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# Health Halos: How Nutrition Claims Influence Food Consumption for Overweight and Normal Weight People

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# Health Halos: How Nutrition Claims Influence Food Consumption for Overweight and Normal Weight People

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# Health Halos: How Nutrition Claims Influence Food Consumption for Overweight and Normal Weight People


## Abstract

How do the nutrition claims on packaged goods influence how much a person eats? In an era of increasing obesity and increasing threats of legislation, regulation, and boycotts, this question is a concern both to responsible packaged goods companies and to regulatory agencies. To address this question, we develop and test a framework that shows how relative nutrition claims (such as “low-fat”) can increase food intake by increasing perceptions of appropriate serving size and decreasing anticipation of consumption guilt. Three studies show that relative nutrition claims can lead all consumers to overeat, but this becomes more exaggerated for overweight consumers than for those with a normal weight. Further results show that providing objective serving size information eliminates the overeating that is encouraged by low-fat nutrition claims, but only among normal weight consumers. With consumer welfare and corporate profitability in mind, win-win labeling insights are suggested for manufacturers and public policy officials.

> "At one point, the most commonly asked question to the Nabisco Consumer Hotline was whether [low-fat] Snackwells could be purchased in larger packages," (Alexander 2004).

Food companies are on trial for contributing to the growing problem of obesity in the United States and abroad. They have been threatened by taxes, fines, restrictions, legislation, and the possibility of being "the tobacco industry of the new millennium" (Nestle 2002). In particular, food labeling is of critical concern among regulators such as the U.S. Food and Drug Administration (FDA). Although past research has effectively examined how health claims and nutrition labels influence health beliefs and purchase intentions (Andrews et al. 1998; Balasubramanian and Cole 2002; Ford et al. 1996; Keller et al. 1997; Kozup et al. 2003; Moorman 1990; Moorman 1996; Moorman et al. 2004), the pressing issue for the FDA is how relative nutrition claims (such as "low-fat" or "reduced calories") influence food intake on a single eating occasion and on what companies can do about it (Food and Drug Administration 2003). In particular, the FDA is concerned that relative nutrition claims may lead to the over-consumption of nutrient-poor and calorie-rich snack foods by the 65% of US consumers who are already overweight[1] (Hedley et al. 2004).

Although no food company would want to discourage consumers from purchasing their products, it may be in their interest to use relative nutrition claims to help consumers better control how much they consume on a single eating occasion (Wansink and Huckabee 2005). Consider indulgent, hedonic foods, such as candies and snacks. Single occasion over-consumption of these foods can not only lead to weight gain but can also lead to rapid satiation and to delayed repurchasing (Inman 2001). Over the longer term, helping consumers better control their consumption could also help promote more favorable attitudes toward the brand and company. This may result in what Rothschild (1999) refers to as a "win-win" policy-sensitive solution for both companies and consumers.

Because of these concerns with food labels and claims, the FDA raised three specific questions for companies like Kraft Foods and M&M/Mars (now Masterfoods) to answer: 1) How do relative nutrition claims influence how much people consume on a single eating occasion? 2) Do relative nutrition claims influence overweight consumers differently than consumers with a normal weight? and 3) Can serving size information eliminate this bias? To help managers address these questions, we develop a general framework suggesting that relative nutrition claims increase consumption because (1) they increase perceptions of the appropriate serving size and (2) they reduce anticipated consumption guilt. This framework also suggests that relative nutrition claims have less of an influence on consumption when objective serving size information is provided and when there are high levels of consumption guilt, which depends on both the food-type (hedonic vs. utilitarian) and the consumer (overweight vs. normal weight).

We test this framework in three studies, in which we show the process by which low-fat nutrition labels lead consumers to increase their snack food consumption. Study 1 establishes the main finding of the research by showing that visitors to a university-wide open house eat more chocolate candies when they are labeled as "low-fat" than when they are labeled as "regular," particularly if they are overweight. Study 2 investigates the two hypothesized mediators and shows that low-fat nutrition claims lead all consumers to lower their anticipated consumption guilt and to increase the amount they believe to be an appropriate serving size.

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[1] Following the guidelines of the World Health Organization, persons are classified as "normal weight" if their body mass index (BMI) is between 18 kg/m² and 25 kg/m², as "overweight" if their BMI is greater than 25 kg/m², and as "obese" if their BMI is greater than 30 kg/m². BMI is computed as the ratio of weight, measured in kilograms, to squared height, measured in meters.

Study 3 uses a movie theatre environment to show how relative nutrition claims and objective serving size information jointly influence the consumption of granola by overweight and normal weight consumers. In the last section, we discuss the implications of our findings for nutrition research, responsible food manufacturers, and public policy officials.

## How Relative Nutrition Claims Influence Consumption

When determining how much to eat, labels offer both objective and subjective consumption cues. Objective consumption cues, such as those provided by the serving size information on a label, explicitly suggest some guidance about how much should be consumed on a single occasion (Caswell and Padberg 1992). Subjective consumption cues, such as those provided by endorsed[2] or relative nutrition claims, do not specify an exact serving size, but they may influence serving size inferences (how much a person thinks is appropriate to eat) and how guilty they should feel about it. Figure 1 shows the predicted relationship of these variables on food consumption, and it foreshadows how these relationships may vary across foods and across people.

--- Insert Figure 1 about here ---

### Serving Sizes Inferences

Inferences made about serving sizes are in some ways similar to inferences made in daily conversations. Because of conversational norms, consumers first assume that the information communicated to them (such as in a conversation or on a label) is potentially informative and relevant to their decisions (Grice 1975; Schwarz 1996). Consumers therefore use the information provided to make inferences about missing attributes that are important for their decision. For example, Broniarczyk and Alba (1994) found that people make inferences about important missing attributes based on their intuitive beliefs about the relationship between the attributes that are missing and those that are available, even in the face of contradictory cues. Similar inferential mechanisms are well documented in several nutrition studies that have shown that consumers inappropriately generalize health claims (Garretson and Burton 2000; Ippolito and Mathios 1991; Kozup et al. 2003; Moorman and Matulich 1993). For example, Andrews, Netemeyer, and Burton (1998) showed that consumers erroneously infer that foods low on cholesterol are also low on fat. Similarly there is strong evidence that many consumers erroneously believe that “low-fat” nutrition claims indicate fewer calories (National Institutes of Health 2004). They do not realize that when determining whether “low-fat” nutrition claims are appropriate, the FDA[3] only looks at the amount of fat, not at the number of calories (see Table 1).

---- Insert Table 1 about here ---

Supporting the argument that nutrition claims influence perceived serving sizes, studies have shown that consumers’ perception of serving size are ambiguous and flexible. Of course, with discretely packaged items—such as a 12-ounce can of a soft drink or a single-serving candy bar—the intended serving size is obvious. In many other contexts—such as with large bags of M&Ms, a large bag of granola, or a full 24-ounce serving bowl of macaroni and

[2] Endorsed nutrition claims are those that have been tested, proven, and ratified by an endorsing entity such as the Food and Drug Administration or the American Cancer Association. Endorsed claims specifically note the effect a targeted ingredient has on health (Geiger 1998). These include links between soy and heart disease, between folic acid and birth defects, and between fiber and cancer.

[3] While it is true that fat contains more calories per grams than either carbohydrates or proteins, low-fat foods typically compensate the reduction in fat by an increase in carbohydrate (Burros 2004). As a result, foods labeled as “low-fat” do not, on average, contain significantly fewer calories per serving than foods without this label (National Institutes of Health 2004). For example, the low-fat Snackwells cookies developed by Nabisco contain less fat but not fewer calories than regular cookies because the fat had been replaced by high-calorie starches and sugars.

cheese—the appropriate serving size is more ambiguous. In the absence of salient, unambiguous serving size information, an appropriate serving size is whatever amount a person thinks should be the consumption norm for that particular food and situation (Wansink 2004).

Conversational norms, inferential mechanisms, and ambiguity about serving sizes lead us to predict that relative nutrition claims could create misleading "health halos" that lead consumers to believe that the appropriate amount to consume is higher when the food is described as being lower in fat, calories, or carbohydrates. We therefore hypothesize that a relative nutrition claim communicated by a "low-fat" label increases food intake per consumption occasion because it increases consumers' estimations of the appropriate consumption volume (their perception of serving size) and because it decreases consumers' estimations of the calorie density of the food (the number of calories per volume) and of their associated consumption guilt.

**Anticipated Consumption Guilt**

Food decisions often involve a trade-off of two goals: The hedonic goal of short-term taste gratification and the utilitarian goal of long-term health preservation and enhancement (Dhar and Simonson 1999; Shiv and Fedorikhin 1999 ). Whichever of these two goals is most salient will influence how consumers choose between hedonic and utilitarian foods and how they determine how much they will eat. For example, Fishbach and Dhar (2005) showed that making the hedonic goal more salient leads them to choose a candy bar over an apple.

For some consumers, fulfilling their hedonic goal rather than their utilitarian goals can lead to strong feelings of guilt (Baumeister 2002; Kivetz and Keinan forthcoming). For example, Kivetz and Keinan (forthcoming) found that consumers making hedonic choices (e.g., pleasure rather than work) exhibit more guilt than consumers making utilitarian choices (e.g., work rather than pleasure). Similarly, feelings of guilt occur when choosing taste over health. Consider a restaurant's dessert menu. Okada (2005) found that people eating at a restaurant were more likely to order "Cheesecake deLite," a low-fat dessert, than "Bailey's Irish Cream Cheesecake," a high-fat dessert, when they were presented side-by-side on the menu, but they preferred the high-fat dessert to the low-fat dessert when each item was presented alone. She attributes these findings to the fact that presenting both options together increased the feelings of guilt associated with the low-fat option.

We therefore expect that another way in which relative nutrition claims (such as low-fat labels) increase consumption is by reducing a consumer's anticipated consumption guilt. This hypothesis is supported by several findings showing that low-fat products are considered more hedonic than high-fat products. For example, Wertenbroch (1998) found that consumers expect better taste when potato chips are labeled "25% fat" than when they are labeled as "75% lean" (a frame which is known to reduce perception of fat). Similarly, Raghunathan, Walker and Hoyer (2005) showed that increasing the perceived amount of "bad" fat increases consumers' expectations about the taste of a product.

People are more likely to feel guilty about overeating an indulgent, hedonic food (such as chocolate) than they would about eating a food they saw as relatively more healthy (such as granola). Yet the guilt of overeating is likely to be a more powerful motivator to some people than others. One of the individual characteristics associated with feelings of consumption guilt may be related to an individual's weight. Studies have shown that one's Body Mass Index (BMI) is strongly associated with dietary disinhibition. That is, overweight people have a greater tendency to lose control over eating and to have higher levels of hunger and lower levels of consumption guilt (Hays et al. 2002). For example, the Three Factor Eating Questionnaire, the main survey instrument for measuring dietary disinhibition, includes items such as "life is too short to worry about dieting" (Stunkard and Messick 1985).

## Implications for Reducing the Effects of Low-fat Labels on Consumption

Because of the ambiguity of sensory experience (Deighton 1984; Ha and Hoch 1989), it is unlikely that consumers will realize that they are over-consuming foods with relative nutrition claims. Indeed, a wide range of studies have shown that consumers are unable to monitor the number of calories that they consume (Livingstone and Black 2003). As a result, we expect that consumers will not be aware that their consumption has increased because of "low-fat" nutrition labels.

Will serving size information reduce this tendency to over eat because of a health halo? When objective serving size information is provided, consumers do not need to rely on low-fat information to infer serving size. Support for this hypothesis comes again from studies of conversational norms, which suggest that communication from institutional sources is generally perceived as truthful in the absence of better information or disconfirming evidence (Grice 1975; Schwarz 1996). Accordingly, although most consumers are skeptical of health claims, they generally believe nutrition facts, labels, and nutrition claims (Wansink, 2004). This hypothesis is also supported by self-generated validity research, which shows that inputs that are perceived to be only moderately diagnostic are ignored when more diagnostic ones can be retrieved (Feldman and Lynch 1988).

Yet the influence of serving size should vary across people and across foods. Recall that for more utilitarian foods (such as granola), we expect that the tendency to consume more food with low-fat labels will be similar for overweight and normal weight consumers. This is because all consumers will anticipate the same low levels of guilt from consuming products that are seen as generally good for them to eat. In contrast, low-fat labeling should have a stronger influence on the consumption of hedonic foods (such as chocolate candies) for overweight consumers than for normal weight consumers. This is because consumers with a normal weight will anticipate higher feelings of guilt from consuming candies, regardless of whether it is labeled as low-fat or not. As a result, objective serving size information should be more effective in reducing the effects of relative nutrition claims for normal weight consumers than for overweight ones.

## Study 1: Do "Low-Fat" Nutrition Labels Increase Consumption?

Study 1 examines whether low-fat nutrition claims increase the actual and estimated consumption of hedonic chocolate candies by overweight and normal weight consumers. To achieve this, we asked adults participating in a university open-house to serve themselves unusual colors of M&M's (gold, teal, purple, and white) which were very clearly labeled as either "New Colors of Regular M&Ms" (regular label condition) or as "New Low-Fat" M&Ms (low-fat label condition), and we measured how many calories of M&Ms they served themselves and how many they thought they served.

### Procedure

Participants were incoming students and their families who were visiting a university open-house to look at information, videos, and interactive displays related to food science and human nutrition. The open-house operated from 9:00 to 4:00 on a Friday and Saturday and sign-in records indicated that at least 361 people visited the area in which these displays were located. As families entered the display area, they were greeted by a research assistant who welcomed them and provided a brief overview of the display area. Following this, each family was taken to one of two gallon-size serving bowls of M&Ms that had been placed on either side of the entrance but out of sight of each other. Each family member was given a 16-ounce bowl and sanitary gloves and told they could help themselves to the M&Ms. The gallon bowls were placed on separate tables and participants could only see the nutrition labels on the M&M

bowl to which they had been led. To ensure that participants would pay attention to the nutrition label, bowls were filled with unusual colors of M&Ms (gold, teal, purple, and white). Participants in the regular label condition saw a gallon bowl with a professionally-designed 8x5-inch label which read "New Colors of Regular M&M's." Participants in the low-fat label condition saw a gallon bowl with a similar label which read "New Low-fat M&M's" (no such product is currently available on the market).

Immediately after these open-house guests had selected the M&Ms they had wanted, the research assistants asked them if they wanted to be involved in a series of demonstrations and short surveys about how consumers make choices and decisions. Of the 361 visitors, 293 claimed to be of legal age (18 and over) and 269 of these eligible adults agreed to participate (91.8%). The research assistant then asked permission to weigh their plastic bowls (which contained their M&Ms) and handed them a brief survey which asked their age, gender, height, weight, nutrition knowledge, and familiarity with M&M's. Nutrition knowledge and product familiarity were self-assessed on 3-point scales (from low to high). After they completed the questionnaire, the research assistant asked each visitor to estimate how many total calories of M&Ms they had served themselves. At this time, each person was told that the M&Ms they had selected were actually regular (full calorie) M&Ms. They were then thanked, given a bookmark, a refrigerator magnet, and a nutrition tip-sheet. Most people then took 15 to 20 minutes to read the materials and watch the videos before exiting out of a far door. Because they had been told that they could not eat food outside of this display area, all but seven (97.3%) finished their M&Ms in the display area.

**Results**

Following the analysis guidelines of the World Health Organization, we classified participants as overweight (n = 103) or normal weight (n = 166) depending on whether their BMI was above or below 25 kg/m². To facilitate the comparison between actual and estimated consumption, we converted the weight measures of the M&Ms into calories using the information available in the manufacturer's website. We used ANCOVAs to analyze estimated and actual consumption using the nutritional label (low-fat versus regular), the individual's body mass (below vs. above 25 kg/m²), and their interaction. Each participant's gender, age, self-assessed nutrition knowledge, and familiarity with M&Ms were included as covariates.

--- Insert Figure 2 about here ---

*Actual consumption.* As predicted, low-fat labels increased consumption ($F(1, 251) = 13.1$, $p < .001$). Participants ate 28.4% more M&M's when they were labeled as "low-fat" ($M$ = 244 cal) than when they were labeled as "regular" ($M$ = 190 cal). Furthermore, overweight participants took 16.7% more M&M's ($M$ = 237 cal) than normal weight participants ($M$ = 203 cal), $F(1, 251) = 4.3$, $p < .05$. As expected, the interaction between low-fat labeling and body mass was statistically significant ($F(1, 251) = 3.9$, $p < .05$). Low-fat labeling had a stronger impact among overweight participants, whose intake increased by 90 calories (a 47% increase), than among normal weight participants, whose intake increased by only 30 calories (a 16% increase). Contrast tests show that the calorie increase due to low-fat labeling was statistically significant among overweight participants ($F(1, 91) = 9.2$, $p < .001$) but not among normal weight participants ($F(1, 156) = 2.2$, $p = .13$). None of the effects of the covariates were statistically significant ($p > .10$).

*Consumption estimation bias.* As illustrated in Figure 2, calorie estimates were not influenced by the nutrition labels and were only marginally influenced by a person's body mass. To directly examine the dissociation between actual and estimated calories, we conducted an ANCOVA using consumption bias (the estimated minus the actual number of calories) as the dependent variable and using the same factors and covariates as in the analysis of actual consumption. On average, participants underestimated the number of calories of

M&M's by 48% ($F(1, 251) = 42.5$, $p < .001$). Overweight and normal weight participants similarly underestimated the number of calories contained in the M&M's that they were about to consume ($F(1, 251) = 1.7$, $p = .21$). The main effect of nutrition labels ($F(1, 251) = 23.9$, $p < .001$) and its interaction with body mass ($F(1, 251) = 4.5$, $p < .05$) were both statistically significant. That is, people who saw low-fat labels were more biased in their calorie estimates ($M$ = –132 cal) than those in the regular label condition ($M$ = –81 cal), and overweight participants were even more biased than normal weight participants (see Figure 2). The effects of gender, self-assessed nutrition knowledge, and familiarity were not statistically significant (respectively, $F(1, 251) < .1$, $p = .71$, $F(1, 251) = 1.3$, $p = .25$ ,and $F(1, 251) = .5$, $p = 0.48$), but the magnitude of the consumption estimation bias decreased by 0.7 calories per year of age ($F(1, 251) = 3.9$, $p < .05$), leading older participants (who tended to take smaller amounts) to be more accurate than younger ones.

**Discussion**

There are three key results from Study 1. First, it shows strong support for a health halo: Participants consumed 28% more M&M's when they were described as "low-fat" than when they were described as "regular." Second, the influence of low-fat labeling was stronger among those who were overweight. Third, all participants strongly underestimated the number of calories they consumed, and they were unaware that low-fat labeling influenced their consumption. The magnitude of this calorie underestimation was particularly strong among overweight participants, the people for whom underestimating calories is potentially the most harmful.

Because low-fat foods contain slightly fewer calories than regular versions, it would be reasonable for a hungry calorie-counter to consume more candy when it is described as low-fat than when it is not. The key question for public health is whether relative nutrition claims, such as "low-fat," lead people to increase consumption so much that it offsets the lower calorie density of low-fat foods.

To determine this, we conducted a market survey of all brands of chocolate candies, bars, cookies, milk drinks, and muffins with at least a 5% market share. We found 17 brands sold with both a regular and a low-fat version. Serving sizes were nearly identical across versions ($t = 1.08$, $p = .30$). On average, low-fat versions contained 59% less fat per serving than regular versions (3.2 vs. 6.7 grams, $t = 7.43$, $p < .001$). However, they contained only 15% fewer calories per serving than regular versions (140 vs. 170 cal, $t = 4.79$, $p < .01$). Assuming that participants in Study 1 had eaten real "low-fat" M&M's, and that they had an average level of reduced fat and calories, participants would have consumed 48% less fat from the low-fat M&M's but would have consumed 9% more total calories. In reality, the increase in calories is likely to be even higher because the ingredients used to replace fat tend to make people hungrier (Nestle 2002).

## Study 2: Do "Low-Fat" Nutrition Labels Influence Perceptions of Serving Size and Guilt?

Study 1 established that relative nutrition claims, such as "low-fat" labels, can lead people to increase their food consumption without realizing they are doing so. These results do not, however, establish why this might occur, or why this tendency is so much stronger among overweight people than among those with normal weight. In Study 2, we examine the role of two possible mediators of this label-consumption relationship (perceived serving size and anticipated consumption guilt), and we will do so for the hedonic foods (M&Ms) as well as for the more utilitarian foods (granola).

**Procedure**

We recruited 74 consumers on a major university campus for a study that they were told dealt with visual illusions and volume perceptions. In exchange for free movie coupons, each participant was told that we would ask them to rate familiar snack foods displayed in transparent containers. Two transparent cylindrical measuring cups (20-ounce capacity) were placed in each of two separate rooms. In each room, one cup contained 10 ounces of M&M's (1,380 cal) and the other contained 10 ounces of regular granola (1,330 cal). Half the participants were assigned to the first room and saw measuring cups that were labeled as "Regular M&M's" or "Regular granola." The other half of the participants were assigned to the other room and saw measuring cups labeled as "Low-fat M&M's" or "Low-fat granola." The two snacks were chosen based on pre-tests which indicated that, although both foods have the similar calorie density (135-140cal/oz), granola is perceived as less hedonic, more nutritious, and more healthy than M&Ms.

Each participant was given a two-page questionnaire. On the first page, they were asked to evaluate serving sizes by a) estimating the number of ounces of the snack that would be appropriate *for a typical person* to eat during a 90-minute movie, and by b) estimating the number of ounces that would be appropriate *for them* to eat in the same situation. Calibrating such estimates was aided by detailed ounce markings that were on the side of each measuring cup. They were also asked to estimate the total number of calories contained in each container, and to rate how guilty (1 = not guilty; 9 = guilty) they would feel after consuming a two-ounce bowl of each food. The sequence of these four questions was systematically rotated across the participants to avoid an order bias. On the back of the questionnaire, participants recorded their gender, height, weight, and were asked to guess the purpose of the study. We then thanked the participants and debriefed them. No one guessed the purpose of the study.

**Results**

To increase the reliability of the serving size estimates, the two measures of serving sizes were averaged and analyzed with a repeated-measure ANOVA using the two different foods as a within-subject factor and the nutritional label, each individual's BMI, and their interaction as between-subjects factors. Using the World Health Organization BMI cutoff of 25 kg/m$^2$, 52 participants were classified as being normal weight and 16 were classified as being overweight. As shown in Table 2, all participants who saw a food that was labeled as "low-fat" believed that an appropriate serving size was 25.1% larger ($F(1, 60) = 6.0$, $p < .01$). There were no differences between overweight and normal weight participants ($F(1, 60) = .4$, $p = .55$). The effect of low-fat labels was consistent regardless of one's BMI ($F(1, 60) = .4$, $p = .55$). None of the interactions between food type (granola or M&Ms) and any of the between-subjects factors was statistically significant ($p > .20$). On average, participants estimated that the appropriate consumption amount was 1 oz higher in the low-fat label condition than in the regular label condition. As shown in Table 2, the effects of low-fat labels was similar across snacks (1.1 oz for M&M's and 0.9 oz for granola) and across BMI groups (1.5 oz for normal weight participants and 0.9 oz for overweight participants).

Estimates of calorie density followed the opposite pattern than serving size estimates. Participants who saw a food that was labeled as "low-fat" believed it to be much lower in calories ($F(1, 69) = 4.1$, $p < .05$). There were no differences between overweight and normal weight participants $F(1, 69) = 2.9$, $p = .10$). The effect of low-fat labels was consistent regardless of one's BMI ($F(1, 69) = 2.9$, $p = .10$). None of the interactions between food type (granola or M&Ms) and any of the between-subjects factors was statistically significant ($p > .20$). As shown in Table 2, low-fat labels decreased calories estimates by an average of 260 calories and the amount of the reduction was similar across both M&Ms and granola (–292 versus –229 calories) and across both low- and high-BMI groups (–254 versus –272 calories).

---- Insert Table 2 about here ---

Did low-fat labeling lessen one's anticipation of consumption guilt? In general, all participants anticipated they would feel less guilty ($M$ = 3.6 on a nine-point scale anchored at 1= "not guilty" and 9 = "guilty) in the low-fat label condition than in the regular label condition ($M$ = 4.6, $F(1, 69) = 3.8$, $p < .05$), but this was stronger for overweight participants. As shown in Table 2, the interaction between food type and BMI was statistically significant ($F(1, 69) = 5.0$, $p < .05$). M&M's elicited more guilt among normal weight participants ($M$ = 4.6) than among overweight participants ($M$ = 3.2), $F(1, 69) = 5.4$, $p < .05$. In contrast, granola elicited little guilt by either normal weight participants ($M$ = 2.9) or overweight participants ($M$ = 2.5), $F(1, 69) = .6$, $p = .44$. Overall, these results show that low-fat labels reduced the guilt everyone associated with consuming granola. With M&Ms, low-fat labels only made the overweight participants feel less guilty.

**Discussion**

Low-fat labels increase perceived serving sizes and anticipated guilt even when no snack is consumed. This provides important evidence as to the mechanism of how low-fat foods might influence food intake (the mediation analysis itself will be tested in Study 3). Low-fat labels decrease the perceived calorie density of both foods, and they help explain why low-fat labels make larger portions more appropriate: Consumers expect that low-fat M&M's will contain 20% fewer calories per ounce than their regular counterparts and that low-fat granola will contain 25% fewer calories per ounce than their regular counterparts. They therefore view that comparable increases in serving size are justified for both foods when they are labeled as "low fat" (21% for M&M's and 18% for granola).

The patterns of results regarding feelings of guilt help explain why overweight participants in Study 1 ate three times more M&Ms when they were labeled as low-fat. It suggests that normal weight participants in Study 1 responded less strongly to low-fat labeling than overweight participants because of their higher guilt—they knew it was still indulgently hedonic. In addition, the social nature of Study 1 (in which participants served themselves in the presence of the research assistant and of family members) may have exacerbated the guilt of normal weight consumers, further reducing the amount of M&M's they took and consumed. If anticipated guilt influences how much one consumes of a product, we should find little difference between overweight and normal weight consumers when they are eating a food they both feel low levels of guilt about eating. We will examine this in Study 3 using low-fat granola.

One purposeful limitation of Study 2 is that we did not measure consumption. This was necessary in order to avoid contamination between the measures of consumption and measures of the mediators. For example, a consumer might exaggerate serving sizes to justify high consumption. This raises the question of whether providing objective serving size information can help prevent people from overeating when they see a low-fat label. We also address this question in Study 3.

## Study 3: Can Objective Serving Size Information Reduce the Effects of "Low-Fat" Nutrition Labels on Consumption?

Study 3 tests the hypothesis that "low-fat" nutrition labels increase consumption because they increase consumers' perception of what is the appropriate serving size. By doing this, we also test whether providing objective serving size information can prevent people from overeating a food with relative nutrition claims. To further explore the role of anticipated consumption guilt, Study 3 also examines the consumption of granola (which is less hedonic than M&M's) and uses a procedure in which product quantity is exogenous and in which consumption is unobserved by others. This enables us to test the prediction that low-fat nutrition labels had a stronger influence on overweight consumers because they felt less guilty about over-serving themselves.

**Procedure**

Study 3 uses a 2 ("Regular" vs. "Low-fat" label) by 3 (no serving label, "Contains 1 Serving" label, "Contains 2 Servings" label) between-subject design. Two hundred and seven university staff, undergraduates, and graduate students were recruited from across a large university campus to be part of a study asking them to evaluate a pilot episode for a television show. In exchange, they were given a free ticket to an upcoming movie, a coupon for a free dessert at a local cafeteria, four chances to win $100 gift certificates to a campus bookstore, and free snacks to eat during the viewing. The study was conducted over ten sessions that lasted from 3:30 to 5:00 on each of ten days (Tuesdays and Thursdays for five nonconsecutive weeks). Upon arriving to the dimly-lit theatre, participants were seated at every other seat and asked to watch and rate a series of made-for-TV movie previews and a 60 minute pilot show called "Hazard County." They were also told that since it was late in the afternoon, they would be given a cold 24-ounce bottle of water and a bag of granola from a respected campus restaurant called the "Spice Box." They were told to enjoy as much or as little of it as they wanted.

Based on a pre-test involving 79 consumers similar to those participating in the main study, we selected a brand of granola mix that was well-liked, and we chose a realistic amount (160 gm) that was sufficient to ensure that no one would eat all the granola within a 90-minute time period. Each participant received 640 calories (160 grams) of granola in zip-lock bags that were labeled with an attractive 3.25 x 4 inch color label. Depending on the condition, the granola was either described as "Regular Rocky Mountain Granola" or "Low-fat Rocky Mountain Granola." Below this, the label either indicated that it "Contains 1 Serving", "Contains 2 Servings," or it provided no serving size information.

Following the completion of the previews and the show (approximately 75 minutes), participants were given an evaluation sheet that was consistent with the cover story. Because there was concern of contamination between the ten sessions if too many questions were asked about the granola, such questions were limited to estimations of how many calories they believed they ate and to measures of weight, height, and gender. As they left the theatre, they were allowed to select a free coupon for an upcoming movie along with a dessert coupon while the amount of granola remaining in their bag was weighed. As the bag was being weighed out of their sight, participants were asked how many serving sizes they believed their bag contained. Following this, they were thanked and dismissed. Because of fears of contamination across subsequent sessions, there was no debriefing at that time. Those who were interested in learning more about the study signed an e-mail roster and were e-mailed a debriefing later that semester after all the sessions were completed.

Seven individuals were eliminated from the study because they did not stay until the end of the show. Three individuals were eliminated from the study because they spilled their granola on the floor, and three more were eliminated because they transferred the granola to another container while standing in line waiting to have their bag weighed. Of those who successfully completed the study and returned their granola, four were eliminated because dietary restrictions did not allow them to eat any granola, and fourteen were eliminated because they did not provide complete weight and height information.

**Results**

*Effects of low-fat labels on consumption (no serving size information condition).* No participant consumed all of the granola in their bag while they were watching the show. As in Study 1, we converted consumption volume into calories in order to facilitate comparison with their calorie estimates. To benchmark with Study 1, an analysis of the no serving size condition used an ANCOVA with three factors (nutrition label, body mass group, and their interaction) and gender as a covariate. As in the earlier studies, the determination of whether one was overweight was made by the BMI cut-off of 25 kg/m² established by the World Health Organization. In this study, 110 had a normal weight (BMI < 25 kg/m²) and 69 were overweight (BMI > 25 kg/m²).

Consistent with our earlier findings, people in the "Low-fat" label condition consumed 50.1% more granola than people who were given granola labeled as "Regular" (249 vs. 165 calories, $F(1, 62) = 7.8$, $p < .01$). As in Study 1, overweight participants consumed more granola ($M = 256$ cal) than those with a normal weight ($M = 174$ cal), $F(1, 62) = 8.5$, $p < .01$. As expected based on the guilt results from Study 2, the interaction between label and BMI was not statistically significant ($F(1, 62) = .3$, $p = .59$), and the increase in consumption was similar for low- and high-BMI consumers (see Figure 3).

To test our hypothesis that perceived serving size mediates the influence of low-fat labeling on consumption, we conducted a mediation analysis using data from the control (no serving size information) condition (Baron and Kenny 1986). We first regressed the number of calories eaten onto the same three factors (nutrition label, body mass group, and their interaction) and covariate (gender). We found that low-fat labels increased consumption by 73.9 calories after controlling for the effects of body mass and gender (B = 73.9, $t = 3.0$, $p < .01$). We then regressed the mediator (the estimated number of servings in the bag) on the same variables and found that low-fat labeling reduced the estimated number of servings contained in the bag (B = –.61, $t = –3.3$, $p < .01$). None of the other coefficients were statistically significant ($p > .10$). We then regressed the dependent variable onto the mediator and the same control variables. The coefficient of perceived number of servings was negative and statistically significant (B = –65.9, $t = –4.3$, $p < .01$), indicating higher consumption among participants with lower estimates of the number of servings in the bag (and thus higher estimations of serving size).

In the last regression of the mediation analysis, we regressed calories eaten on low-fat labeling, estimated number of servings, and the control variables. When the mediator was included in the regression, the coefficient of low-fat labeling became statistically insignificant (B = 40.5, $t = 1.6$, $p = .11$) whereas the influence of estimated number of servings was significant (B = -55.1, $t = –3.4$, $p < .01$). A Sobel test (1982) indicated that the mediation effect was statistically significant ($z = 2.69$, $p < .01$). Overall, these results suggest that the estimated number of servings mediates the effects of low-fat labeling on consumption. However, because serving size estimations were measured at the end of the study, it is possible that they were contaminated by consumption decisions. To better test the moderating role of serving size information, we now turn to the analysis of the experimental manipulation of objective serving size information.

*Moderating effects of objective serving size information.* As a manipulation check, we examined participant's estimates of the number of servings contained in the bag in the two conditions where serving size information was available. People's estimations were accurate when given a bag with a "Contains 1 Serving" label ($M = 1.05$, $t = 1.7$, $p = .08$) or when given one with a "Contains 2 Servings" label ($M = 1.92$, $t = –1.6$, $p = .10$). The estimated number of servings in these two conditions was uninfluenced by low-fat labeling ($F(1, 114) = .5$, $p = .48$) or by the participant's body mass ($F(1, 114) = .1$, $p = .76$). These results show that the manipulation of serving size information was successful in blocking inferences about serving size from nutrition labeling. Participants who were provided with serving size information clearly knew the number of servings purported to be in their bag and were uninfluenced by nutrition labels.

To examine the moderating effects of serving size information on consumption, we used an ANCOVA with four factors ("Contains 1 Serving," "Contains 2 Servings," body mass group, and serving size information), all two- and three-way interactions, and one control variable (gender). The two factors "Contains 1 Serving" and "Contains 2 Servings" were necessary to estimate the effects of each of the two serving size labels. As expected, the main effects of low-fat labeling, "Contains 2 Servings" condition, and body mass group were all statistically significant (respectively, $F(1, 167) = 12.1$, $p < .001$; $F(1, 167) = 11.8$, $p < .001$; and $F(1, 167) = 13.4$, $p < .001$), as was the three-way interaction between them ($F(1, 167) = 4.6$, $p < .05$). No other interactions were statistically significant, and gender was not significant as a covariate. To facilitate the discussion of the results, we conducted separate ANCOVAs for normal weight and overweight participants and discuss their results separately.

--- Insert Figure 3 about here ---

First, consider participants with a normal weight. When bags of granola were labeled as "Contains 2 Servings," consumption was reduced by 50 calories compared to the control condition in which no serving size information was provided ($F(1, 103) = 4.7$, $p < .05$). When the bags were labeled as "Contains 1 Serving," however, there were no differences compared to the control condition ($F(1, 103) = .6$, $p = .44$). With these normal weight participants, the main effect of labeling the granola as "Low-fat" was not statistically significant ($F(1, 103) = 2.2$, $p = .14$), but its interaction with the "Contains 2 Servings" manipulation was significant ($F(1, 103) = 4.3$, $p < .05$), and its interaction with the "Contains 1 Serving" manipulation was directionally significant ($F(1, 103) = 3.1$, $p = .08$). These important interactions are illustrated in Figure 3A. In the control condition, low-fat labels increased consumption by 62% ($F(1, 36) = 6.8$, $p < .01$) but this effect disappeared when granola was labeled as "Contains 1 Serving" ($F(1, 36) = .3$, $p = .85$) or as "Contains 2 Servings" ($F(1, 36) = .13$, $p = .72$). There was no influence of gender ($F(1, 103) = .6$, $p = .43$). Providing objective serving size information was therefore effective in eliminating the effects of low-fat labeling.

Now let us consider overweight participants. Again, labeling the bag of granola as containing two servings reduced consumption by 74 calories compared to the control condition ($F(1, 62) = 7.0$, $p < .01$) but labeling them as containing one serving had no effect ($F(1, 62) < .1$, $p = .88$). In contrast to normal weight participants however, the main effect of low-fat labeling was statistically significant ($F(1, 62) = 11.4$, $p < .001$) and there was no interaction with the "Contains 1 Serving" manipulation ($F(1, 62) < .1$, $p = .96$) or with the "Contains 2 Servings" manipulation ($F(1, 62) = 1.4$, $p = .23$). There was no influence of gender ($F(1, 62) = .32$, $p = .57$). Overweight consumers ate more granola when it was labeled as low-fat, regardless of the serving size information that was provided to them

*Biases in consumption estimation.* Consistent with Study 1, we examined the dissociation between actual and estimated calorie consumption by conducting an ANCOVA with the difference between the estimated and actual number of calories as the dependent variable and the same factors and covariates as in the analysis of actual consumption. As in Study 1, participants underestimated their consumption (by 45 calories or 18%, $F(1, 167) = 11.4$, $p < .001$) and this underestimation was larger when they saw a "Low-fat" label than when they saw a "Regular" label (–69 vs. –21 calories, $F(1, 167) = 38.5$, $p < .001$). This calorie underestimation bias was also larger among overweight participants than among participants with a normal weight (–61 vs. –30 calories, $F(1, 167) = 5.5$, $p < .05$). The interaction between low-fat labels and body mass indicated that the biased influence of low-fat labels was even stronger among overweight participants ($F(1, 167) = 3.8$, $p < .05$). Finally, calorie underestimation was also stronger in the control condition ($M$ = –55 cal) than in the “Contains 2 Servings” condition ($M$ = –26 calories, $F(1, 167) = 5.5$, $p < .05$). None of the other two-way or three-way interactions were statistically significant.

**Discussion**

When no serving size information was given to participants, the results of Study 3 replicate those of Study 1. Low-fat nutrition labels increased granola consumption by 48% (80 calories). Again, an important question is whether this increase in consumption volume would overcompensate for the calorie savings in the lower-fat granola.

To determine this, we conducted a market survey of the nutrient content of regular and low-fat granola bars and cereals, and we found 14 brands sold with both a “Low-fat” and a “Regular” version. Serving sizes were almost identical across both versions ($t$ = .99, $p$ = .34). Low-fat granola contained 56% less fat per serving than regular versions (2.3 vs. 5.9 grams, $t$ = 4.0, $p < .001$). However, they contained only 10% fewer calories per serving than regular versions (196 vs. 173 calories, $t$ = 3.3, $p < .01$). Assuming that participants in Study 3 had eaten real low-fat granola, and that these low-fat granola had the average level of fat and calories for the category, participants would have consumed 35% less fat from the low-fat granola but would have consumed 33% more total calories. The increase in calorie would have probably been even higher than that because the ingredients used to replace fat tend to make people hungrier (Nestle 2002).

The calorie estimation results also replicate the findings of Study 1 that consumers are unaware that low-fat labeling increases their consumption. As a result, whereas they were able to accurately estimate their calorie consumption when the granola were labeled as “regular” (they only underestimated consumption by 17 calories), they strongly underestimated actual consumption (by 94 calories or 35%) when the granola was labeled as “low-fat” and when they ate more of them. The convergence between the results of Study 1 (which were obtained pre-intake) and Study 3 (which were obtained post-intake) shows the robustness of our finding that low-fat labeling increases the calorie underestimation bias.

By measuring and manipulating serving sizes, Study 3 further contributes to our understanding of why low-fat labeling increases consumption and what can be done to better control it. The mediation analyses show that when no objective serving size information is available, consumers' estimate of how many serving sizes are in a bag determined how much they would eat. This was consistent with all consumers regardless of body mass. While this would lead us to believe that putting salient serving size information on packaging would eliminate the biasing influence of low-fat labeling, this only occurred with normal weight participants. Overweight participants increased their consumption in response to low-fat labeling regardless of whether information about serving sizes was made available.

Further analyses show that this difference cannot be explained by the fact that overweight participants did not pay attention to serving size information. First, the manipulation checks showed that all participants accurately identified the number of servings in the two conditions where serving size information was provided on the label. Second, overweight participants reduced their overall consumption when the granola bags mentioned “Contains 2 Servings” compared to the control condition when no serving size information was available. One explanation may be found in the low levels of guilt triggered by consuming granola and in the fact that participants could not serve themselves less food, a common self-control mechanism (Wertenbroch 1998). Even in the “Contains 2 Servings” label condition, when overweight participants knew that the quantity of granola in the bag was higher than what most people consume, they did not want to restrain their consumption. This is consistent with the findings from Study 2 showing that consumption creates less guilt among overweight individuals than among individuals with a normal weight.

## General Discussion

In our obesity-inducing environment, a priority of the FDA is to examine whether relative nutrition claims, such as "Low-fat," lead to the over-consumption of food, especially high-calorie snack foods consumed by "at-risk" (overweight) consumers. This issue of relative nutrition claims and consumption is also an important for food companies that are battling accusations that they contribute to the obesity epidemic. Yet, research on health claims and nutrition labels has generally been focused on perceptions and purchase intention, not on single occasion consumption.

We address this consumption issue by developing a framework of how relative nutrition claims influence how much a person consumes. The framework predicts that relative nutrition claims increase food intake per consumption occasion by increasing perceived serving sizes (the perception of how much is appropriate to eat) and by reducing anticipated consumption guilt. This helps explain why the influence of relative nutrition claims differ according to the factors associated with guilt, such whether an individual is overweight or whether the food is hedonic. We test the predictions of the framework in one lab study and two field experiments involving actual food consumption. Our key results are as follows:

Labeling snacks as "low-fat" increases food intake during a single consumption occasion by up to 50%. This is robust across hedonic and utilitarian snacks, young and old consumers, self-reported nutrition experts or novices, in a public or private consumption setting, and regardless of whether consumers serve themselves or not.

For guilt-inducing hedonic snacks and consumption settings, the influence of low-fat labeling is higher for overweight consumers than for normal weight consumers.

For low-guilt snacks and consumption settings, the influence of low-fat labeling is the same for overweight and normal weight consumers.

Providing objective serving size information eliminates the influence of low-fat labeling, but only for consumers with a normal weight.

Implications for Public Policy

Agencies such as the U.S. FDA have created specific guidelines for nutrition labels and claims (recall Table 1). These rules have guaranteed that nutrition information and claims are consistently accurate, and they have resulted in high public trust in nutrition information. Yet because of the robust influence of health halos, our findings suggest that truthful labels and claims may not be sufficient to significantly improve food behavior. In light of this, what can the FDA do to prevent consumers from making erroneous inferences that lead them to overeat?

One solution is to make serving size information more salient. This would be useful for packaged goods, whose serving size labels are not always inspected (Balasubramanian and Cole 2002). It would be even more useful for the fast-food industry, where relative nutrition claims are widespread and nutrition labels are not mandatory. For example, one Subway ad shows that a Subway Sweet Onion Teriyaki chicken foot-long sub has only 10 grams of fat whereas a Big Mac contains 33 grams of fat. In the ad, the Subway spokesman, Jared Fogle, then states that this means that "you can eat another and another over the course of three different meals and still not equal the fat content of one Big Mac." What the ad does not mention, however, is that the Onion Teriyaki chicken foot-long sub contains 740 calories and 100 milligrams of cholesterol, compared to 600 calories and 85 milligrams of cholesterol for the Big Mac. Hence, eating three Subway Subs would provide 1,620 more calories and 215 more milligrams of cholesterol than eating one Big Mac.

Another solution for regulators would be to increase the threshold for relative nutrition claims. For example, to claim "reduced calories," the food might have to contain 33% fewer calories than the reference food instead of only 25% less (which is currently the case). This would increase the likelihood that calorie intake is really lower for those eating “low-fat” foods than for those eating “regular” (higher fat) foods, even after accounting for differences in consumption volume. More generally, it would be important to account for health halos when forming future guidelines or endorsements for foods (such as for low carbohydrates or low sodium).

The most thorough reform would be to change the definition of serving sizes so that they are higher for foods making relative nutrition claims. Currently, the FDA defines serving sizes as “an amount of food customarily consumed per eating occasion by persons 4 years of age or older, which is expressed in a common household measure that is appropriate to the food.” Measures of the amount of food customarily eaten per eating occasion are obtained from the Nationwide Food Consumption Surveys conducted by the U.S. Department of Agriculture. The key problem is that these reference amounts are measured for all the foods in a category, regardless of their nutrition claims, and they do not reflect how much is over eaten because of a relative nutrition claim. Increasing serving sizes in the case of relative nutrition claims would increase the number of calories per serving mentioned in the label for these foods. This would have the double advantage of more accurately describing the actual amount of food consumed and in deterring consumers from eating more than the serving size.

Implications for Food Manufacturers

Our findings also have implications for responsible food manufacturers (see Table 3). First, manufacturers could consider being more explicit when defining something as low-fat or as reduced-calorie. This could be in the form of the percentage reduction over the regular version *along with* an absolute calorie level per serving or container. Because people infer the appropriate serving size of a food from a variety of external cues, a manufacturer could also help consumers better control their consumption by making packaging changes that alter their perception of the appropriate serving size. One potentially profitable approach may be to manufacture multi-packs of products with smaller individual servings. This would provide break-points at which a person would have to reassess whether they were going to continue eating.

--- Insert Table 3 about here ---

Another option for food manufacturers would be to consider manufacturing smaller, premium-priced packages. Although they would not be priced competitively (per unit) compared to the larger packages, they would satisfy the person who was willing to trade-off value for self-control (Wertenbroch 1998). Although such packaging would increase production costs, the $12 billion per year diet industry would suggest there is a portion-predisposed segment that would be willing to pay a premium for packaging that enabled them to eat less of a food in a single serving and to enjoy it more. For example, a loyalty program survey of current consumers of a Kraft product indicated that 57% of these will be willing to pay up to 15% more for portion-controlled packaging (Zaff 2004).

**Research Implications**

By showing that relative nutrition claims influence consumption our findings open up new areas for nutrition research. Because of the interest of the FDA and of Kraft, we focused on nutrition labels involving “low-fat.” Pilot studies with other nutrition labels (including “reduced calorie”) showed similar results. It would be interesting to study whether the same health halo can be caused by simple nutrition facts (such as “100-calorie” portions) or even by general health claims (such as those made by Pepsico’s “Smart Spot” and Unilever’s “Better-for-You” icons).

Another extension would be to study how these claims influence what else a person eats. For example, consuming a food with a relative health claim (such as a low-fat sandwich) may lead a consumer to subsequently indulge in a calorie-rich dessert. As a result, consumers may end up eating more calories when going to “healthy” restaurants than to restaurants which are not making these claims. Because such unintended overeating might even operate with vague claims (such as Subway’s “Eat fresh” campaign), it would be difficult for the FDA to regulate. Yet, the health halos that are inferred by relative claims on labels may offer an important conceptual tool to help investigate the single occasion consumption of non-food products of which the FDA is also concerned, such as medicines, supplements, and personal care products.

Another important area for future research is to understand whether the influence that relative nutrition claims have on consumption might also be related to the influence they have on the taste of a food. Raghunathan, Walker, and Hoyer (2005) found that labeling food as “healthy” reduces consumers’ taste expectations and even reduces their post-intake taste experience. Could this mean that relative nutrition claims increase consumption because consumers trade off taste reductions with increased consumption? When health perceptions are manipulated but the actual food remains the same, one study found that consumers actually consumed more when the product seemed to taste better because it was labeled as “unhealthy” (Raghunathan et al. 2005). In reality however, the low-fat ingredients used to replace the fat may leave more of a watered-down taste, which consumers may try to offset by consuming more. It would therefore be important for future research to study the joint effects of nutrition claims and actual nutrition content.

Finally, an important area for future research would be to extend these results to additional consumer segments, additional product categories, and additional consumption contexts. For example, the packages in Study 3 made the labeling information highly salient. Yet people do not always eat out of clearly marked packages. As with nutrition information in general, the format of information on the label should influence its effectiveness (Levy and Fein 1996). The effects of the message are also certainly influenced by consumers’ motivation to process nutrition information and by their objective and subjective nutrition knowledge (Andrews et al. 1998; Moorman et al. 2004). Not all consumers have nutrition or weight-loss as an objective in their life, and heavy-handed regulation could increase the current consumer backlash against diet and nutrition messages (Patterson et al. 2001). To make matters even more difficult, recent research on willful ignorance suggests that even highly-involved consumers may actively ignore nutrition information in order to avoid the negative emotions that may arise, should nutrition information be below expectations (Ehrich and Irwin 2005).

**Conclusion**

We are at a point of development where much of the incremental improvement in our life span—and especially in our quality of life—is likely to come more from behavioral changes in our lifestyle than from new medical treatments. When it comes to contributing most to the life-span and quality of life in the next couple of generations, smart, well-intentioned marketers may be well-suited to effectively help lead the movement toward behavior change. Obesity is a good place to start.

**TABLE 1**

FDA Definitions and Restrictions for Selected Relative Nutrition Claims

| **Claim** | **Free** | **Low** | **Reduced/ Less/ Fewer** | **Comments** |
|---|---|---|---|---|
| Total fat | Less than .5 g per reference amount and per labeled serving.<br><br>For meals and main dishes, less than .5 g per labeled serving. | 3 g or less per reference amount (or per 50 g if reference amount is small).<br><br>Meals and main dishes: 3 g or less per 100 g and not more than 30% of calories from fat. | At least 25% less fat per reference amount than reference food.<br><br>Reference food may not be "Low Fat". | "__% Fat Free": OK if meets the requirements for "Low Fat".<br><br>"100% Fat Free": Food must be "Fat Free".<br><br>"Light"--see below.<br><br>For dietary supplements: fat claims cannot be made for products that are 40 calories or less per serving. |
| Calories | Less than 5 cal per reference amount and per labeled serving.<br><br>Not defined for meals or main dishes. | 40 cal or less per reference amount (and per 50 g if reference amount is small).<br><br>Meals and main dishes: 120 cal or less per 100 g. | At least 25% fewer calories per reference amount than reference food. | "Light" or "Lite": if 50% or more of the calories are from fat, fat must be reduced by at least 50% per reference amount. If less than 50% of calories are from fat, fat must be reduced at least 50% or calories reduced at least 1/3 per reference amount.<br><br>"Light" or "Lite" meal or main dish product meets definition for "Low Calorie" or "Low Fat" meal and indicates which definition is met. |
| Carbo-hydrates | No Current FDA guide-lines. | Use of the term "low" only in reference to a diet or lifestyle, but not to describe a particular food. | No Current FDA guidelines. | Any notation of carbohydrate content must describe how the calculations were made. Any method is acceptable as long as enough information is provided on the labeling. |

Note: The information on calories and fat have been principally adopted from U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition (Stehlin 1993). The FDA has yet to publish definitions characterizing the carbohydrate content of food, but are soon believed to (1) establish definitions for "carbohydrate free" and "low-carbohydrate," (2) confirm the use of the relative claims "reduced," "fewer" or "less" in relation to a reference food; and (3) confirm the use of the term "modified carbohydrate" (Burros 2004).

**TABLE 2**

Study 2: How Low-fat Labels Influence Perceived Serving Size, Calorie Density, and Guilt
(Means and Standard Deviations)

| Mediator | Product | Normal weight participants (BMI < 25) | | Overweight participants (BMI > 25) | |
|---|---|---|---|---|---|
| | | "Regular" label | "Low-fat" label | "Regular" label | "Low-fat" label |
| Perceived serving size | M&M's | 5.8 (2.2) | 6.5 (3.3) | 4.3 (1.2) | 7.1 (2.3) |
| | Granola | 5.3 (1.7) | 6.4 (3.3) | 5.5 (3.0) | 5.9 (1.0) |
| Perceived calorie density | M&M's | 1,545 (819) | 1,320 (676) | 1,377 (624) | 942 (578) |
| | Granola | 1,013 (562) | 732 (458) | 765 (373) | 626 (281) |
| Anticipated consumption guilt | M&M's | 4.7 (3.0) | 4.5 (2.1) | 3.6 (2.4) | 2.7 (2.4) |
| | Granola | 3.6 (2.3) | 2.3 (1.5) | 3.1 (2.2) | 1.9 (1.2) |

Note: Perceived serving size was measured as the number of ounces appropriate to eat during a 90-minute movie. Perceived calorie density was measured as the estimated number of calories in a 10 oz cup. Anticipated consumption guilt was measured by asking respondents to rate how they would feel after eating two ounces of the product on a nine-point scale (1 = not guilty, 9 = guilty).

**TABLE 3**

Potential Implications of Health Halos for Responsible Packaged Goods Companies

| Food categories | | Labels that could provide misleading health halos | Impact of health halos on normal weight consumers | Impact of health halos on overweight consumers | Possible Recommendations |
|---|---|---|---|---|---|
| Perceived as relatively healthy and utilitarian | - Granola<br>- Crackers<br>- Main meals<br>- Side dishes<br>- Cereals<br>- Sports drinks | - Organic<br>- Natural<br>- "Better for You"<br>- "Smart Spot" | - Labeling decreases feelings of guilt<br>- Labeling increases appropriate serving sizes<br>- People consumed 61% more volume<br>- People consumed 45% more calories | - Labeling decreases feelings of guilt<br>- Labeling increases appropriate serving sizes<br>- People consumed 24% more volume<br>- People consumed 12% more calories | - Consider providing sub-packaging on some selections<br>- Make serving size more salient<br>- Offer re-sealable packages |
| Perceived as relatively indulgent and hedonic | - Potato chips<br>- Cookies<br>- Cakes<br>- Candies<br>- Ice creams<br>- Desserts | - Low fat<br>- Low carbs<br>- Reduced calorie<br>- Vitamin fortified | - Labeling does not greatly reduce guilt<br>- Labeling does not greatly reduce serving sizes<br>- People consumed 16% more volume<br>- People consumed no more calories | - Labeling decreases feelings of guilt<br>- Labeling increases appropriate serving sizes<br>- People consumed 47% more volume<br>- People consumed 25% more calories | - Communicate moderation, such as "Eat less, enjoy more<br>- Underscore calorie reduction as a percentage and in terms of total calories<br>- Reduce calories in the package |

Note: Illustrations of consumption volume increases are based on the increases observed in Study 3 for utilitarian foods (control condition/no serving size information) and on the increases observed in Study 1 for hedonic foods. Illustrations of calorie increases are based on industry-wide calorie averages for low-fat and regular versions of granola and chocolate candies.

**FIGURE 1**

A Framework of How Relative Nutrition Claims Influence Consumption

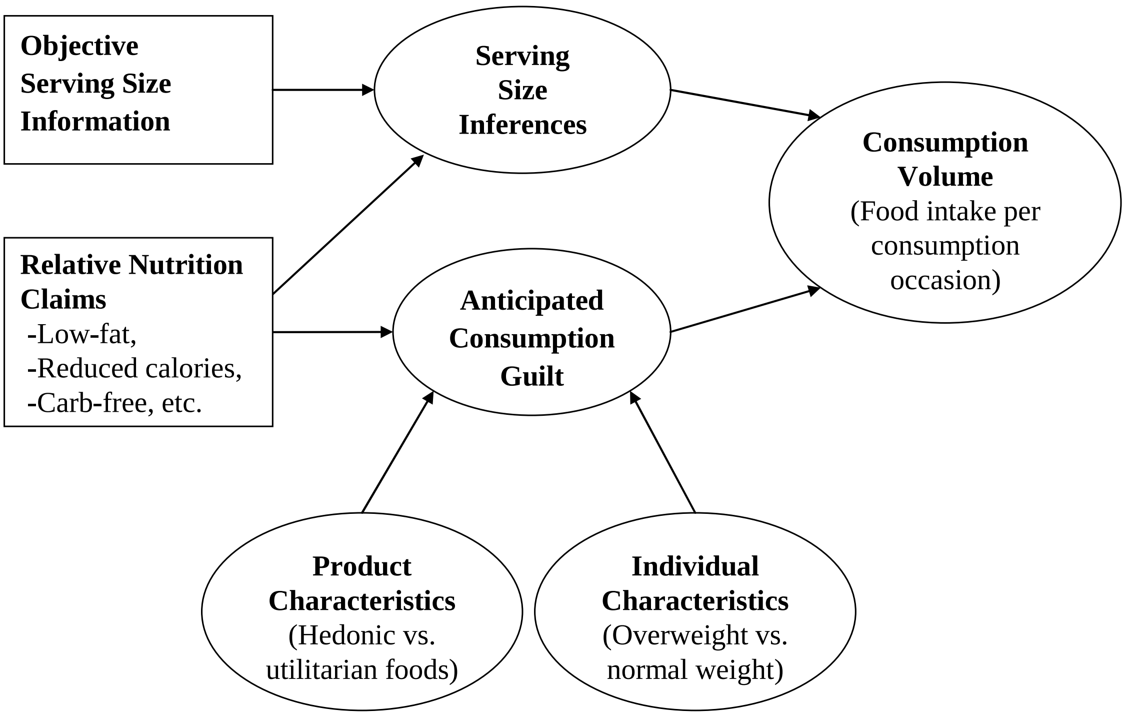


**FIGURE 2**

Study 1: How Low-Fat Labels Influence Actual and Estimated Calorie M&M's Consumption for Normal Weight and Overweight Consumers

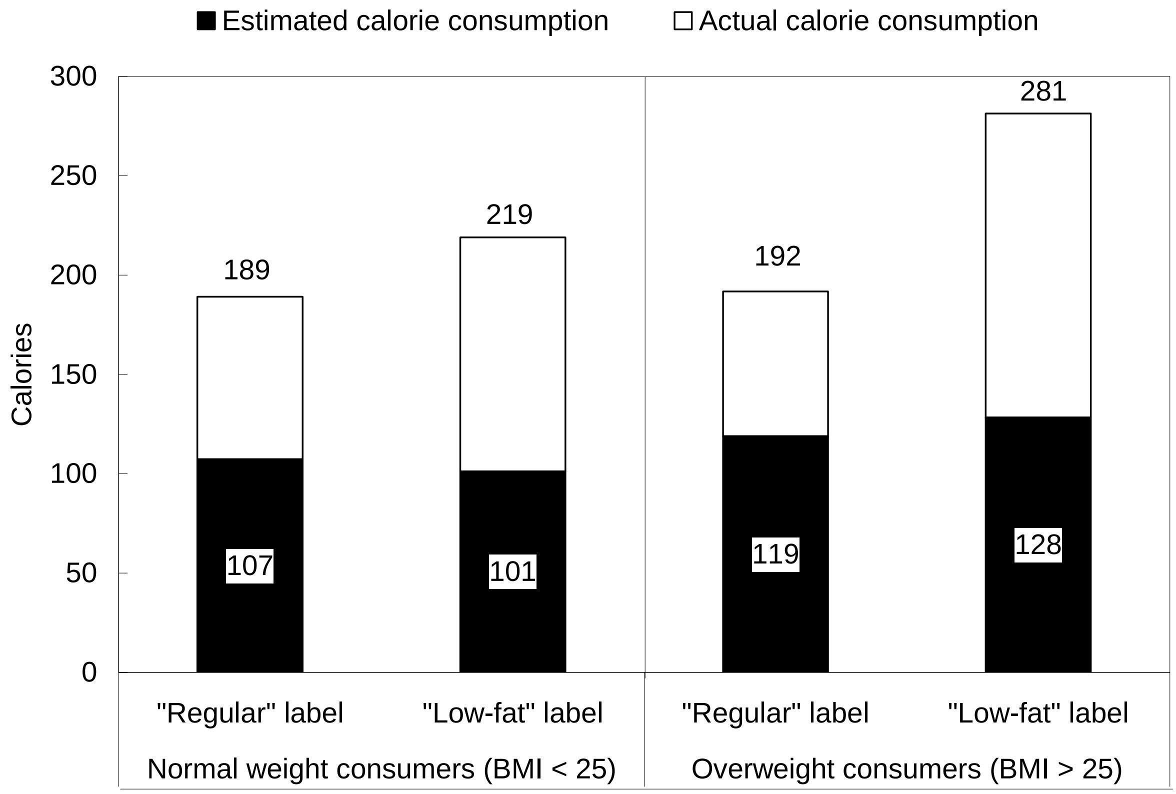
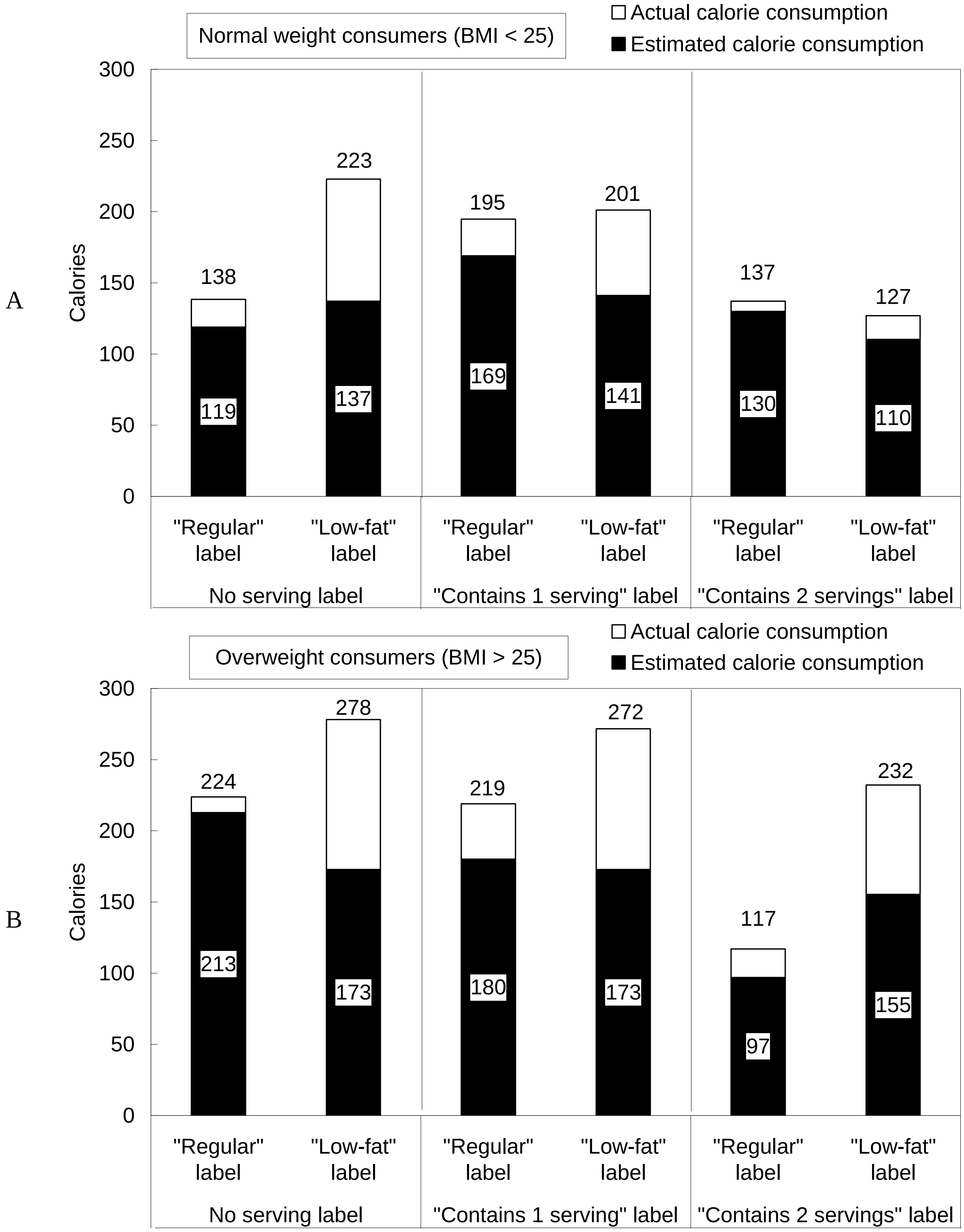


**FIGURE 3**

Study 3: How Objective Serving Size Information and Low-Fat Labels Influence Granola Consumption for Normal Weight Consumers (Panel A) and Overweight Consumers (Panel B)



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