping Consumers Self-Regulate Their Eating Behavior

In general, self-regulation is the process used to exert control over one's thoughts, emotions, attention, or impulses, to bring the self in line with preferred long-term goals (Baumeister, 2014; Vohs & Baumeister, 2004). For example, a consumer might delay the purchase of a new TV to reach this year's retirement savings goal. Similarly, a dieter may give up eating a tempting dessert in pursuit of a longer-term weight loss goal. Hoch and Loewenstein (1991) describe such situations as a struggle between desire and willpower during which people are drawn toward short-term pleasure at the expense of their longer-term goals.

Research has demonstrated that people are heavily reliant on external cues to help them monitor their food intake. For example, Trudel and Murray (2011) find that the availability of nutritional information and the type of information people process can have a substantial impact on consumers' ability to regulate eating behavior. The authors conceptualize food, at a general level, in terms of cost and pleasure attributes. Pleasure attributes provide information about the hedonic value of food (e.g., "how rich and creamy it will taste"), while cost attributes provide more utilitarian information and highlight the consequences of consumption (e.g., "how much fat and how many calories it contains"). Their research findings indicate that when details about the caloric and fat content of chocolate are available, dieters who have a goal to limit consumption tend to spend more time focusing on cost-related attributes. As a result, dieters are better able to control their eating behavior and consume fewer chocolates than nondieters who focus on the hedonic value of food.

In a follow-up article, the authors demonstrated that dieters are better able to control their eating behavior because focusing on the cost of consumption provided consumers with the motivation necessary to *amplify* their self-regulatory strength (Trudel & Murray, 2013). Put another way, when dieters have access to nutritional information they selectively focus on the costs of consumption and, as a result, have greater willpower available to resist temptations that would otherwise compromise dieters' long-term goals.

The current research connects the theory developed in prior work (e.g., Baumeister, 2014; Hoch & Loewenstein, 1991; Vohs & Baumeister, 2004) to the effects of TLC labels on actual consumer behavior. While the research of Trudel and Murray (2011, 2013) has indicated that information about the costs of consumption can help dieters reach their self-regulatory goals, this research tests the effect that TLC labels have on evaluations of health quality and the food choices made by both dieters and nondieters. This is an important question as governments around the world consider implementing TLC systems to aid consumer decision making.

TLC Labels as Decision Aids

Proponents of nutritional labels on food products and restaurant menus contend that people will be more successful in regulating their eating behavior if they have relevant information available and are aware of the costs of consumption when making decisions. This is consistent with a more general body of work recognizing that people can benefit from the assistance of an effective decision aid, especially in the context of a complex choice or evaluation (Bettman, Luce, & Payne, 1998; Häubl & Trifts, 2000; Simon, 1955). Even relatively simple changes in the way that information is presented to decision makers can have a substantial impact on the ultimate choices people make (Johnson et al., 2012; Thaler & Sunstein, 2008; Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012). In the realm of food packaging, one proposal that continues to receive attention around the world is the implementation of a TLC system to highlight the nutritional contents of food relative to recommended guidelines (Gorton, Ni Mhurchu, Chen, & Dixon, 2009; Grunert & Wills, 2007).

A series of recent review articles have found a generally positive impact of TLC systems as a simplified approach to food labeling that can help consumers understand nutritional information (e.g., Grunert & Wills, 2007; Hawley et al., 2013; Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013; Lobstein & Davies, 2009). Research also indicates that people prefer TLC systems that help them categorize food in terms of its health quality (Pettigrew, Pescud, & Donovan, 2011), are more effective at recognizing healthier foods with a TLC label (Borgmeier & Westenhoefer, 2009), and are more likely to avoid foods that TLC systems highlight in red (Balcombe, Fraser, & Di Falco, 2010).

Other studies, however, have called into question the extent to which such labels actually affect consumption and eating behavior (Bollinger et al., 2010; Downs et al., 2013; Elbel, Gyamfi, & Kersh, 2011; Helfer & Shultz, 2014). Research suggests that TLC labels can help consumers better understand the health quality of food choices and more accurately identify healthy options, but do not always significantly affect the health quality of the foods people choose to consume (Borgmeier & Westenhoefer, 2009; Feunekes, Gortemaker, Willems, Lion, & Van den Kommer, 2008). For example, using actual sales of ready-meals and sandwiches after the introduction of TLC labels in the United Kingdom, Sacks, Rayner, and Swinburn (2009) found no effect on the relative healthiness of the purchases that consumers made.

We argue that the impact of a food label depends heavily on three key factors: (a) consumers attending to the information; (b) consumers being motivated to process the information; and (c) consumers understanding what the information means. Not all people in the general population meet these criteria. For instance, older adults and people with lower levels of education are less likely to understand and accurately interpret nutrition labels (Malam et al., 2009). Dieters pay more attention to and are more motivated to process information on the costs of consumption, as compared with nondieters (Trudel & Murray, 2011). This view is consistent with Burton and Kees (2012), who argue that prior work may have failed to find an effect of nutritional labels on food evaluations and choices because they focused on aggregate effects rather than breaking the results down by people's awareness of calorie labels and motivation to process the label information. As a result, studies that look at aggregate effects tend to miss important distinctions between people who vary in health consciousness, such as dieters and nondieters, who we know differ in

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their response to nutritional information (Onozaka, Melbye, & Hansen, 2014; Trudel & Murray, 2013). We expect that the TLC approach will draw people's attention to label information. However, we predict that once their attention is drawn to the label, dieters and nondieters will process that information in very different ways.

For nondieters, the costs of consumption are less directly relevant and, as a result, we expect that they will tend to engage in more superficial processing and be more literal in their use of the traffic light cues (Chaiken & Trope, 1999; Petty & Cacioppo, 1986). That is, green means go ahead (the food is healthy), while yellow and red indicate increasing levels of caution (the food is less healthy to unhealthy; Grunert & Wills, 2007). Therefore, we predict that nondieters' evaluations of the health quality of a food product will tend to reflect the dominant color cues presented by the TLC decision aid. Food with predominately green labels will be perceived by nondieters to be relatively healthy, while foods with predominantly red labels will be perceived to be relatively unhealthy.

In contrast, dieters have both the requisite knowledge and motivation to effectively process information available on a product label (Eves, Gibson, Kilcast, & Rose, 1994; Stewart & Martin, 1994; Trudel & Murray, 2013). As a result, rather than the literal processing expected of nondieters, we predict that color highlighting will be more likely to trigger greater attention to the product's cost of consumption for dieters (Burton & Kees, 2012). Moreover, as part of a selective information processing strategy used to limit consumption, dieters will tend to focus on the costs of consumption (Trudel & Murray, 2011). If dieters with a traffic light decision aid have a greater focus on the food's nutritional details, then they should also have better recall of that information as compared with both nondieters and dieters without access to the color-coding. As a result, we predict that dieters' evaluations of the health quality of a food product will be lower when they are given a traffic light decision aid for high caloric and high fat foods, regardless of the color coding, as compared with dieters without the decision aid.

Ultimately, we expect that peoples' health quality evaluations will have an important effect on consumption decisions and predict actual behavior. However, in the same way that evaluations depend on the interaction between color-coding and a self-regulatory goal, we expect that food choices will be influenced by the interaction between evaluations and the consumer's self-regulatory goal. That is, we expect people's dieting goals to be a constant and continuous influence. We propose the following theoretical model in which health quality evaluations will mediate the relationship between self-regulatory goals, traffic light decision aids, and food choice (see Figure 1).

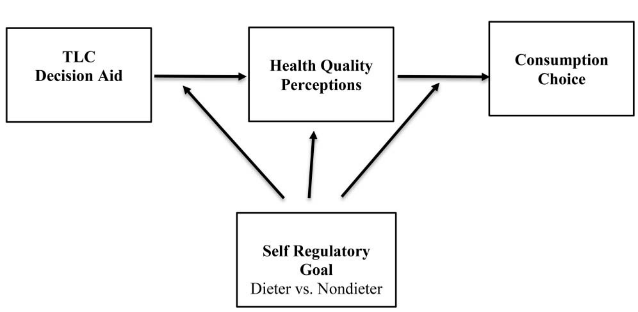

Figure 1. Moderated mediation model.

Pretest and Overview of Experiments

Thirty undergrads completed the pretest and evaluated four menu items: (a) Marbella Chicken Sandwich, (b) Stuffed Chicken Breast (c) Thai Chicken Salad, and (d) Breakfast Sandwich. Participants were shown a photo of the menu item, a short description of the item, and the item's nutritional information presented without any coloring (i.e., photo, information and label were identical to our control condition in the studies that follow). Participants then answered "How healthy is the Sandwich [Chicken, Salad, Breakfast Sandwich]?" (9-point scale: 1 = *unhealthy*, 9 = *healthy*). In designing our experiments, we intentionally selected foods that were relatively high in calories and fat content but fall midway on a scale of healthiness. This was done not only to guard against any floor or ceiling effects, but also to test how traffic light color-coded decision aids can differentially influence dieters and nondieters. The four items qualified: (a) Marbella Chicken Sandwich (M = 4.57, SD = 1.83), (b) Stuffed Chicken Breast (M = 3.86, SD = 1.60), (c) Thai Chicken Salad (M = 4.60, SD = 1.71), and (d) Breakfast Sandwich (M = 3.63, SD = 1.61).

In addition, our studies focus on the evaluation and choice of foods that are relatively high in fat and caloric content. We keep all label information constant within each study, but change the color highlighting between conditions, to test the effects of TLC product labels. As a result, the color coding in our experiments is not always consistent with the nutritional guidelines; however, it is always counterbalanced across conditions. The exception being Experiment 1, where the color coding of the nutrition label was based on U.S. government guidelines. Across four studies, this approach allows us to confidently conclude that our effects are being driven by differences in color coding. We find that a simple traffic light decision aid can influence food evaluations and choice behavior.

Experiment 1

The first experiment examines the impact of a TLC decision aid on evaluations of a chicken sandwich compared with a control condition in which the same label is presented without any color-coding. For the TLC label, we use a color-coding scheme that reflects the actual nutritional properties of the sandwich based on U.S. Department of Agriculture & U.S. Department of Health and Human Services (2010) recommendations and, as a result, the label includes green, yellow, and red highlights. The colors in this case (three green, three red, and two yellow highlights) do not provide a clear overall health quality cue to participants, as one color does not dominate. Without a dominant color cue we do not expect the traffic light label to have much of an effect on nondieters. However, consistent with our theory, we predict that dieters' evaluations will decrease when the color highlighting draws their attention to the costs of consuming the sandwich, as compared with the control condition.

Method

Participants. There were 123 undergraduates (67 women; full descriptive statistics of the all our samples are provided in Appendix A) who participated in exchange for course credit. Participants were randomly assigned to one of two between-subjects conditions (decision aid: control vs. traffic light).

Procedure. Participants were told that they would participate in several unrelated studies, the first of which was a 15-item lifestyle questionnaire. Embedded within that questionnaire was one item that asked participants "Are you currently watching your diet"? Consistent with prior research, participants who answered yes were classified as dieters (e.g., Fishbach & Shah, 2006; Trudel & Murray, 2013). Then participants were asked to evaluate a sandwich. Participants were shown a photo of the "Marbella Chicken Sandwich" and provided with the following description: *The Chicken Marbella Sandwich is a smoked chicken breast sandwich with sun dried-tomato mayonnaise, field greens, red onions, and tomatoes made to order on your favorite sandwich bread.* In the control condition, participants saw the nutritional information in the standard table format commonly used on labels for food products (the traffic light color-coded labels for Experiments 1–4 are presented in Appendix B). In the traffic light decision aid condition, participants saw the label information in the TLC format with the rows of the table highlighted with three green, three red, and two yellow ratings.

Next, participants responded to a single item asking "How healthy is the sandwich?" (9-point scale: 1 = *unhealthy*, 9 = *healthy*). Respondents then completed an affect scale that measured how they currently felt on 10 dimensions consisting of both positive and negative affect descriptors (Motivated, Good, Energetic, Frustrated, Positive, Bad, Worried, Happy, Guilty, and Relaxed; 5-point scale: 1 = *clearly does not describe my feelings*, 5 = *clearly describes my feelings*), after which they were debriefed, thanked, and dismissed. Analyses of the affect measures did not reveal any significant differences between dieters and nondieters on any of the items. Similarly, no significant differences were found between decision aid conditions on any of the affect items. In addition, there were no significant interactions and thus the affect items are not included in the following analyses or discussion.

Results

Health evaluations. The health quality evaluation data were analyzed using a 2 (self-regulatory goal: dieter vs. nondieter) × 2 (decision aid: control vs. traffic light) between-subjects analysis of variance (ANOVA). The data revealed a significant main effect of self-regulatory goal ($F(1, 119) = 17.26$, $p < .001$, $\eta_p^2 = .13$) and a significant self-regulatory goal by decision aid interaction ($F(1, 119) = 5.00$, $p = .027$, $\eta_p^2 = .04$; Figure 2). The main effect of decision aid was not significant ($F < 1.5$, $p = .301$). Further analyses revealed that the decision aid had a significant effect on dieters, who rated the sandwich as much less healthy when presented with the traffic light decision aid ($M = 3.13$, $SD = 1.78$) in comparison with the control condition ($M = 4.14$, $SD = 1.61$; $F(1, 119) = 5.88$, $p = .017$, $\eta_p^2 = .05$). Health perceptions of the sandwich were the same across decision aid conditions for nondieters ($F < 1$, $p = .419$). Comparisons across decision aid conditions revealed that dieters ($M = 3.13$, $SD = 1.78$) in the traffic light decision aid condition had significantly lower health perception ratings than nondieters ($M = 5.10$, $SD = 1.61$; $F(1, 119) = 20.51$, $p < .001$, $\eta_p^2 = .15$). In the control condition, dieters ($M = 4.14$, $SD = 1.61$) and nondieters had similar health perception ratings ($M = 4.73$, $SD = 1.82$; $F(1, 119) = 1.83$, $p = .178$).

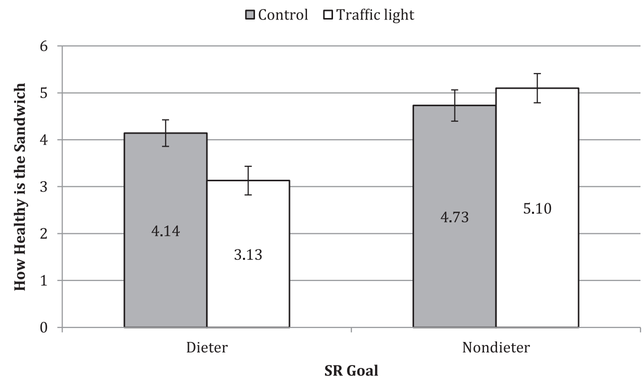

Figure 2. Experiment 1: Health quality evaluations as a function of SR goal and decision aid.

Discussion

The traffic light label in this study used three green, three red, and two yellow highlights. Consequently, the label did not provide a clear summary cue to nondieters about the health quality of the sandwich and, as expected, ratings among nondieters did not differ between the TLC condition and the control condition. In contrast, dieters rated the sandwich as significantly less healthy when given the traffic light decision aid as compared with dieters without the color-coded label. Experiment 1 provides initial support for our predictions. However, it is possible that in this experiment, dieters simply adopted a decision rule that treated any red ratings as negative (regardless of the presence of green ratings) and adjusted their evaluations downward. This alternative explanation is ruled out in the following experiments.

The studies that follow use less ambiguous color coding in the decision aid conditions—that is, we manipulate the traffic light labels to be predominately red, all red, predominately green, or all green without changing the actual nutritional information. This allows us to test whether nondieters' perceptions of the health quality of a food product are affected by the dominant cues presented by the traffic light decision aid. The less ambiguous labels also provide a stronger test of our prediction that dieters' perceptions of the health quality of a food product will decrease when they are given a traffic light decision aid regardless of the color coding.

Experiment 2

Experiment 2 examines participants' responses to two types of TLC labels (predominantly green and predominantly red). In addition, this study includes three new products with a broader range of nutritional values. We also introduce a new and more conservative dependent variable that asks participants to categorize foods as either healthy or unhealthy. Based on our theory, we expect that nondieters will categorize the predominately green labeled foods as healthy and the predominantly red labeled foods as unhealthy. Additionally, we predict that dieters presented with a TLC label will evaluate the food items as less healthy, as compared with dieters without a decision aid, because it will draw more attention to the label and lead to an even greater focus on the costs of consumption (fat and caloric content). That is, regardless of the

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color coding, dieters will categorize foods labeled with a TLC decision aid as less healthy more often than when the same food has a traditional nutrition label. In doing so, this study aims to replicate and generalize the key findings of the first experiment.

Method

Participants. There were 182 undergraduates (83 women) who participated in exchange for course credit. As in the first experiment, participants were randomly assigned to one of two between-subjects conditions (TLC decision aid: green-dominant vs. red-dominant).

Procedure. Participants entered the lab in groups of 10–16 and were seated at computer terminals. They were provided with instructions and then told that they would participate in several unrelated studies, the first of which included a lifestyle questionnaire similar to that used in the previous study. Embedded within that questionnaire was one item that asked participants "Are you currently watching your diet?" (those who answered yes were classified as dieters). Participants then completed an unrelated study for ~10 min. This filler study was intended to minimize the demand effect of the lifestyle questionnaire on evaluations.

After they finished, participants moved on to the focal study and were told that they would be evaluating several menu items for a new restaurant that would soon be opening. Next, participants were asked to sequentially classify four menu items as either healthy or unhealthy. For each item, participants were shown a photo of the menu item, a short description, and a traffic light decision aid—the menu item was randomly assigned to either a green dominant (6 of 8 attributes were green) or red dominant (6 of 8 attributes were red) nutrition label. The photos, descriptions, and nutritional facts for each menu item were the same for both conditions—that is, only the color highlighting differed. The menu items were: (a) Marbella Chicken Sandwich (as in the first experiment), (b) Stuffed Chicken Breast, (c) Thai Chicken Salad, and (d) Breakfast Sandwich. Caloric content ranged from 510–790 calories and fat content ranged from 25–45 g. Participants categorized each item by dragging and dropping the food into either a box labeled healthy or a box labeled unhealthy.

Results

Health perception categorization. The categorization data were analyzed using a repeated measures logistic regression with participant as the between subject effect and menu item as the within subject effect. The dependent variable in this model was participants' categorization of the food items (1 = healthy, 0 = unhealthy), with independent variables for the decision aid (1 = green dominant, 0 = red dominant) and self-regulatory (SR) goal (1 = dieter, 0 = nondieter), as well as the aid-by-goal interaction.

The analysis revealed a significant main effect of the decision aid ($\beta = 1.40$, $\chi^2 = 35.34$, $p < .001$). The main effect of SR goal was not significant ($p = .873$). The analysis also indicated a significant SR goal by decision aid interaction ($\beta = -1.34$, $\chi^2 = 16.55$, $p < .001$). Consistent with our predictions, follow-up tests revealed that nondieters were more likely to categorize the food items as healthy in the green dominant decision aid condition (62.65%) than in the red dominant condition (28.92%; $\beta = 1.38$, $\chi^2 = 34.57$, $p < .001$). The results indicated that dieters were equally likely to categorize the food items as healthy in the green dominant condition (30.61%) as they were in the red dominant condition (29.59%; $p = .712$). Comparing dieters to nondieters in the green dominant decision aid condition revealed that nondieters were more likely to categorize the food item as healthy (62.65%) in comparison with dieters (30.61%; $\beta = 1.38$, $\chi^2 = 35.84$, $p < .001$). There were no differences between nondieters and dieters in their categorization of the food as healthy in the red dominant decision aid condition (28.92% vs. 29.59%; $p = .942$). As a robustness test, we also looked at the menu items individually using a logistic regression model for each food item. All results including those of the individual menu items are summarized in Table 1.

Discussion

Experiment 2 replicates our initial results using a more conservative dependent variable and demonstrates that the findings are not specific to one type of food or measurement tool. We find that nondieters are more likely to evaluate the menu item as healthy when given a green dominant decision aid and more likely to evaluate the menu item as unhealthy when given a red dominant decision aid. Hence, nondieters are directly influenced in a manner consistent with the "stop" and "go" logic behind the TLC labels. We have argued that dieters with the TLC label have lower evaluations of the health quality of food products and that these results are being driven by differences in the depth of processing between dieters and nondieters (Table 2). The next experiment addresses this prediction by examining participants' recall of label information.

Experiment 3

It is possible that dieters in Experiments 1 and 2 were focusing on and responding only to the red highlights—that is, even one red

Table 1
Summary of Results From Experiment 2

Logistic regression analysis of health categorization			
Independent variables	β	χ^2	*p*
All menu items combined			
Self-regulation (SR) goal			*n.s.*
Decision aid	1.40	35.34	<.001
SR goal × Decision aid	−1.34	16.55	<.001
Individual menu items			
Chicken Marbella Sandwich			
SR goal			*n.s.*
Decision aid	1.57	10.91	.001
SR goal × Decision aid	−1.58	6.36	.012
Stuffed Chicken Breast			
SR goal			*n.s.*
Decision aid	1.63	10.96	.001
SR goal × Decision aid	−1.43	4.13	.042
Thai Chicken Salad			
SR goal			*n.s.*
Decision aid	1.27	7.21	.007
SR goal × Decision aid	−1.12	3.16	.075
Breakfast Sandwich			
SR goal			*n.s.*
Decision aid	1.44	7.60	.006
SR goal × Decision aid	−1.49	3.64	.056

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Table 2
Planned Comparisons of Percent Categorized as Healthy

	Dieter		Nondieters	
	Green-dominant aid	Red-dominant aid	Green-dominant aid	Red-dominant aid
All menu items combined	30.61%	29.59%	62.65%	28.92%
Individual menu items				
Chicken Marbella Sandwich	45.83%	46.00%	72.09%	35.00%***
Stuffed Chicken Breast	22.00%	18.75%	57.50%	20.93%***
Thai Chicken Salad	41.67%	38.00%	74.42%	45.00%**
Breakfast Sandwich	14.00%	14.58%	45.00%	16.27%**

** $p < .01$. *** $p < .001$.

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row on the label could have resulted in lower evaluations of health quality. In Experiment 3, we introduce two new conditions in which the labels have *only red* or *only green* highlights. These conditions are not designed to enhance the external validity of the study (i.e., they do not reflect the underlying nutritional value of the food), but are instead intended to allow us to have greater experimental control and improve the internal validity of this study relative to Experiments 1, 2, and 4. If dieters continue to rate products in these traffic light conditions as less healthy, then the result cannot be attributed to the presence of a red highlight. In other words, if dieters consider the *only green* labeled sandwich to be less healthy than dieters in the control condition, then they are not responding to the specific color of red (that is absent on this label), but simply increasing their depth of processing in response to a color on the label.

In addition to product health quality ratings, Experiment 3 measures the depth of information processing by recording participants' ability to recall label information in each condition. We expect that dieters in general will demonstrate higher recall than nondieters because dieters will be more motivated to effectively process information available on any product label (Eves et al., 1994; Trudel & Murray, 2013). However, we further expect that color-coding will trigger even greater attention to the label for dieters. Moreover, as part of a selective information process strategy used to limit consumption, dieters will tend to focus on the costs of consumption that will lead to lower evaluations. To summarize, we expect an interactive effect between individual's self-regulatory goal and the TLC decision aid on the perceived health quality of a food product that is mediated by people's recall of the information on the food label.

Method

Participants. There were 227 undergraduates (129 women) who participated in exchange for course credit. Participants were randomly assigned to one of four between-subject conditions (decision aid: control vs. green dominant vs. all green vs. all red).

Procedure. The procedure closely mirrored that of the previous experiments. Participants were told that they would participate in several unrelated studies, the first of which was a 7-item lifestyle questionnaire. Embedded within that questionnaire was one item that asked participants "Are you currently watching your diet?" (participants who answered yes to the question were classified as dieters). As in Experiments 1 and 2, participants were shown a photo and a written description of the "Marbella Chicken Sandwich." In the control condition, participants saw the label information in the standard nutrition table format (i.e., no color highlights). In the green dominant condition, participants saw the label information in the traffic light decision aid format with six green, one red, and one yellow highlights. In the all green decision aid condition, all the color highlights were green. In the all red decision aid condition, all the color highlights were red (see Appendix).

Next, participants responded to a single item asking, "How healthy is the sandwich?" (9-point scale: 1 = *unhealthy*, 9 = *healthy*). Lastly, in a departure from the previous experiments, we asked participants to recall the information from each label. To do so, we used a cued recall task (Burke & Srull, 1988; Krishnan & Chakravarti, 1999) during which participants were given a blank label; the format of the label was the same, but the nutritional facts were removed. Participants were instructed to fill in the nutritional values. Once finished, participants were debriefed, thanked, and dismissed.

Results

Health perceptions. To analyze the health perception data, we conducted a 2 (self-regulatory goal: dieter vs. nondieter) × 4 (decision aid: control vs. green dominant vs. all green vs. all red) between-subjects ANOVA (see Figure 3). The results revealed a significant main effect of self-regulatory goal ($F(1, 219) = 15.60$, $p < .001$, $\eta_p^2 = .07$), a marginally significant main effect of decision aid ($F(3, 219) = 2.23$, $p = .086$, $\eta_p^2 = .03$), and a significant self-regulatory goal by decision aid interaction ($F(3, 219) = 2.93$, $p = .035$, $\eta_p^2 = .04$).

Follow-up tests investigating the effects within self-regulatory goal conditions revealed that the effect of decision aids on health perceptions of the sandwich was significant for dieters ($F(3, 219) = 3.15$, $p = .026$, $\eta_p^2 = .04$), but not for nondieters, $F(3, 219) = 1.95$, $p = .123$ even though the pattern of results was consistent with the logic behind the traffic labeling. Dieters in all traffic light decision aid conditions rated the sandwich as less healthy, in the green dominant ($M = 3.51$, $SD = 1.94$; $p = .003$), all green ($M = 3.59$, $SD = 1.40$; $p = .007$), and in the all red decision aid conditions ($M = 3.41$, $SD = 1.62$; $p = .002$), as compared with dieters in the control condition ($M = 4.72$, $SD = 1.49$). There were no differences in health perceptions between dieters in the green dominant, all green, and all red decision aid conditions (ps $> .65$). In comparison with the control condition, nondieters rated the sandwich in the green dominant condition

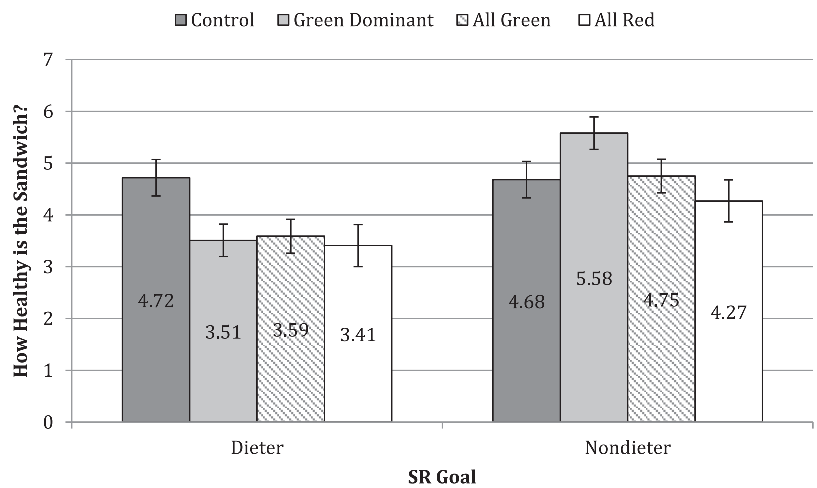

Figure 3. Experiment 3: Health quality evaluations as a function of SR goal and decision aid.

(M = 5.58, SD = 2.13) as marginally healthier than the control condition (M = 4.68, SD = 2.21, p = .098). All other pairwise comparisons with the control condition were insignificant. A significant difference was found between the green dominant and all red conditions (M = 5.58, SD = 2.12 vs. M = 4.27, SD = 2.45; p = .021).

Follow up tests investigating the effects within decision aid conditions revealed significant differences between dieters and nondieters in the all green (M_{dieter} = 3.59 SD = 1.40 vs. $M_{nondieter}$ = 4.75, SD = 2.11; $F(1, 219)$ = 5.24, p = .023, η_p^2 = .02) and green dominant decision aid conditions (M_{dieter} = 3.51, SD = 1.94 vs. $M_{nondieter}$ = 5.58, SD = 2.12; $F(1, 219)$ = 17.22, $p < .001$, η_p^2 = .07). The difference between dieters and nondieters in the all red decision aid condition was not significant (M_{dieter} = 3.41, SD = 1.62 vs. $M_{nondieter}$ = 4.27, SD = 2.45; $F(1, 219)$ = 2.70, p = .102, η_p^2 = .01). Dieters and nondieters assigned to the control condition showed no differences in their health perceptions of the sandwich ($F < .02$).

Recall accuracy. Recall was measured as the number of items from the nutritional label that were accurately recalled. For instance, if the participant correctly recalled only the number of calories, they received a score of one. If they correctly recalled the number of calories and the amount of fat, they received a score of two. The median number of accurate recall items was 2 (min = 0, max = 8). To analyze the recall accuracy data, we conducted a 2 (self-regulatory goal: dieter vs. nondieter) × 4 (decision aid: control vs. green dominant vs. all green vs. all red) ANOVA on the number of accurate recall items. The data revealed a significant main effect of SR goal ($F(1, 219)$ = 7.62, p = .006, η_p^2 = .03) and a significant SR goal by decision aid interaction ($F(3, 219)$ = 2.87, p = .037, η_p^2 = .04, Figure 4). The main effect of decision aid was not significant ($F < 1.5$, p = .357).

Follow-up tests of the effects within SR goal conditions revealed that the effect of decision aids on recall accuracy was significant for dieters ($F(3, 219)$ = 3.74, p = .012, η_p^2 = .05), but not for nondieters, $F(3, 219)$ = .58, p = .632. In comparison with

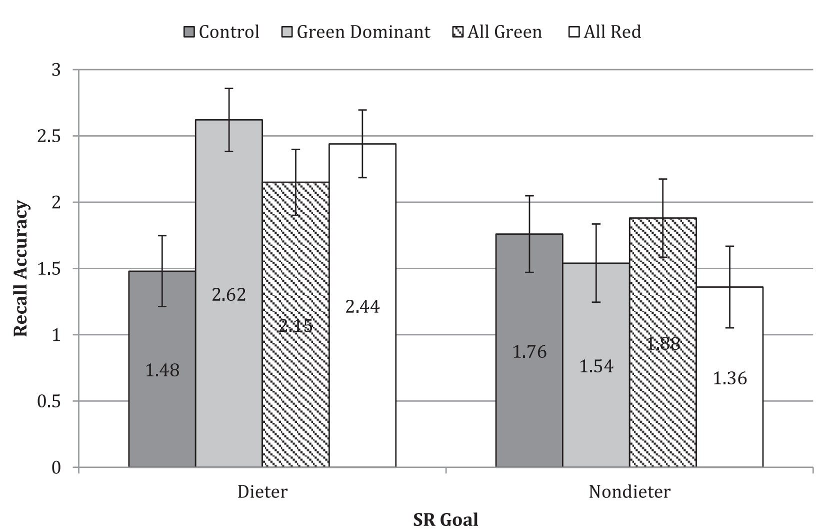

Figure 4. Experiment 3: Recall accuracy as a function of SR goal and decision aid.

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dieters in the control condition (M = 1.48, SD = 1.24), dieters displayed significantly greater recall accuracy in the green dominant (M = 2.62, SD = 1.59; p = .002) and in the all red conditions (M = 2.44, SD = 1.48; p = .002) and marginally greater recall in the all green condition (M = 2.15, SD = 1.65; p = .070).

Dieters, as compared with nondieters, demonstrated greater recall accuracy in two of the three decision aid conditions: green dominant (M_{Dieter} = 2.62, SD = 1.59 vs. $M_{Nondieter}$ = 1.54, SD = 1.50; $F(1, 219) = 8.15$, p = .005, η_p^2 = .04) and all red (M_{Dieter} = 2.44, SD = 1.48 vs. $M_{Nondieter}$ = 1.36, SD = .95; $F(1, 219) = 7.22$, p = .008, η_p^2 = .03). The all green and control decision aid conditions did not reveal significant differences between dieters and nondieters (Fs < 1).

To test the prediction that the presence of the decision aid increases recall for dieters, we analyzed the recall accuracy data by aggregating the decision aid conditions and by conducting a 2 (self-regulatory goal: dieter vs. nondieter) × 2 (decision aid: present vs. absent) ANOVA. The data revealed a marginal main effect of decision aid ($F(1, 223) = 2.86$, p = .092, η_p^2 = .01) and a significant SR goal by decision aid interaction ($F(1, 223) = 2.87$, p = .017, η_p^2 = .03). The main effect of SR goal was not significant ($F < 1.5$, p = .242).

Follow-up tests revealed that the effect of decision aids on recall accuracy was significant for dieters, $F(1, 223) = 9.32$, p = .003, but not among nondieters, $F(1, 223) = .23$, p = .634. Specifically, in comparison with the decision aid absent condition (M = 1.48, SD = 1.24), dieters displayed significantly greater recall accuracy when the decision aid was present (M = 2.40, SD = 1.57; $F(1, 223) = 9.32$, p = .003, η_p^2 = .04).

In comparing dieters to nondieters, dieters demonstrated greater recall accuracy when the decision aid was provided (M_{Dieter} = 2.41, SD = 1.57 vs. $M_{Nondieter}$ = 1.60, SD = 1.22; $F(1, 223) = 13.08$, $p < .001$, η_p^2 = .06). There were no differences in recall accuracy between dieters and nondieters in the decision aid absent condition ($F < 1$).

Moderated mediation. We conducted a moderated mediation analysis to provide further process evidence (Hayes, 2013; PROCESS Model 7). The model tested was defined such that the independent variable (self-regulatory goal) affects the mediator (recall accuracy) and the effect of the mediator on the dependent variable (health perceptions) depends on the presence or absence of a nutritional decision aid. Bootstrapping techniques used to test the conditional indirect effects of self-regulatory goal on health perceptions at different values of the moderator (decision aid) further confirmed our predictions. A significant and negative indirect effect was observed when participants had a traffic light decision aid ($a \times b = -.209$), with a 95% confidence interval (CI) that excludes zero (−.436 to −.063). However, the indirect effect was not significant in the control condition (95% CI includes zero; −.117 to .381). The direct effect of self-regulatory goal on health perceptions was also negative ($\beta = -.91$) and significant ($p < .001$). Since $a \times b \times c$ (0.190) is positive, the results indicate complementary mediation (Preacher, Rucker, & Hayes, 2007; Zhao, Lynch, & Chen, 2010).

Discussion

The results of Experiment 3 provide additional support for our theory. We found that across all of the color conditions, dieters exposed to the traffic light label rated the sandwich as less healthy than dieters in the control condition without the color-coded decision aid. To better understand the process by which color-coding affects evaluations, this experiment measured consumers' ability to recall information from the product's nutritional label. We find that recall was higher among dieters in the traffic light label condition than it was in the control condition (i.e., the traditional black-and-white label without color-coding). Similarly, dieters displayed better recall of nutritional information than nondieters. More important, we find that TLC decision aids trigger different processing in people depending on whether they are dieters or nondieters, and that variations in recall affect product health quality evaluations.

Experiment 4

The previous three experiments demonstrate that responses to TLC decision aids depend on individuals' self-regulatory goals. In general, dieters' health quality evaluations are lower when they are given a TLC decision aid of any color. Nondieters' responses are more directly influenced by the TLC decision aids such that evaluations are higher for green dominant and lower for red dominant labels. While these results are consistent across studies and support our theory, the data are not without limitations. First, in the three preceding experiments, we measured research participants' health perceptions of food, which may or may not correspond to their actual food choice. Second, our participant samples were drawn entirely from undergraduate students, which are not representative of the general population. Third, all of the menu items in the previous studies had fairly high caloric content. Experiment 4 addresses these limitations and examines the effect of traffic light labels in a field setting. Specifically, Experiment 4 uses a sample from the general population, focuses on a smaller serving size item and importantly, in addition to product health quality ratings, measures actual food choices in a grocery store.

Experiment 4 uses individually wrapped chocolates as the food product and two traffic light nutrition labels (red dominant vs. green dominant) that have the same objective nutrition information but have different color-coding. We chose chocolates for this experiment because they are relatively common, small, and inexpensive products that are well suited to our in-store sampling procedure, and the number taken from the sampling station can be discretely counted and measured. Chocolates have also been used extensively to study self-regulatory eating behavior in prior work (Laran & Janiszewski, 2009; Trudel & Murray, 2011, 2013; Vohs & Heatherton, 2000; Wansink, Painter, & Lee, 2006). We expect that people's health quality evaluations of chocolate in the field will be similar to what we observed in our lab experiments and that their heath quality evaluations will predict how many chocolates are taken (see Figure 1). As in Experiments 1–3, we expect nondieters' health quality evaluations to vary consistently with the TLC logic of the decision aid. Nondieters will evaluate the chocolate as healthier when given a green versus a red dominant decision aid. For dieters, we expect a focus on the costs of consumption regardless of the color-coding of the decision aid and, as a result, lower product evaluations. We expect that nondieters who are given a green dominant label will consume more chocolate than dieters and nondieters in the other conditions.

Method

Participants. There were 150 shoppers (82 women) from the general population who participated in this experiment. The average

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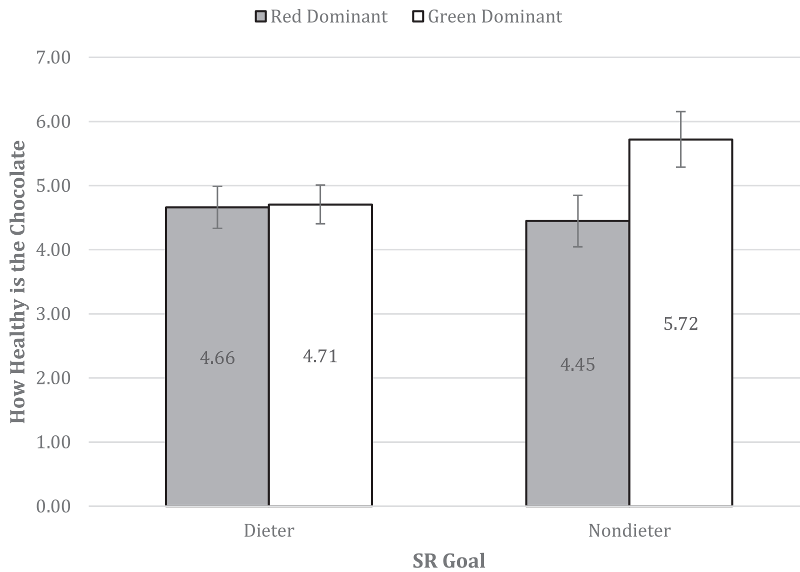

Figure 5. Experiment 4: Health quality evaluations as a function of SR goal and decision aid.

age of the participants in this study was 39.87 years old (min = 18, max = 80), average Body Mass Index was 25.44 (*SD* = 5.29, min = 16.95, max = 45.19), and 68.7% of the participants listed English as their first language. Participants were randomly assigned to one of two between-subjects conditions (decision aid: green dominant vs. red dominant).

Procedure. This study was conducted just inside the entrance to a local grocery store. As shoppers entered the store, a research assistant asked them if they would like to participate in a short food and lifestyle survey. Participants were told that they would be given some information about chocolate and would then be asked to evaluate it. Consumers who agreed to participate read and signed a consent form and completed the same lifestyle survey used in our previous studies. Among the questions in the survey was one single item that asked "Are you currently watching your diet?" Consistent with the procedure used in Experiments 1–3, participants who answered yes were classified as dieters.

After completing the lifestyle survey, participants were randomly assigned to either the green dominant decision aid condition or the red dominant decision aid condition. Next, participants were given a "chocolate fact sheet" that included a short description of the chocolate and a nutritional label that differed in terms of color (e.g., green dominant or red dominant). Participants then moved on to another station where they were offered a bowl of 25 chocolates and asked to sample as many as they wish to evaluate the chocolate. After eating the chocolates, participants were asked to respond to a short survey that included the following items: perceived health ratings (1 = *very unhealthy*, 9 = *very healthy*), and 3-items measuring the taste (1 = *not very tasty*, 9 = *very tasty*), serving size (1 = *much too small*, 9 = *much too large*), and quality of the chocolate (1 = *very low quality*,

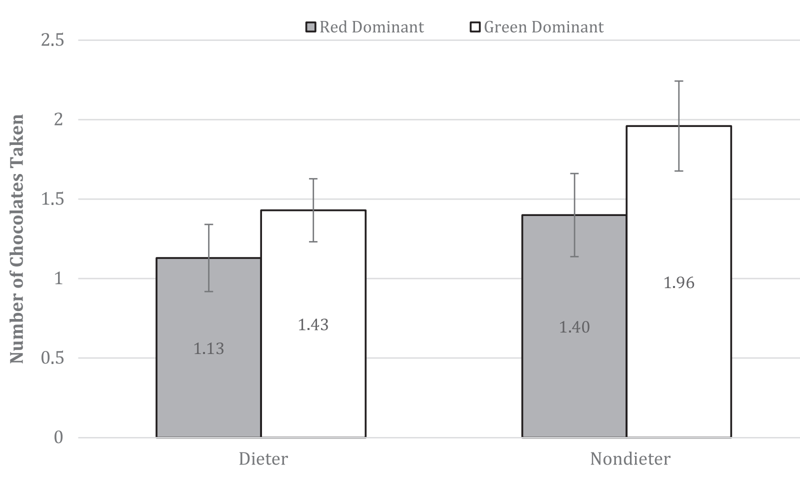

Figure 6. Experiment 4: Chocolates taken as a function of SR goal and decision aid.

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9 = *very high quality*). Participants then completed the affect grid (Russell, Weiss, & Mendelsohn, 1989), which measured their current mood (valence and arousal). Analyses of the three evaluation items (taste, serving size, and quality), and the mood and arousal measures did not yield any significant differences between dieters and nondieters with regard to any of the items, nor were there any significant differences between decision aid conditions on any of the items. No significant interactions were observed; therefore, these items are not included in the analyses or discussion below. Lastly, participants responded to demographic questions including native language, years speaking English, gender, age, weight, and height. No personally identifying information was collected. After completing the survey, participants were invited to take as many additional chocolates as they like. After participants left the sampling station and went further into the grocery store to shop, research assistants recorded the total number of chocolates taken.

Results

Health perceptions. To analyze the health perception data, we conducted a 2 (self-regulatory goal: dieter vs. nondieter) × 2 (decision aid: green dominant vs. red dominant) between-subjects ANOVA. The results revealed a marginally significant main effect of decision aid ($F(1, 145) = 3.17$, $p = .077$, $\eta_p^2 = .02$) and a marginally significant self-regulatory goal by decision aid interaction ($F(1, 145) = 2.74$, $p = .100$, $\eta_p^2 = .02$).[1] Follow-up tests revealed that nondieters rated the same chocolate as significantly more healthy when they received the green dominant decision aid ($M_{Green} = 5.72$, $SD = 1.95$) in comparison with when they received the red dominant decision aid ($M_{Red} = 4.45$, $SD = 1.84$; $F(1, 145) = 4.63$, $p = .033$, $\eta_p^2 = .03$). Dieters, on the other hand, rated the chocolate similarly regardless of the color of the decision aid ($M_{Green} = 4.71$, $SD = 2.23$ vs. $M_{Red} = 4.66$, $SD = 2.39$; $F < .02$). Further comparisons showed that nondieters rated the chocolate as marginally healthier than dieters in the green dominant condition ($M_{dieter} = 4.71$, $SD = 2.23$ vs. $M_{nondieter} = 5.72$, $SD = 1.95$; $F(1, 145) = 3.68$, $p = .057$, $\eta_p^2 = .03$); however, dieters and nondieters rated the chocolate similarly when given a red dominant decision aid ($F < .20$). These field study findings are consistent with our previous laboratory findings and provide additional support for our theory.

Chocolate consumption. The count of the number of chocolates taken by participants was analyzed using a 2 (self-regulatory goal: dieter vs. nondieter) × 2 (decision aid: green dominant vs. red dominant) generalized linear regression with a Poisson distribution. The results revealed a significant effect of the decision aid ($Wald(1, 146) = 4.345$, $p = .037$). The effect of self-regulatory goal was marginal ($Wald(1, 146) = 3.314$, $p = .069$) and the interaction was not significant ($Wald(1, 146) = 0.177$, $p = .674$). Consistent with our prediction, planned comparisons showed that nondieters in the green dominant condition ate more chocolates ($M = 1.96$, $SD = 1.86$) than in the other three conditions ($M = 1.31$, $SD = 1.31$; $\beta = .65$, $t = 2.10$, $p = .037$). All other effects were not significant (Figures 5 and 6).

Next, we test the full moderated mediation model, by examining how traffic light color-coded decision aids and self-regulatory goals influence chocolate consumption through health quality evaluations. Our focus in Study 4 is on the overall model and testing of our process theory, which predicts a conditional indirect effect. Our approach is consistent with the "growing consensus among methodologists that the total effect of X on Y (or X*W on Y) should not be a prerequisite to searching for evidence of indirect effects" (Hayes, 2013, p. 169; also see LeBreton, Wu, & Bing, 2009; Rucker, Preacher, Tormala, & Petty, 2011). That is, we find strong support for the predicted mediation process without a significant interaction (Hayes, 2009; MacKinnon, 2008; Rucker et al., 2011; Shrout & Bolger, 2002; Zhao, Lynch, & Chen, 2010).

Moderated mediation model. Following Hayes (2012; Process Model 58), we simultaneously tested the relationships among our variables through a moderated mediation analysis (see Figure 7). Using a bootstrap procedure that generated a sample size of 5,000 for our regression analyses, the first model regressed decision aid condition (coded, green dominant = 0, red dominant = 1), self-regulatory goal (coded, nondieters = 0, dieter = 1), and their interaction on health quality evaluations. Consistent with the earlier ANOVA results, the analysis revealed a significant effect of decision aid ($\beta = -1.27$, $t = -2.15$, $p = .033$) such that participants had lower health quality evaluations when given a red dominant decision aid. A marginal main effect of self-regulatory goal ($\beta = -1.01$, $t = -1.92$, $p = .057$) showed that dieters in general had lower health quality evaluations than nondieters. The decision Aid × Self-regulatory goal interaction was also marginally significant ($\beta = .31$, $t = 1.65$, $p = .100$), suggesting that the effect of decision aid on health quality evaluations does depend on self-regulatory goals.[2] The second model regressed health quality evaluations, self-regulatory goal, and their interaction on the number of chocolates consumed. The results showed a positive effect of evaluations on choice ($\beta = .22$, $t = 2.18$, $p = .031$); that is, the more positive the health evaluations of chocolates, the more chocolates were consumed. The main effect of self-regulatory goal was not significant ($\beta = .71$, $t = 1.12$, $p = .264$) indicating that consumption between dieters and nondieters was similar. Consistent with our theory, the results revealed a marginal self-regulatory goal and health quality evaluations interaction ($\beta = -.21$, $t = 1.81$, $p = .072$) showing that the effect of health quality evaluations on chocolate consumption depends on self-regulatory goals. To complete the moderated mediation analysis, direct and indirect tests revealed a significant negative conditional indirect effect of decision aid on the number of chocolates consumed by nondieters ($a \times b = -.27$), with a 95% CI that did not include zero ($-.814$ to $-.008$). However, for dieters, the effect was not significant (95% CI = $-.070$ to .035). This result supports our moderated mediation model with consumption being driven by participants' chocolate evaluations (see Figure 7).

Discussion

Experiment 4 was conducted in a field setting with grocery shoppers sampled from a broad population. This study recorded both product evaluations and actual choice behavior (Table 3). The results replicate the patterns of evaluations in the first three experimental

[1] The same analysis with age and native language as covariates results in significant main effects of decision aid ($p = .012$) and SR goal ($p = .035$) and a significant goal by decision aid interaction ($p = .039$). We have opted to report the more conservative result above.

[2] The analysis with age and native language as covariates results in the following effects in Model 1: significant main effects of decision aid ($p = .012$), SR goal ($p = .035$), and a significant goal by decision aid interaction ($p = .039$). In Model 2, a marginally significant health quality Evaluations × SR goal interaction is revealed ($p = .059$). Again we have opted to report the more conservative result above.

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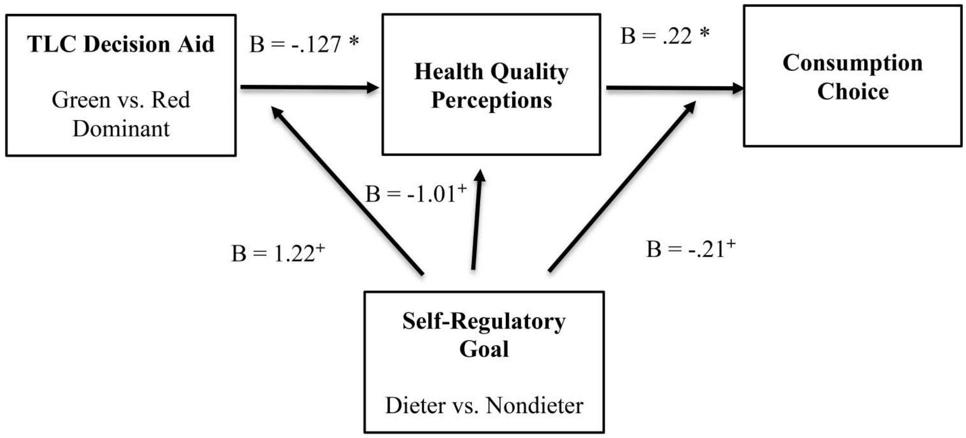

Figure 7. Experiment 4: Moderated mediation model of the influence of health quality perceptions on consumption. * $p < .05$. $^{+}$ $p < .10$.

studies. Nondieters rated the health quality of the chocolates higher when given a green dominant decision aid, as compared with a red dominant decision aid. Across all of our studies, dieters' with a traffic light decision aid reported evaluations that were lower than nondieters in the green condition. Dieters' evaluations were also lower in TLC label conditions as compared with dieters in control conditions; however, dieters' responses did not differ based on the color of the highlights on the label. In addition, Experiment 4 finds that consumers' health quality evaluations predict consumption. The moderated mediation model indicates that traffic light decision aids can affect choice behavior as well as evaluations.

General Discussion

In this article, we demonstrated that TLC labels influence food evaluations and choices, but that those effects differ between dieters and nondieters. Theoretically, we contribute to the extant literature in two important ways. First, we demonstrate that a relatively simple and inexpensive consumer decision aid can have a substantial effect on evaluations and behavior. In this way we add to prior work, which has shown that the format of information presentation can play a fundamental role in supporting consumer decision making through relatively simple changes (Bettman et al., 1998; Johnson et al., 2012; Thaler & Sunstein, 2008). Second, we explain the psychological mechanism that underlies differences in food evaluations, which in turn affect consumers' choices in a grocery store. Specifically, we find that TLC labeling has systematic effects: Dieters with the decision aid are better able to recall information from the product label; while nondieters have lower levels of recall and use the TLC label as a more direct guide for their evaluations of foods' health quality.

Table 3
Summary of Results From Experiment 4

	β	*SE*	*t*	*p*
Model 1				
Outcome: Health quality evaluations; IV: Decision aid condition; Moderator: Dieter vs. nondieter				
Decision aid condition	−1.27	.59	−2.15	.033
SR goal (dieter vs. nondieter)	−1.01	.53	−1.92	.057
Decision aid × SR goal	1.22	.74	1.65	.100
Model 2[a]				
Outcome: Food consumption; IV: Decision aid condition; Mediator: Health quality perceptions; Moderator: Dieter vs. nondieter				
Decision aid condition	−.28	.23	−1.22	.264
Health quality evaluation	.22	.10	2.18	.031
SR goal (dieter vs. nondieter)	.71	.63	1.12	.264
Health quality perceptions × SR goal	−.21	.12	−1.81	.072
Direct and indirect effects	Effect	*SE*	LLCI	ULCI
Decision aid on food consumption	−.28	.23	−.748	.179
Conditional indirect effects at values of the moderator				
Nondieters	−.27	.19	−.814	−.008
Dieters	−.001	.03	−.065	.061

Note. Level of confidence for confidence intervals is 95%.
[a] Based on 10,000 bootstrap samples.

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Implications for Practice and Policy

In practice, improving product labels to aid consumers in their food choices is a complex problem. The research presented in this article contributes to an important, global, and growing body of work that addresses eating behavior and decision making from a variety of perspectives (e.g., Bollinger et al., 2010; Downs et al., 2013; Elbel et al., 2011; Grunert & Wills, 2007; Hawley et al., 2013; Helfer & Shultz, 2014; Hersey et al., 2013; Lobstein & Davies, 2009). Prior research has argued that the current black-and-white back-of-package nutritional labels are too complex and difficult to understand (Héroux et al., 1988; Kristal et al., 1998; Wansink et al., 2004). While others contend that calorie labeling has a negligible effect on evaluations and behaviors (Bollinger et al., 2010; Chandon, 2013; Downs et al., 2009, 2013), our research suggests it is important to make the distinction between dieters and nondieters when investigating how consumers process TLC label information and make food choices. Investigating only aggregate effects may lead to overstated conclusions. Our results show that the TLC approach to labeling affects both dieters' and nondieters' choices. The color-coded labels provide nondieters with an information processing cue that directly influences evaluations in a manner that is consistent with the stop and go logic behind the traffic light labels. Given that nondieters respond appropriately to the color coding, TLC labels can be a useful decision aid. Our field study provides evidence in support of this view.

For dieters, the story is more nuanced. Clearly, TLC labels affect dieters' evaluations and information recall, as compared with the more traditional black-and-white labels in Experiments 1 and 3. Dieters' recall improves with color-coding and they rate relatively high cost of consumption foods as less healthy. Experiment 4 further demonstrates that those lower evaluations influence actual consumption behavior. However, differences in color—for example, green versus red highlights—do not affect evaluations or choice. Therefore, TLC labels do influence dieters, but changing perceptions and behavior for dieters is not as simple as stop and go. Instead the color highlighting draws dieters' attention to the label and improves recall of TLC information. This alone may be a valuable tool in the effort to help consumers make product choices that are consistent with their long-term goals. In the context of the higher cost of consumption of foods in the current studies, we find that color-coded labels, as compared with traditional black-and-white labels, do engage dieters. More research is needed to better understand how such highlighting might also improve dieters' evaluations of healthy alternatives and overall food decision making.

Limitations and Directions for Future Research

By examining the efficacy of TLC food labels, this research contributes to a growing body of work that supports the use of relatively simple aids to assist decision making (Häubl & Trifts, 2000; Johnson et al., 2012; Thaler & Sunstein, 2008). There are, of course, a variety of other tools and techniques that have been proposed in theory and practice to accomplish similar objectives in the domain of eating behavior and self-regulation. Examples include the Nu Val label used in some U.S. supermarkets (Helfer & Shultz, 2014), the Canada Health Check label (http://www.healthcheck.org/), the Swedish National Food Agency's Keyhole label (http://www.slv.se/en-gb/Group1/Food-labeling/Keyhole-symbol/), Finnish Hearth Symbol (http://www.sydanmerkki.fi/en), as well as simple smiley faces and stars (Feunekes et al., 2008). Each labeling system draws attention to different aspects of the product and, as a result, may very well have different effects on behavior, and different psychological mechanisms may underlie those effects. We hope future work will incorporate other approaches, building on the variety of labels that prior investigations have already considered (Borgmeier & Westenhoefer, 2009; Feunekes et al., 2008; Grunert & Wills, 2007; Helfer & Shultz, 2014; Hersey et al., 2013).

We have chosen to focus on the TLC labels because they appear to be especially well adapted to highlighting the costs of consumption using the red "stop" color-coding (Balcombe et al., 2010). In addition, given that the overconsumption of calories is an important driver of obesity (Abelson & Kennedy, 2004), nutritional cost information is especially relevant. In the context of a typical grocery store selling tens of thousands of food products, we have examined a relatively limited range of foods that are prototypical of higher cost items. We do not examine differences in information processing or behavior that may arise from TLC labels or similar highlighting of facts about vitamins, minerals or other potential health "benefits" of consumption. Nor have we investigated the impact of color-coding on thoughts or perceptions about the temptation of tastier foods that have higher, even "red" levels, of salt, sugar, or fat. Therefore, our conclusions focus on the effects that TLC labels, which highlight the costs of consumption, have on dieters' and nondieters' food evaluations and choice behavior.

It is also worth noting that we have used a self-report measure of dieting. Our measure is simple and clear; however, it is asking dieters to self-identify. At a general level, we are interested in better understanding the extent to which simple decision aids can help people reach their own goals—that is, goals they set for themselves, such as dieting, saving money or exercising more. In this context a clear single-item measure is a reasonable approach to eliciting information about a general goal, such as dieting (Bergkvist & Rossiter, 2007; Drolet & Morrison, 2001; Rossiter, 2002). It is also a measure used in closely related research (Trudel & Murray, 2011, 2013). This measure, however, does not indicate that these people are successful dieters and it can include people who are dieting for reasons other than weight management. It may be worthwhile for future research to dig deeper into the underlying motivations and multiple dimensions of dieting to further explain the effects of labeling on different people in different contexts. Similarly, we have focused on food evaluations and consumption, but we do not have data on weight loss or long-term progress toward dieting goals. The current work is an important departure from prior studies that focused on aggregate results (Burton & Kees, 2012). We hope that more will be done to understand labeling effects among heterogeneous consumers using a variety of dependent variables, including longitudinal studies examining effects over extended periods of time.

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(*Appendices follow*)

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Appendix A

Descriptive Information of Samples

Experiment	Gender	Mean age	Number of dieters	Number of female dieters	Number of male dieters
1 (n = 123)	67 females	19.93 years	67 (54.5%)	44 (65.7%)	23 (41.1%)
2 (n = 182)	83 females	19.89 years	98 (54.1%)	52 (62.7%)	46 (46.9%)
3 (n = 227)	129 females	na	132 (58.1%)	81 (61.4%)	51 (38.6%)
4 (n = 150)	82 females	39.87 years	96 (64%)	52 (54.2%)	44 (45.8%)

Appendix B

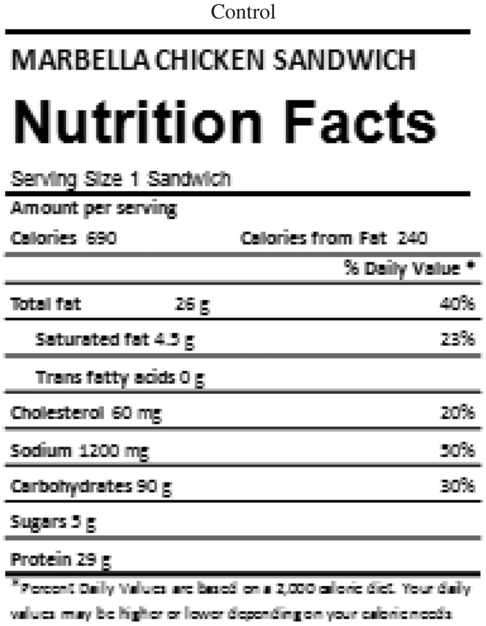
Experimental Stimuli

Table B1
Stimuli for Experiment 1

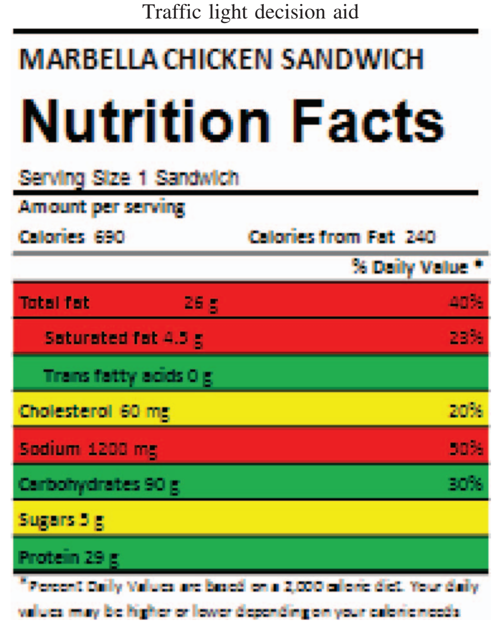
Chicken Marbella Sandwich

The Chicken Marbella Sandwich is a smoked chicken breast sandwich with sun dried-tomato mayonnaise, field greens, red onions, and tomatoes made to order on your favorite sandwich bread.

Control



Traffic light decision aid



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

(*Appendices continue*)

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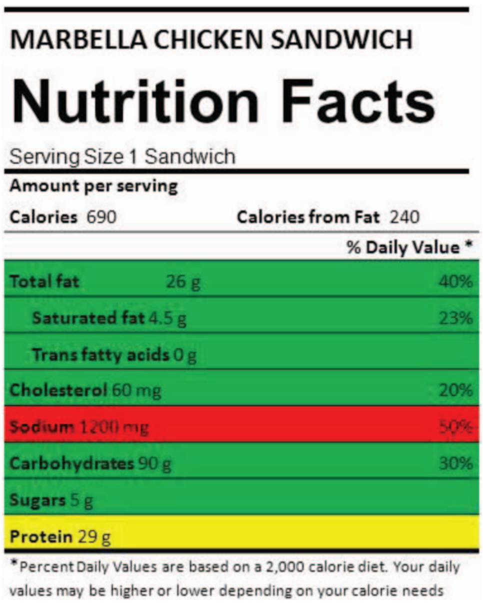
Table B2
Stimuli for Experiment 2

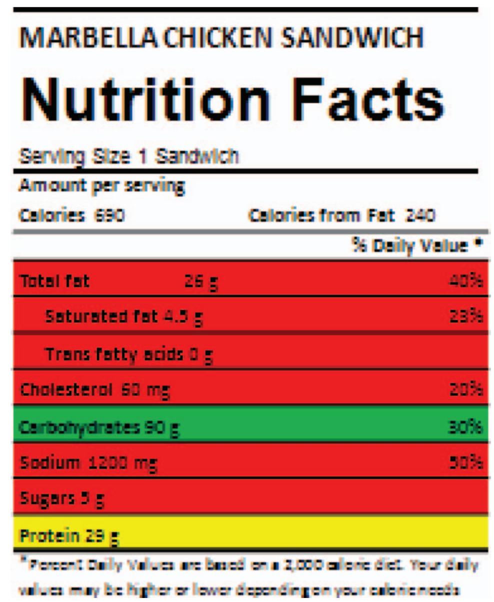
Chicken Marbella Sandwich

The Chicken Marbella Sandwich is a smoked chicken breast sandwich with sun dried-tomato mayonnaise, field greens, red onions, and tomatoes made to order on your favorite sandwich bread.

Green dominant



Red dominant



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

(*Appendices continue*)

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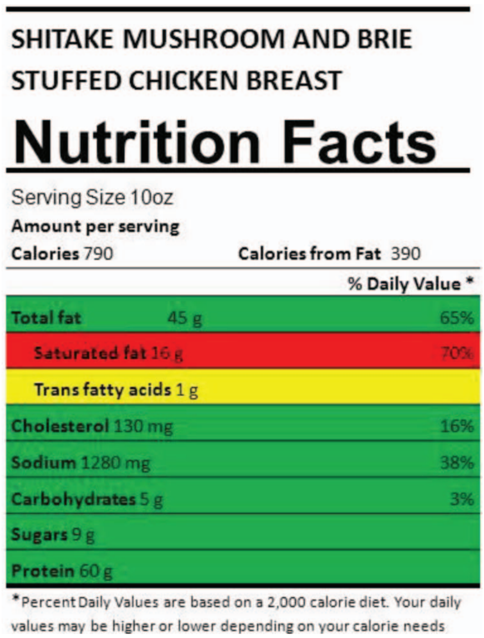
Table B3
Stimuli for Experiment 2

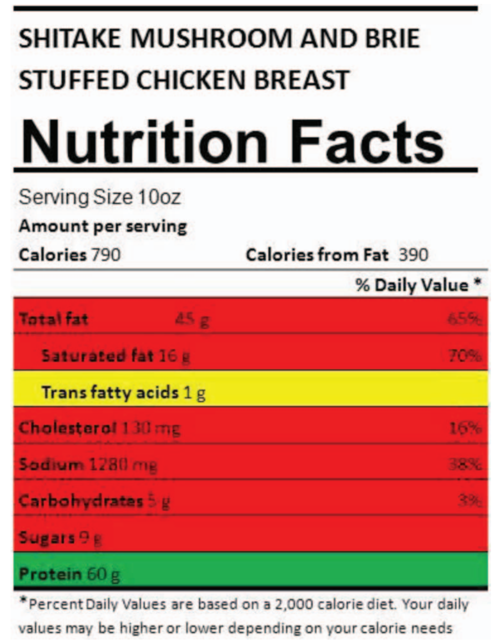
Stuffed Chicken Breast

The stuffed Chicken Breast is a whole chicken breast stuffed with sautéed Shitake mushrooms, Brie cheese, red onions, and garlic.

Green dominant



Red dominant



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

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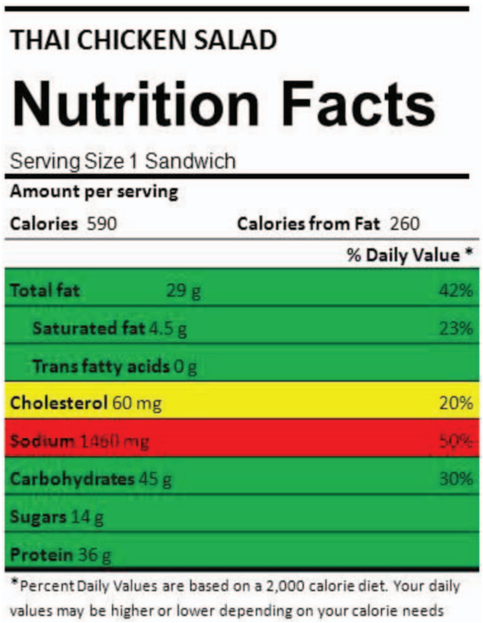
Table B4
Stimuli for Experiment 2

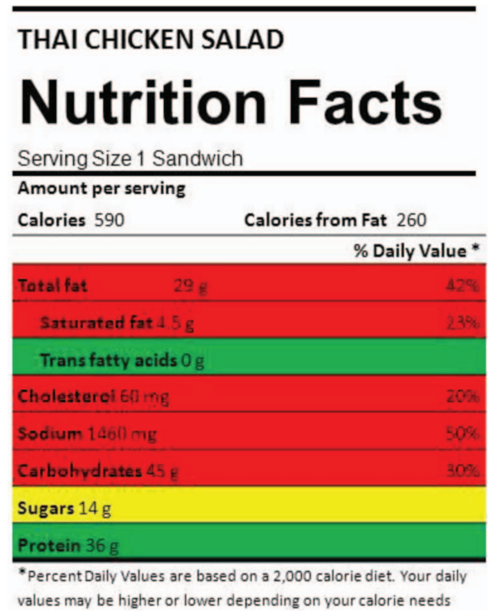
Thai Chicken Salad

The Thai Chicken Salad is made of all natural chicken breast, romaine lettuce, Thai cashews, fire-roasted edamame, red peppers, fresh cilantro, and wonton strips all tossed in a Thai Chili Vinaigrette and drizzled with peanut sauce.

Green dominant



Red dominant



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

(*Appendices continue*)

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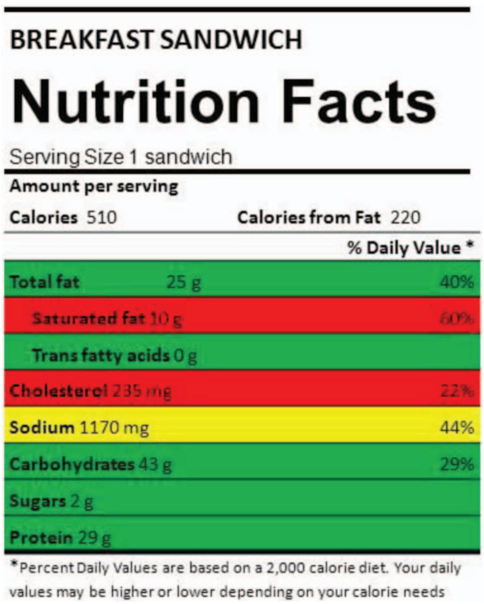
Table B5
Stimuli for Experiment 2

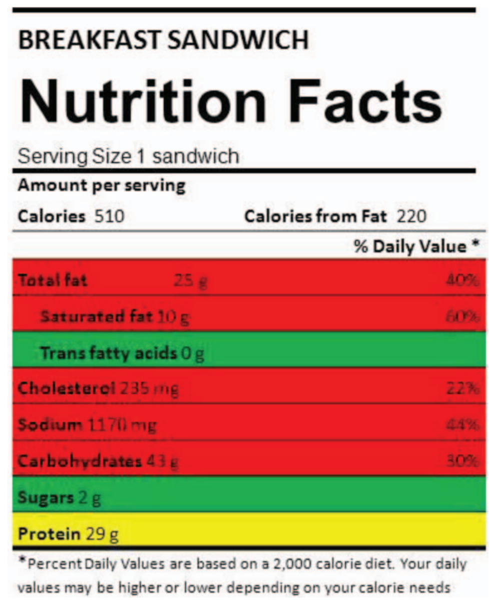
Breakfast Sandwich

The Breakfast Sandwich has an all-natural egg, a thick slice of Vermont white cheddar, a generous amount of applewood-smoked bacon all grilled on freshly baked Ciabatta bread.

Green dominant



Red dominant



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

(*Appendices continue*)

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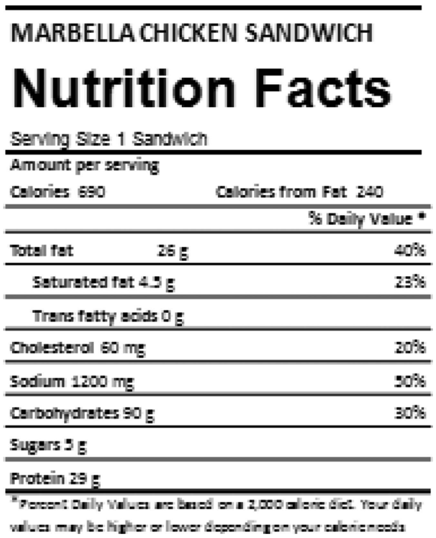
Table B6
Stimuli for Experiment 3

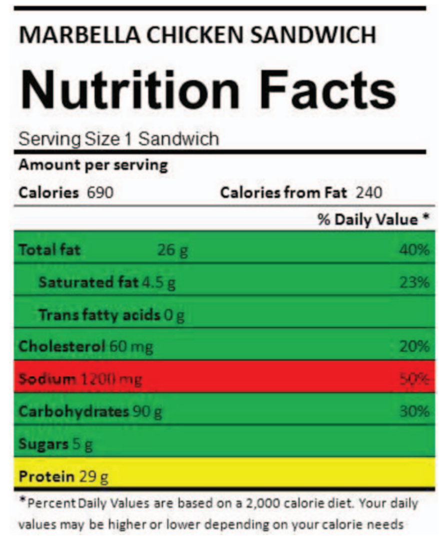
Chicken Marbella Sandwich

The Chicken Marbella Sandwich is a smoked chicken breast sandwich with sun dried-tomato mayonnaise, field greens, red onions, and tomatoes made to order on your favorite sandwich bread.

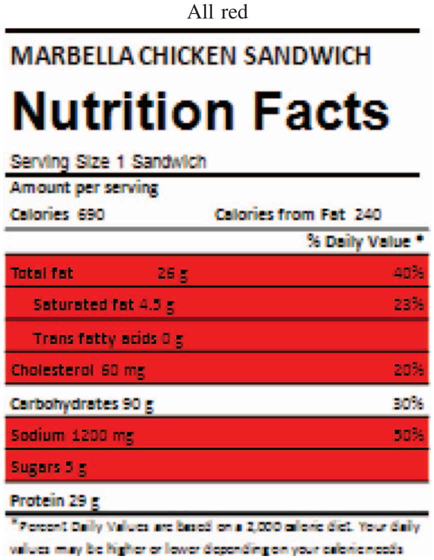
Control



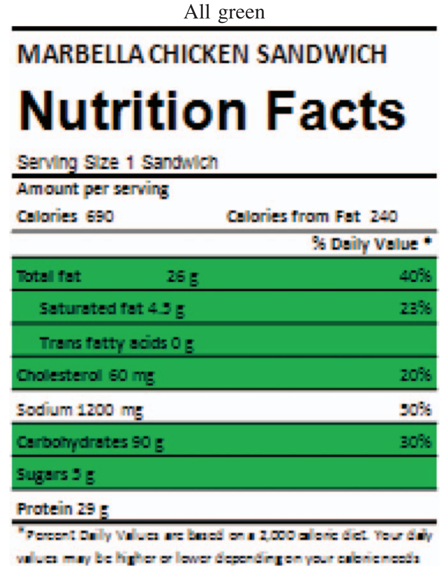
Green dominant



All red



All green



Note. Product description, nutrition facts, and labels were produced by the authors. See the online article for the color version of this table.

(*Appendices continue*)

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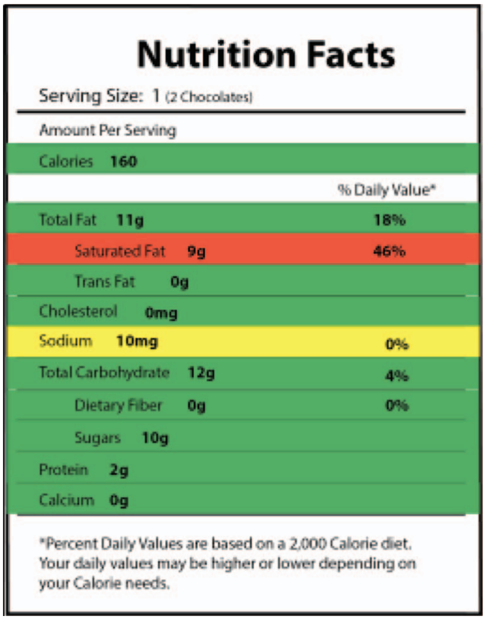
Table B7
Stimuli for Experiment 4: Field Study

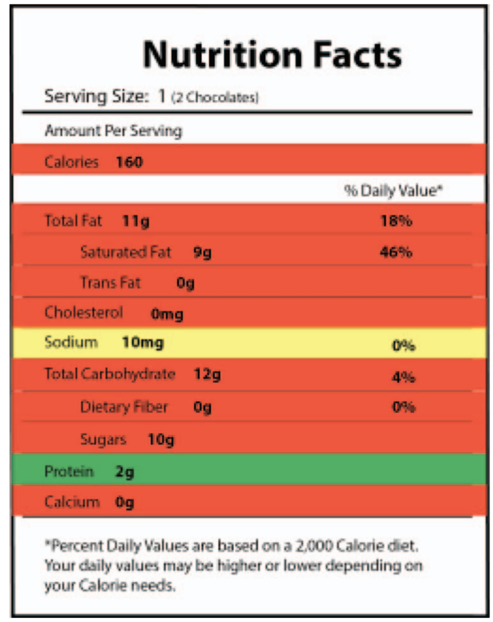
Chocolate

Individually wrapped mini milk chocolates were used.

Green dominant



Green dominant



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