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In this era of increasing obesity and increasing threats of legislation and regulation of food marketing practices, regulatory agencies have pointedly asked how "low-fat" nutrition claims may influence food consumption. The authors develop and test a framework that contends that low-fat nutrition labels increase food intake by (1) increasing perceptions of the appropriate serving size and (2) decreasing consumption guilt. Three studies show that low-fat labels lead all consumers—particularly those who are overweight—to overeat snack foods. Furthermore, salient objective serving-size information (e.g., "Contains 2 Servings") reduces overeating among guilt-prone, normal-weight consumers but not among overweight consumers. With consumer welfare and corporate profitability in mind, the authors suggest win–win packaging and labeling insights for public policy officials and food marketers.

Can "Low-Fat" Nutrition Labels Lead to Obesity?

Food companies are on trial for contributing to the growing problem of obesity in the United States and abroad. They have been threatened with taxes, fines, restrictions, legislation, and the possibility of being "the tobacco industry of the new millennium" (Nestle 2002). Labeling is an area of critical concern among regulators such as the U.S. Food and Drug Administration (FDA). Although much is known about how nutrition labels influence health beliefs and purchase intentions (e.g., Moorman et al. 2004), the pressing issue for the FDA is how relative nutrition claims (e.g., low fat) influence single-occasion intake (Blakely 2005). A particularly acute concern is that low-fat labels may lead to the overconsumption of nutrient-poor and calorie-rich snack foods by the 65% of U.S. consumers who are already overweight (Hedley et al. 2004).[1]

Although no food company would want to discourage consumers from purchasing its products, it may be in the firm's 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 overconsumption of these foods can lead not only to weight gain but also to rapid satiation (Inman 2001) and delayed repurchase. Over the long run, helping consumers better control their consumption not only could reduce the likelihood of adverse regulations and boycotts but also could 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.

This need for a policy-sensitive solution was underscored in a series of FDA (2003) meetings, which raised three related questions for companies such as Kraft Foods and M&M's/Mars (now Masterfoods): (1) How do relative nutrition claims (e.g., low fat) influence how much people consume on a single eating occasion? (2) Do relative nutrition claims influence overweight consumers differently from normal-weight consumers? and (3) Can serving-size information eliminate any potential bias? To help managers and policy makers better address these questions, we propose a framework that suggests that low-fat nutrition claims increase consumption because they increase perceptions of the appropriate serving size and reduce anticipated consumption guilt.

We test this framework in one lab study and two natural field studies. Study 1 establishes the main finding of the research in the context of an open-house reception. It shows that all people—particularly those who are overweight—eat

[1]Following the guidelines of the World Health Organization (WHO), people are classified as "normal weight" if their body mass index (BMI) is between 18 kg/m^2 and 25 kg/m^2, as "overweight" if their BMI is greater than 25 kg/m^2, and as "obese" if their BMI is greater than 30 kg/m^2. The BMI is computed as the ratio of weight, measured in kilograms, to squared height, measured in meters.

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more calories of snack food when it is labeled as "low fat" than when it is labeled as "regular." Study 2 shows that low-fat nutrition claims lead all consumers in a lab to increase the amount they believe to be an appropriate serving size, regardless of whether the snack is relatively hedonic (chocolate candies) or relatively utilitarian (granola). It further demonstrates that low-fat claims reduce guilt, especially for people who are overweight. Study 3 shows how relative nutrition claims and objective serving-size information jointly influence the consumption of granola by overweight and normal-weight moviegoers. Following these studies, we discuss the implications of our findings for public policy officials, responsible food manufacturers, researchers, and consumers who are interested in better controlling how much they eat.

HOW RELATIVE NUTRITION CLAIMS INFLUENCE CONSUMPTION

When people determine how much to eat, labels can provide both objective and subjective consumption cues. Objective consumption cues, such as serving-size information, explicitly suggest an amount to eat on a single occasion (Caswell and Padberg 1992). Subjective consumption cues, such as those provided by endorsed nutrition claims or by relative nutrition claims (e.g., low fat), do not specify a serving size.[2] However, they may influence how much a person infers to be a reasonable amount to eat, and they may influence how much pleasure or guilt a person anticipates feeling by eating that amount. In the following paragraphs, we describe a framework that explains how these key variables influence food intake (illustrated in Figure 1). Our description foreshadows how this framework may vary across foods and across people.

Serving-Size Inferences

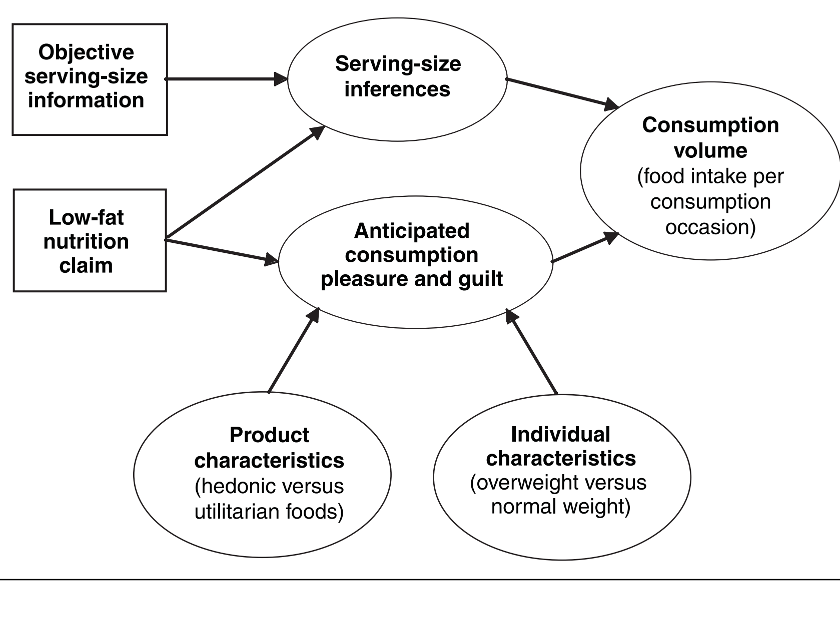
A consumer's perceptions of serving size are highly unreliable and can unknowingly vary by as much as 20% (Wansink 2004). With discretely packaged items, such as a 12-ounce can of a soft drink or a single-serving candy bar, the intended serving size is obvious. In many other contexts, however, such as a one-pound bag of M&M's, a large box of granola, or a full 24-ounce bowl of macaroni and cheese, the appropriate serving size is more ambiguous. In the absence of salient, unambiguous serving-size information, people must infer what the appropriate serving size is from other cues. Although such inferences might be based on prior experience, they might also be made on the basis of cues that are found on a package or nutrition label.

In some ways, inferences about serving sizes are similar to inferences made in daily conversations. Because of conversational norms, consumers first assume that the information communicated to them (e.g., in a conversation or on a label) is potentially informative and relevant to their decisions (Grice 1975; Schwarz 1996). Therefore, consumers use the information provided and their intuitive beliefs to make inferences about missing attributes that are important for their decision (Broniarczyk and Alba 1994). With nutrition, however, such inferences can result in inappropriate generalizations (Garretson and Burton 2000; Ippolito and Mathios 1991; Kozup, Creyer, and Burton 2003; Moorman and Matulich 1993; Wansink 2004). For example, Andrews, Netemeyer, and Burton (1998) show that consumers falsely infer that foods low in cholesterol are also low in fat. Similarly, there is anecdotal evidence that some consumers erroneously believe that low-fat nutrition claims indicate fewer calories (National Institutes of Health 2004). They do not realize that when the FDA determines whether low-fat

[2]Endorsed nutrition claims are those that have been tested, proved, and ratified by an endorsing entity, such as the FDA or the American Cancer Association (Geiger 1998). Endorsed claims specifically note the effect of a targeted ingredient on health (Geiger 1998). These include links between soy and heart disease, between folic acid and birth defects, or between fiber and cancer (Wansink 2005).

Figure 1

A FRAMEWORK OF HOW LOW-FAT NUTRITION CLAIMS INFLUENCE CONSUMPTION



nutrition claims are appropriate, it considers only the amount of fat, not the number of calories.[3]

The ambiguity regarding serving sizes and inferential mechanisms suggest that relative nutrition claims could create misleading "health halos" that lead consumers to believe that the food contains fewer calories and that the acceptable or appropriate amount to consume is higher when the food is described as being lower in fat. Therefore, we hypothesize that a relative nutrition claim communicated by a low-fat label increases food intake because it increases a consumer's serving-size estimate.

Anticipated Consumption Pleasure and Guilt

Cognitive inferences about serving sizes are not the only factor influencing consumption volume. A lot of research has shown that emotions and, particularly, anticipation of consumption pleasures and guilt can play a central role in determining how much a person eats (Baumeister 2002; Dhar and Simonson 1999; Shiv and Fedorikhin 1999; Wertenbroch 1998). For example, King, Herman, and Polivy (1987) find that people spontaneously categorize foods in terms of the pleasure-related or guilt-related emotions that they elicit. Although many studies have examined the role of emotions in food consumption decisions (e.g., Andrade 2005; Shiv and Fedorikhin 1999), relatively few have studied the role of guilt. This is surprising given that food-related guilt is a particularly prevalent emotion among U.S. consumers, compared with consumers from Europe or Japan (Rozin et al. 1999).

Feelings of guilt arise because food consumption decisions frequently entail a conflict between two opposite goals: the hedonic goal of short-term pleasure gratification versus the utilitarian goal of long-term health preservation and enhancement. Kivetz and Keinan (2006) find that consumers making hedonic choices exhibit more guilt than consumers making utilitarian choices. Other studies show that high-fat products are considered more hedonic than low-fat products. For example, Wertenbroch (1998) finds that consumers expect better taste when potato chips are labeled as "25% fat" than when they are labeled as "75% lean" (a frame that is known to reduce perception of fat). This suggests that low-fat nutrition claims should lead consumers to eat more because it allows them to feel less guilty while enjoying their food.

This prediction is supported by studies that show that guilt leads people to choose lower-fat foods. Consider a restaurant's dessert menu. Okada (2005) finds 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 notion that presenting both options together increased the feelings of guilt associated with the high-fat option. Therefore, we expect that another way that low-fat nutrition claims increase consumption is by reducing a consumer's anticipated consumption guilt.

Figure 1 also shows that feelings of guilt may vary across different types of food and different types of people. People are more likely to feel guilty about overeating an indulgent, hedonic food, such as chocolate candies, than they are about eating a food they view as relatively more utilitarian and healthy, such as granola (Okada 2005; Wertenbroch 1998).[4] The guilt of overeating is also likely to be a more powerful motivator to some people than to others. Indeed, overweight people have a greater tendency to lose control when eating and to have lower levels of consumption guilt (Hays et al. 2002). Therefore, we expect that low-fat nutrition labels have a stronger effect on guilt-free utilitarian foods and overweight consumers than on guilt-prone hedonic foods and regular-weight consumers. We also expect that the difference between overweight and regular-weight consumers is lower for utilitarian foods, which are unlikely to trigger high levels of guilt, than for hedonic foods, which are likely to elicit particularly strong levels of guilt among regular-weight consumers.

Reducing the Effects of Low-Fat Nutrition Labels on Consumption

There is often a marked difference between objective knowledge and subjective knowledge, especially in the nutrition domain (Brucks 1985; Moorman et al. 2004). Because of the ambiguity of sensory experience (Deighton 1984; Ha and Hoch 1989), it is unlikely that consumers realize that they are overconsuming foods with low-fat nutrition claims. Indeed, a wide range of studies have shown that consumers are unable to monitor the number of calories they consume (Livingstone and Black 2003). As a result, we expect that consumers tend to overeat low-fat foods but are not aware of this tendency.

A way to reduce this biased tendency to overeat foods with low-fat labels may be to provide objective serving-size information (e.g., "This package contains 2 servings" or "Contains 2 Servings"). When objective serving-size information is provided, consumers do not need to rely on low-fat claims to infer serving size (Feldman and Lynch 1988). Indeed, although most consumers are skeptical of health claims, in general, they believe the salient nutrition information on most packaging (Wansink and Huckabee 2005). Therefore, we expect that salient serving-size information reduces the effects of low-fat nutrition labels on consumption.

As we indicate at the bottom of Figure 1, the moderating influence of serving size should vary depending on the characteristics of both a food (utilitarian or hedonic) and a person (normal weight or overweight). For example, objective serving-size information should be more effective in reducing the effects of relative nutrition claims for normal-weight consumers than for overweight ones.

[3]Although it is true that fat contains more calories per grams than either carbohydrates or proteins, low-fat foods typically compensate for the reduction in fat by an increase in carbohydrates (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 Snackwell's cookies developed by Nabisco contain less fat but not fewer calories than regular cookies because the fat is replaced with high-calorie starches and sugars.

[4]The distinction between hedonic and utilitarian foods is relative (Wertenbroch 1998). Among snack foods, those typically assumed to be hedonic include foods such as potato chips, cookies, cake, candies, ice cream, and full-calorie soft drinks. Those typically assumed to be utilitarian include granola, main meals, side dishes, cereals, and sports drinks.

STUDY 1: DO LOW-FAT NUTRITION LABELS INCREASE CONSUMPTION?

Study 1 examines whether low-fat nutrition labels increase the actual and estimated consumption of hedonic chocolate candies by overweight and normal-weight consumers. To achieve this, we asked adult family members (53% males, 31 years old, 25.3 body mass index [BMI]) participating in a university open house to serve themselves unusual colors of M&M's (gold, teal, purple, and white), which were clearly labeled either as "New Colors of Regular M&M's" (regular-label condition) or as "New 'Low-Fat' M&M's" (low-fat-label condition). We then measured how many calories of M&M's 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 was from 9:00 A.M. to 4:00 P.M. 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. Then, each family was taken to one of two gallon-size serving bowls of M&M's that had been placed on either side of the entrance. Each family member was given a 16-ounce bowl and sanitary gloves and was told to help him- or herself to the M&M's. The gallon-size bowls were placed on separate tables, and participants could only see the nutrition labels on the M&M's 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&M's (gold, teal, purple, and white). Participants in the regular-label condition saw a gallon bowl with a professionally designed 8 × 5 inch label that read "New Colors of Regular M&M's." Participants in the low-fat-label condition saw a gallon bowl with a similar label that read "New 'Low-Fat' M&M's" (no such low-fat product is currently available on the market).

Immediately after these open-house guests had taken as many M&M's as they 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&M's) and handed them a half-page survey that asked their age, gender, height, weight, nutrition knowledge, and familiarity with M&M's. Basic nutrition knowledge and product familiarity were self-assessed on three-point scales (from low to high). After participants completed the questionnaire, the research assistant asked them to estimate how many total calories of M&M's they had served themselves. After participants completed the calorie estimation task, the assistant told them that the M&M's they had selected were actually regular (full-calorie) M&M's. They were then thanked and given a bookmark, a refrigerator magnet, and a nutrition tip sheet. Most people then took 15–20 minutes to read the materials leisurely, visit with others, and watch the videos before exiting out a far door. Because they had been told that they could not eat food outside of this display area, all but 7 (97.3%) participants finished their M&M's in the display area.

Results

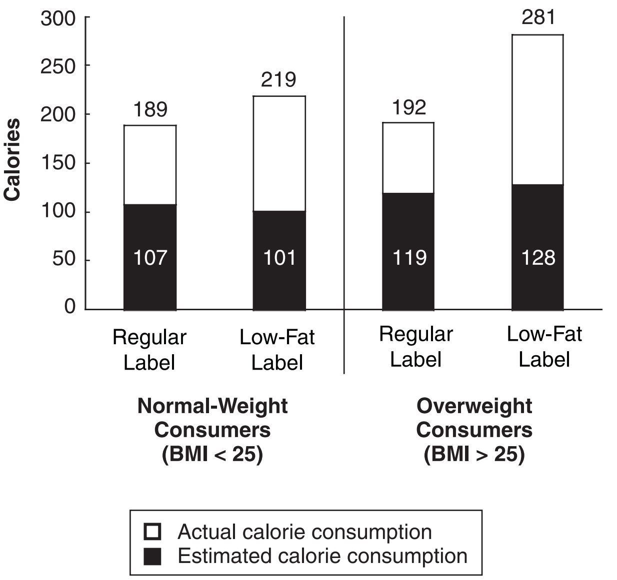
Following the analysis guidelines of the World Health Organization (WHO), we classified participants as overweight (n = 103) or normal weight (n = 166) depending on whether their BMI was above or below 25 kg/m^2. To facilitate the comparison between actual and estimated consumption, we converted the weight measures of the M&M's into calories using the information available on the manufacturer's Web site. We used analyses of covariance (ANCOVAs) to analyze estimated and actual consumption with the nutritional label (low fat versus regular), each participant's body mass (below versus above 25 kg/m^2), and the interaction between nutritional label and body mass. In the analysis, we used each participant's gender, age, self-assessed nutrition knowledge, and familiarity with M&M's as covariates.

Actual consumption. As we predicted, the low-fat label increased consumption of M&M's ($F(1, 251) = 13.1$, $p < .001$). Participants ate 28.4% more M&M's when they were labeled as low fat (M = 244 calories) than when they were labeled as regular (M = 190 calories). Furthermore, overweight participants took 16.7% more M&M's (M = 237 calories) than normal-weight participants (M = 203 calories; $F(1, 251) = 4.3$, $p < .05$). As we expected, the interaction between low-fat labeling and body mass was statistically significant ($F(1, 251) = 3.9$, $p < .05$). Low-fat labeling encouraged greater consumption 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 Figure 2 illustrates, calorie estimates were not influenced by the nutrition labels and were only marginally influenced by a person's body mass. In examining consumption bias (estimated less actual calories), we performed an ANCOVA using the same factors and covariates as in the previous analysis; this indicated that participants underestimated the number of calories of M&M's by 48% ($F(1, 251) = 42.5$, $p < .001$). More important, people who saw low-fat labels were more biased in their calorie estimates (M = –132 calories) than those who saw regular labels (M = –81 calories; $F(1, 251) = 23.9$, $p < .001$).

Although the magnitude of the calorie underestimation bias was the same for overweight and regular-weight participants ($F(1, 251) = 1.7$, $p = .21$), the interaction between body mass and nutrition labeling was statistically significant ($F(1, 251) = 4.5$, $p < .05$). Low-fat labeling increased the severity of the calorie underestimation bias by 80 calories for overweight participants and by 36 calories for normal-weight participants. The effects of gender, self-assessed nutrition knowledge, and familiarity were not statistically significant ($p > .10$), but the magnitude of the bias

Figure 2
STUDY 1: LOW-FAT LABELS INCREASE SNACK-FOOD CONSUMPTION



decreased by .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.

Post Hoc Marketplace Study

Because low-fat foods are believe to contain fewer calories than regular versions, it might 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 a low-fat claim would lead such a person to eat so much more that it offsets the potentially lower-calorie density of low-fat foods. To determine this, we surveyed the fat and calorie content of all brands of chocolate candies, bars, cookies, milk drinks, and muffins with at least a 5% market share.

We found 17 brands that were sold with both a regular and a low-fat version of the same product. The serving sizes indicated on the products were similar for both versions ($t = 1.08$, $p = .30$). Although, on average, the low-fat versions contained 59% less fat per serving than regular versions (3.2 versus 6.7 grams; $t = 7.43$, $p < .001$), they contained only 15% fewer calories (140 versus 170 calories; $t = 4.79$, $p < .01$). If participants in Study 1 had eaten real low-fat M&M's (with the market average of 15% fewer calories than regular chocolate candies), they would have consumed 48% less fat but 9% more total calories. This is a conservative estimate. 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).

Discussion

There are three key results from Study 1. First, we find strong support for our hypothesis that low-fat nutrition claims increase consumption. Participants consumed 28% more candy (54 calories) when it was described as low fat than when it was described as regular. Second, low-fat labeling led overweight consumers to eat dramatically more than normal-weight consumers. Third, all participants strongly underestimated the number of calories they consumed, and they were unaware that low-fat labeling influenced their consumption. Therefore, the magnitude of this calorie underestimation was particularly strong among overweight participants, the very people for whom calorie underestimation is most harmful.

Study 1 established that low-fat labels can lead people to eat more without realizing that they are doing so. However, these results do not establish why this might occur or why this tendency is so much stronger among overweight people. 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 do so for hedonic foods (M&M's) and more utilitarian foods (granola).

STUDY 2: WHY DO LOW-FAT NUTRITION LABELS INCREASE INTAKE?

Procedure

We recruited 74 adults (44% males, 38.3 years old, 24.8 BMI) on a major university campus for a study that they were told addressed visual illusions and volume perceptions. In exchange for free movie coupons, each participant was told that they would be asked about various snack foods. Two transparent 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 (1380 calories), and the other contained 10 ounces of regular granola (1330 calories). Half of the participants were assigned to the first room and saw a measuring cup labeled as "Regular M&M's" and another labeled as "Regular Granola." The other half were assigned to the other room and saw one measuring cup labeled as "Low-Fat M&M's" and another labeled as "Low-Fat Granola." We chose the two snacks on the basis of pretests, which indicated that though both foods have similar calorie density (135–140 calories per ounce), granola is perceived as more nutritious, more healthy, and less hedonic than M&M's.

Participants were given a two-page questionnaire. On the first page, they were asked to evaluate serving sizes by estimating (1) the number of ounces of the snack that would be appropriate *for a typical person* to eat during a 90-minute movie and (2) the number of ounces that would be appropriate *for them* to eat in the same situation. To help them calibrate their estimates, there were ounce markings on the side of each measuring cup. They were also asked to estimate the total number of calories contained in each measuring cup and to rate how guilty they would feel after consuming two ounces of each snack. 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, and weight and were asked to guess the purpose of the study. Using the BMI cutoff of 25 kg/m^2 established by the WHO, we classified 52 participants as being normal weight and 16 as being overweight. 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, we analyzed the two measures of serving sizes using a repeated measure analysis of variance. In this analysis, two different foods (granola versus M&M's) were within-subjects factors and the nutritional label (low fat versus regular), each person's BMI (under 25 kg/m^2 versus above 25 kg/m^2), and the nutrition label × body mass interaction were between-subjects factors. Participants who saw a food labeled as low fat believed that the appropriate serving size was 25.1% larger ($F(1, 60) = 6.0$, $p < .01$) than those who saw the same food labeled as regular. There were no differences between overweight and normal-weight participants ($F(1, 60) = .4$, $p = .55$), and there were no significant interactions between food type (granola or M&M's) and any of the between-subjects factors. On average, participants estimated that the appropriate consumption amount was one ounce higher in the low-fat-label condition than in the regular-label condition.

Serving-size estimates were the inverse of their calorie density estimates. Participants who saw a food labeled as low fat believed that it was much lower in calories ($F(1, 69) = 4.1$, $p < .05$), regardless of their BMI ($F(1, 69) = 2.9$, $p = .10$). As we show in Table 1, low-fat labels decreased calorie estimates by an average of 260 calories, and the amount of the reduction was similar across both M&M's and granola (–292 versus –229 calories) and across both low- and high-BMI groups (–254 versus –272 calories). In summary, low-fat labeling increased perceived serving sizes and decreased perceived number of calories across food and consumer types.

Did low-fat labeling lessen participants' anticipation of consumption guilt? All participants anticipated that they would feel less guilty in the low-fat-label condition ($M = 3.1$ on a nine-point scale anchored by 1 = "not guilty" and 9 = "guilty") than in the regular-label condition ($M = 3.9$; $F(1, 69) = 3.8$, $p < .05$). In general, overweight participants anticipated less guilt ($M = 2.8$) than regular-weight participants ($M = 3.7$), though the effect was only marginally statistically significant ($F(1, 69) = 3.7$, $p < .06$). As Table 1 shows, the interaction between food type and BMI was statistically significant ($F(1, 69) = 5.0$, $p < .05$). Relatively hedonic M&M's elicited more guilt among normal-weight participants ($M = 4.6$) than among overweight participants ($M = 3.1$; $F(1, 69) = 5.4$, $p < .05$). In contrast, relatively utilitarian granola elicited little guilt by either normal-weight participants ($M = 2.9$) or overweight participants ($M = 2.5$; $F(1, 69) = .6$, $p = .44$). Finally, Table 1 shows that low-fat labels reduced the guilt among everyone associated with consuming granola. With the more indulgent M&M's, however, low-fat labels reduced guilt only among overweight participants. In summary, consumption guilt is influenced by low-fat nutrition claims but also varies with the hedonic and utilitarian nature of the food studied and with people's BMI.

Discussion

Building on Study 1, Study 2 provides three additional insights: (1) Low-fat labels decrease the perception of calorie density, (2) low-fat labels increase the perception of the appropriate serving size, and (3) low-fat labels make people feel less guilty about how much they eat. Consumers expect that low-fat M&M's contain 20% fewer calories than their regular counterparts, and they expect that low-fat granola contains 25% fewer calories. Importantly, as a result, they expect that comparable increases in serving sizes are justified for both foods when they are labeled as low fat (21% for M&M's and 18% for granola). The pattern of results regarding feelings of guilt suggests that normal-weight participants in Study 1 responded less strongly to low-fat labeling than overweight participants because of their unwavering guilt. In essence, regular-weight participants behaved as if the M&M's remained indulgently hedonic, regardless of whether they were labeled as low fat or regular. In contrast, overweight participants, whose guilt is lower to begin with, viewed the low-fat M&M's as basically guilt free. In total, Study 2 provides important evidence as to the mechanism of how low-fat foods might influence food intake; we test the mediation analysis itself in Study 3.

Table 1

STUDY 2: HOW LOW-FAT LABELS INFLUENCE PERCEIVED SERVING SIZE, CALORIE DENSITY, AND GUILT (MEANS AND STANDARD DEVIATIONS)

		Normal-Weight Participants (BMI < 25)		*Overweight Participants (BMI > 25)*	
Mediator	*Product*	*Regular Label*	*Low-Fat Label*	*Regular Label*	*Low-Fat Label*
Perceived serving size	M&M's	5.8	6.5	4.3	7.1
		(2.2)	(3.3)	(1.2)	(2.3)
	Granola	5.3	6.4	5.5	5.9
		(1.7)	(3.3)	(3.0)	(1.0)
Perceived calorie density					
	M&M's	1545	1320	1377	942
		(819)	(676)	(624)	(578)
	Granola	1013	732	765	626
		(562)	(458)	(373)	(281)
Anticipated consumption guilt					
	M&M's	4.7	4.5	3.6	2.7
		(3.0)	(2.1)	(2.4)	(2.4)
	Granola	3.6	2.3	3.1	1.9
		(2.3)	(1.5)	(2.2)	(1.2)

Notes: We measured perceived serving size as the number of ounces appropriate to eat during a 90-minute movie. We measured perceived calorie density as the estimated number of calories in a ten-ounce cup. We measured anticipated consumption guilt 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").

A purposeful limitation of Study 2 is that we did not measure consumption. This was necessary to avoid contamination between the measures of consumption and the measures of the mediators. For example, someone might report a small serving size and a low level of guilt to justify high consumption. This raises the question whether providing objective serving-size information can help prevent people from overeating when they see a low-fat label. We address this question in Study 3. Another issue is that the difference between overweight and regular-weight participants might have been exacerbated by the social nature of Study 1, in which participants served themselves in the presence of the research assistant and family members. If anticipated guilt influences how much of a product a person consumes, we should find little difference between overweight and normal-weight consumers when they are eating a food about which they feel low levels of guilt. We examine this in Study 3 using low-fat granola.

STUDY 3: CAN OBJECTIVE SERVING-SIZE INFORMATION REDUCE THE EFFECTS OF LOW-FAT LABELS?

Study 3 directly examines whether low-fat labels increase consumption because they increase what people believe is the appropriate serving size. We test whether providing objective serving-size information can prevent people from overeating a food with low-fat labels. To explore the role of anticipated consumption guilt further, Study 3 examines the consumption of granola (which is less hedonic than M&M's) in a context in which people are given large preportioned quantities and in which their consumption is unobserved by others. This also enables us to test the prediction that low-fat labels had a stronger influence on overweight consumers in Study 1 because they felt less guilty about overserving themselves. In this context, we expect that low-fat labels increase consumption equally for overweight and regular-weight consumers.

Procedure

Study 3 uses a 2 (regular versus low-fat label) × 3 (no serving label, "Contains 1 Serving" label, "Contains 2 Servings" label) between-subjects design. We recruited 210 university staff, undergraduates, and graduate students (49% males, 28.7 years old, 25.1 BMI) at a large university campus to be part of a study in which they would 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 P.M. on each of ten days (Tuesdays and Thursdays for five nonconsecutive weeks). On arriving at the dimly lit theater, participants were seated in every other seat and asked to watch and rate a series of made-for-television movie previews and a 60-minute pilot show called "Hazard County." They were also told that because 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.

On the basis of a pretest involving 79 similar consumers, we selected a brand of granola mix that was well liked, and we chose a realistic amount that was sufficient to ensure that no one would eat all the granola within a 90-minute period. Each participant received 640 calories (160 grams) of granola in ziplock bags that were labeled with an attractive 3.25 × 4 inch color label. Depending on the condition, the granola was described as either "Regular Rocky Mountain Granola" or "Low-Fat Rocky Mountain Granola." Below this, the label indicated Contains 1 Serving or 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 we were concerned about contamination among 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 had eaten and to measures of weight, height, and gender. As participants left the theater, we weighed their granola bag while they selected a free coupon for an upcoming movie along with a dessert coupon. As their bag was being weighed out of their sight, we asked them how many serving sizes they believed their bag contained. Following this, they were thanked and dismissed; there was no debriefing at that time. Participants 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.

We eliminated some participants from analysis for the following reasons: not staying until the end of the show (n = 7), refusing to eat granola because of dietary restrictions or political principles (n = 4), spilling their granola on the floor (n = 3), emptying their granola bags into their pockets (n = 3), and failing to provide height and weight information (n = 14). No participant consumed all the granola in the bag while watching the show. As in Study 1, for the analyses, we converted consumption volume into calories to facilitate comparison with calorie estimates. Of the remaining 179 participants, we classified 110 in the normal-weight group and 69 in the overweight group, using the WHO 25 kg/m^2 cutoff.

Results

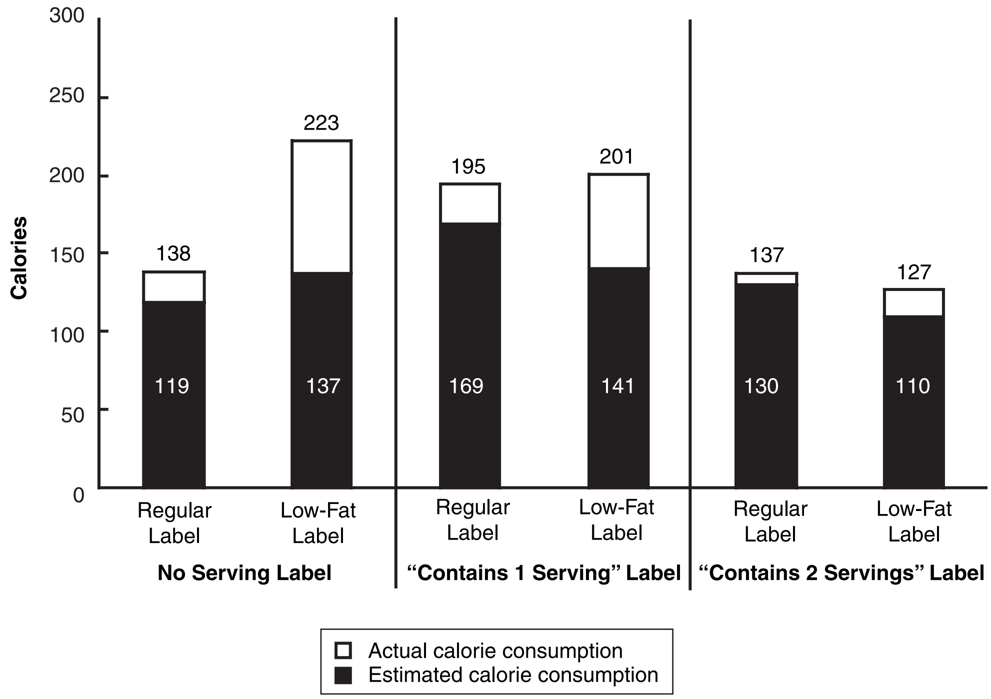
Do low-fat labels increase consumption of granola? To benchmark with Study 1, we analyzed consumption in the control condition, in which no serving-size information was available, using an ANCOVA with three factors (nutrition label, body mass group, and nutrition label × body mass group interaction) and gender as a covariate. Consistent with our earlier findings, people who were given granola labeled as low fat consumed 50.1% more granola than people who were given granola labeled as regular (249 versus 165 calories; $F(1, 62) = 7.8$, $p < .01$). As in Study 1, overweight participants consumed more granola than normal-weight participants (256 versus 174 calories; $F(1, 62) = 8.5$, $p < .01$). As we expected on the basis of the guilt results from Study 2, the interaction between label and body mass was not statistically significant ($F(1, 62) = .3$, $p = .59$), and the increase in consumption was similar for overweight and regular-weight participants (see Figure 3).

To examine whether perceived serving size mediates the effects of low-fat labeling on consumption, we conducted a mediation analysis using data from the control condition (Baron and Kenny 1986). We first regressed the number of calories eaten by the nutrition label and the two control

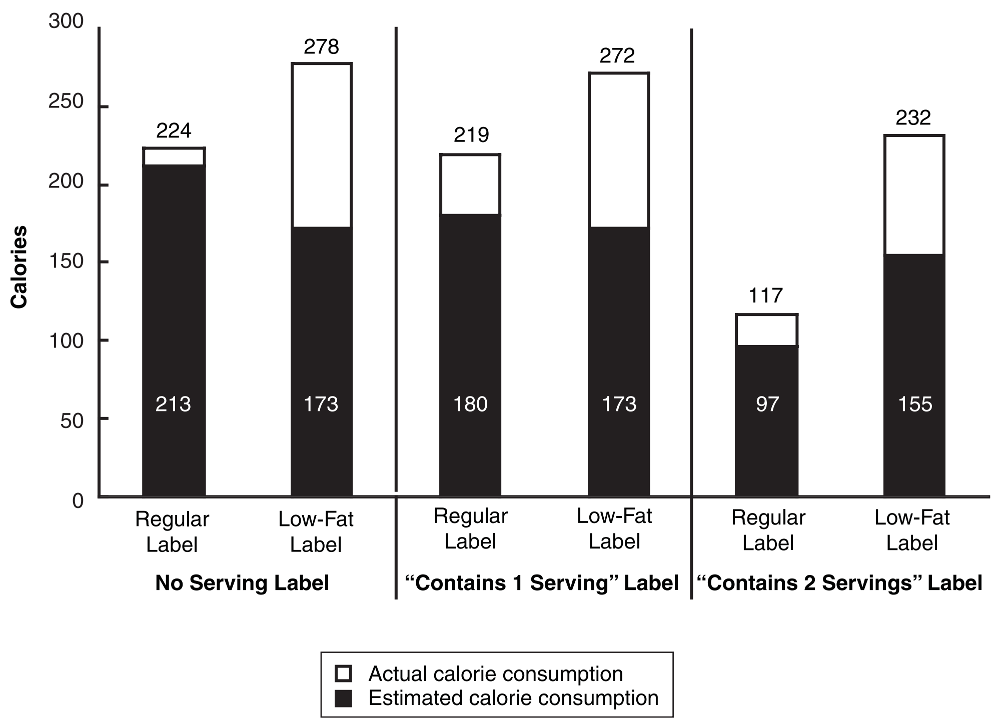
Figure 3

STUDY 3: OVERWEIGHT CONSUMERS ARE LESS RESPONSIVE TO THE SERVING-SIZE INFORMATION ON LOW-FAT LABELS

A: Normal-Weight Consumers (BMI < 25)



B: Overweight Consumers (BMI > 25)



variables (body mass group and gender). We found that low-fat labels increased consumption by 73.9 calories after we controlled 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 ($p > .10$). Next, we regressed the dependent variable on the mediator and the same control variables. The coefficient of the variable measuring the perceived number of servings was negative and statistically significant (B = –65.9, t = –4.3, $p < .01$), indicating that people who believed there were more servings in the bag tended to eat less.

In the last regression of the mediation analysis, we regressed the number of calories eaten on low-fat labeling, the estimated number of servings, and the control variables. When we included the mediator 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 (1982) test 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 we measured serving-size estimations at the end of the study, it is possible that they were contaminated by consumption decisions. To better test the mediating role of serving-size information, we now turn to the analysis of the experimental manipulation of objective serving-size information.

How does serving-size information influence consumption? As a manipulation check, we examined participants' estimates of the number of servings contained in the bag in the two conditions in which serving-size information was available. Their estimations were accurate when they were given a bag with a Contains 1 Serving label (M = 1.05; t = 1.7, $p = .08$) or when they were 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 not influenced by low-fat labeling (F(1, 114) = .5, $p = .48$) or by the participant's body mass (F(1, 114) = .1, $p = .76$). Participants who were provided with serving-size information knew the number of servings purported to be in their bag and were not influenced 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 use of two factors for the serving-size manipulation (Contains 1 Serving and Contains 2 Servings) was necessary to examine the effects of each of the two serving-size labels compared with the control condition. The main effects of low-fat labeling, Contains 2 Servings condition, and body mass group were all statistically significant (F(1, 167) = 12.1, $p < .001$; F(1, 167) = 11.8, $p < .001$; and F(1, 167) = 13.4, $p < .001$, respectively), as was the three-way interaction among them (F(1, 167) = 4.6, $p < .05$). No other interaction was statistically significant, and gender was not significant as a covariate ($p > .10$). To facilitate the discussion of the results, we conducted separate ANCOVAs for normal-weight and overweight participants; we discuss their results separately.

For normal-weight participants, when bags of granola were labeled as Contains 2 Servings, consumption was reduced by 50 calories compared with 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 with 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, $p = .08$). We illustrate these important interactions in Figure 3, Panel A, which focuses on normal-weight participants. 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 ($p > .10$). Therefore, providing objective serving-size information was effective in eliminating the effects of low-fat labeling on normal-weight participants.

For overweight participants, again, labeling the bag of granola as Contains 2 Servings reduced consumption by 74 calories compared with the control condition (F(1, 62) = 7.0, $p < .01$), but labeling them as Contains 1 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 factors that captured the Contains 1 Serving manipulation (F(1, 62) < .1, $p = .96$) or the Contains 2 Servings manipulation (F(1, 62) = 1.4, $p = .23$). Overweight consumers ate more granola when it was labeled as low fat, regardless of the serving-size information that was provided or their gender ($p > .10$).

How do low-fat labels and serving-size information bias consumption estimates? 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 the 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 versus –21 calories; F(1, 167) = 38.5, $p < .001$). This calorie underestimation bias was also larger among overweight participants than among normal-weight participants (–61 versus –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 than in the Contains 2 Servings condition (–55 versus –26 calories; F(1, 167) = 5.5, $p < .05$), in which participants tended to reduce their consumption. None of the other interactions were statistically significant.

Post Hoc Marketplace Study

When no serving-size information was given to participants, the results of Study 3 replicated 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 overcompensates for the reduced calorie in the low-fat granola. To determine this, we conducted a market survey of the fat and calorie content of regular and low-fat granola bars and cereals, and we found 14 brands with at least a 5% market share and sold with both a low-fat and a regular version.

Serving sizes were almost identical across both versions (t = .99, $p = .34$). Although low-fat granola contained 56% less fat per serving than regular versions (2.3 versus 5.9 grams; t = 4.0, $p < .001$), it contained only 10% fewer calories per serving than regular versions (196 versus 173 calories; t = 3.3, $p < .01$). If participants in Study 3 had eaten real low-fat granola and if the 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. This is a conservative estimate. As we noted previously, the calorie increase would have probably been even higher because the ingredients used to replace fat tend to make people hungrier (Nestle 2002).

Discussion

By measuring and manipulating serving sizes, Study 3 further contributes to understanding why low-fat labeling increases consumption and what can be done to control it more effectively. The mediation analyses show that when no objective serving-size information was available, how much a person ate was influenced by how many serving sizes he or she thought was in the bag. Although this would lead us to believe that putting salient serving-size information on packaging would eliminate the biasing influence of low-fat labeling, this appeared to influence only normal-weight people. Overweight participants ate increased amounts of granola labeled as low fat, regardless of the serving size on the label.

This difference cannot be explained by overweight participants not paying attention to serving-size information. First, the manipulation checks showed that all participants accurately identified the number of servings in the two conditions in which serving-size information was provided on the label. Second, overweight participants reduced their overall consumption when the granola bags mentioned Contains 2 Servings compared with the control condition in which no serving-size information was available, indicating that they indeed responded to serving-size information.

A more likely explanation can be found in the low levels of guilt triggered by consuming granola. Even in the Contains 2 Servings condition, when overweight participants knew that the quantity of granola in the bag was higher than what most people consume, they did not restrain their consumption. This is consistent with the findings from Study 2, which show that consumption creates less guilt among overweight people than among normal-weight people. Compared with Study 1, these effects were compounded by normal-weight participants not being able to serve themselves less food, a common self-control mechanism (Wertenbroch 1998), and therefore they ended up overeating in response to low-fat labels as much as overweight participants.

As in Study 1, participants were unaware that low-fat labeling increased their consumption. In the control condition, participants accurately estimated their calorie consumption when the granola was labeled as regular (they underestimated consumption only by 17 calories, or 10%). However, they strongly underestimated actual consumption (by 94 calories, or 38%) when the granola was labeled as low fat. The convergence between the results of Study 1 (which were obtained preintake) and Study 3 (which were obtained postintake) shows the robustness of our finding that low-fat labeling increases the calorie underestimation bias.

GENERAL DISCUSSION

The United States is a country of low-fat foods and high-fat people. In this obesity-inducing environment, a priority of the FDA is to examine whether relative nutrition claims, such as low fat, lead to the overconsumption of high-calorie snack foods by "at-risk" (overweight) consumers. We develop and test a framework that shows that foods that are labeled as low fat increase food intake by increasing perceived serving sizes and by reducing anticipated consumption guilt. This helps explain why the influence of relative nutrition claims differs according to the factors associated with guilt, such as whether a person is of a normal weight and whether the food is hedonic. We test the predictions of the framework in one lab study and two field experiments in natural environments. 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 both hedonic and utilitarian snacks, across young and old consumers, across self-reported nutrition experts and novices, in public and private consumption settings, and regardless of whether people serve themselves or not.
- For normal-weight people, low-fat labeling increases consumption most with foods that are believed to be relatively healthy.
- For overweight people, low-fat labeling increases their consumption of all foods.
- Objective serving-size information prevents normal-weight people from overeating foods labeled as low fat. It does not influence overweight people.

The focus of these studies has been on low-fat nutrition claims. There are many others claims or labels that might provide similar health halos and are critical to investigate. These can include relative nutrition claims, such as "reduced calorie" or "low carbs," and manufacturer-developed labels, such as "Sensible Snacking" (Nabisco/Kraft), "Smart Spot" (PepsiCo), and "Healthy Living" (Unilever). They can also involve production or process-related labels, including "organic," "natural," and "vitamin fortified."

Implications for Public Policy Officials

Agencies such as the FDA have created specific guidelines for nutrition labels and claims. These guidelines 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 these health halos from labels, our findings indicate that truthful labels and claims may not be sufficient to improve eating 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 sizes and calorie information more salient. This would be useful for packaged goods, whose serving-size labels are not always inspected. Indeed low-fat labels and other nutrition-related claims are often used on the front of a package or in the advertising and are more salient than (and often divorced from) the nutritional information that is on the back of the label (Wansink, Sonka, and Hasler 2004). Increasing the salience of serving sizes would be even more useful for the fast-food industry, in which relative nutrition claims (e.g., low fat, reduced calorie, low carbs) are widespread and may be particularly misleading given that nutrition labels are not mandatory. For example, one Subway advertisement shows that a Subway Sweet Onion Chicken Teriyaki foot-long sub has only 10 grams of fat, whereas a Big Mac contains 33 grams of fat. In the advertisement, the Subway spokesman, Jared Fogle, states that this means "You can eat another and another over the course of three different meals and still not equal the fat content of one Big Mac." Yet the advertisement fails to mention that the Sweet Onion Chicken Teriyaki foot-long sub contains more calories (740 versus 600 calories) and more cholesterol (100 versus 85 milligrams) than the Big Mac. Thus, eating three Subway subs would provide 1620 more calories and 215 more milligrams of cholesterol than eating one Big Mac.

A second solution for regulators would be to increase the threshold for relative nutrition claims. For example, to claim "reduced calories," the food might need to contain 33% fewer calories than the reference food rather than only 25% fewer (which is currently the case). This would increase the likelihood that total calorie intake does not end up being unintentionally higher for people eating low-fat foods than for those eating regular (higher-fat) foods. In general, it would be important to account for such health halos when forming future guidelines or endorsements for foods (e.g., for low carbohydrates or low sodium).

A third, and possibly the most thorough, reform would be to change the definition of serving sizes so that it is higher for foods that make relative nutrition claims. Currently, the FDA (2003, pp. 29–30) 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. They do not reflect how much is overeaten because of a relative nutrition claim. Increasing serving sizes in the case of relative nutrition claims (e.g., low fat) would correspondingly increase the number of calories per serving mentioned in the label for these foods. Doing so would have a double advantage: (1) It would more accurately describe the actual amount of food consumed, and (2) it would deter people (at least those of normal weight) from eating significantly more than the serving size.

Implications for Food Manufacturers

These findings also have useful implications for responsible food manufacturers. Manufacturers could consider being more explicit and should provide more information when defining something as low fat. This could be in the form of the percentage reduction over the regular version along with information on the absolute calorie level per serving or per container. Because people infer the appropriate serving size of a food from various 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 multipacks of products with smaller individual servings (or subpackaging). This would provide break points at which a person would need to reassess whether he or she is going to continue eating.

Another option for food manufacturers would be to consider manufacturing smaller, premium-priced packages. Although they would not be priced competitively (per unit) compared with 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 that 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 (Zaff 2004). For example, a loyalty program survey of current customers of a Kraft product indicated that 57% of them would be willing to pay up to 15% more for portion-controlled packaging (Wansink and Huckabee 2005).

Implications for Researchers

In marketing, much of the best nutrition research has been focused on how nutrition labels influence health beliefs and purchase intentions (Andrews, Netemeyer, and Burton 1998; Balasubramanian and Cole 2002; Ford et al. 1996; Keller et al. 1997; Kozup, Creyer, and Burton 2003; Moorman 1990, 1996; Moorman et al. 2004; Wansink and Cheney 2005). 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 companies such as Kraft, Masterfoods, PepsiCo, and Unilever, we focused on the effects of low-fat nutrition labels. Pilot studies with other nutrition labels (e.g., reduced calorie) showed similar results. It may be that a general health halo can be caused by simple nutrition facts (e.g., 100-calorie portions), by health-related claims (e.g., organic, high fiber), and even by general health claims (e.g., those made by PepsiCo's Smart Spot icons). It would be worthwhile to study whether these other claims influence food intake on any given occasion, as we found for low-fat labels, and whether they can also influence the frequency of consumption, as previous studies of the effects of product stockpiling have found (Chandon and Wansink 2002). Any increase in consumption frequency would have important implications for the obesity debate because it is often argued that the rising obesity rates in the United States are caused by increasing consumption frequency more than by increasing consumption quantity per intake (Cutler, Glaeser, and Shapiro 2003).

Another extension would be to study how these claims influence what else a person eats. For example, there is early evidence that consuming a food with a relative health claim (e.g., a low-fat sandwich) can lead some consumers to indulge in a calorie-rich dessert. As a result, consumers may end up eating more total daily calories when going to "healthy" restaurants than to restaurants that do not make such claims. Because such unintended overeating might even operate with vague claims (e.g., 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 nonfood products that the FDA is also concerned with, such as medicines, supplements, and personal care products.

Another important area for further research is to understand whether the influence of relative nutrition claims on consumption might also be related to their influence on the taste of a food. Raghunathan, Walker, and Hoyer (2006) find that labeling food as "healthy" reduces consumers' taste expectations and even reduces their postintake taste experience. Could this mean that relative nutrition claims increase consumption because consumers trade off taste reductions for increased consumption? According to Raghunathan, Walker, and Hoyer, this is unlikely; they find that lower perceived taste (caused by "healthy" labels) actually decreases consumption. Still, they obtained these results by manipulating taste perceptions while the food itself was unchanged. In reality, the ingredients used to replace the fat in low-fat foods may leave more of a watered-down taste, which consumers may try to offset by consuming more. Therefore, it would be important to study the joint effects of nutrition claims and actual nutrition content.

Finally, it would be useful to extend these results to additional consumer segments, additional product categories, and additional consumption contexts. More research is necessary to understand why overweight and regular-weight consumers may respond differently to nutrition claims. For example, studies have shown that overweight and regular-weight consumers have similar estimations of portion sizes (Chandon and Wansink 2007). This implies that emotional differences rather than cognitive ones may underlie the different behavior of these two groups. In general, the effects of the message are also influenced by consumers' motivation and ability to process nutrition information (Moorman et al. 2004). Poor nutrition knowledge might lead some consumers to focus exclusively on fat content rather than on calorie or other nutrient information. This could lead them to believe that they can safely eat more when the product is labeled as low fat. Conversely, not all consumers have nutrition or weight-loss as an objective in their lives, and heavy-handed regulation and nutrition education programs 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 indicates that even highly involved consumers may actively ignore nutrition information to avoid the negative emotions that may arise if the food is less nutritious than they had thought (Ehrich and Irwin 2005).

Given these concerns and the generally disappointing results of educational efforts aimed at increasing consumers' objective knowledge of nutrition, a provocative idea might be to enhance consumers' subjective nutrition knowledge (i.e., their perception of how knowledgeable they are about nutrition). In a series of studies, Moorman and colleagues (2004) manipulate subjective nutrition knowledge through biased feedback on objective knowledge tests. They find that because of the desire for self-consistency, high levels of subjective nutrition knowledge led people to restrict their search to products within healthful product categories.

CONCLUSION

People are at a point of development in which much of the incremental improvement in their life span, and especially in their quality of life, is likely to come more from behavioral changes in lifestyle than from new medical treatments (Wansink 2006). When it comes to contributing to the life span and quality of life in the next generations, well-intentioned marketers can help lead the movement toward behavior change. Obesity is a good place to start.

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