The Calcium Quandary: How Consumers Use Nutrition Labels

Lauren G. Block and Laura A. Peracchio

It has been a decade since the Nutrition Labeling and Education Act mandated that the Nutrition Facts panel on food labels be formatted with nutrient reference values, namely, percent daily value (%DV). Across a series of three studies, the authors demonstrate that consumers have difficulty using %DV from the Nutrition Facts panel to determine their required calcium intake. These effects are demonstrated in Study 1 with consumers who are at risk for osteoporosis (seniors age 55 and over). In Study 2, the authors provide evidence that physicians dispense calcium recommendations to their patients in milligrams, even though most doctors cannot transform the %DV from the Nutrition Facts panel into milligrams. Study 3 reveals that exposing pregnant and lactating women to easy-to-use information in combination with the Nutrition Facts panel increases their calcium consumption to within the suggested daily recommended range.

A patient has just left her physician's office after a routine annual exam, during which she is given a clean bill of health. Feeling good, and possibly relieved, she vows to follow her doctor's recommendation: exercise at least 30 minutes three times a week and get 1200–1500 milligrams of calcium every day. Determined to begin right away, she goes to the local grocery to purchase a container of yogurt. The Nutrition Facts panel indicates that the yogurt provides 45% DV (daily value), which she thinks is a fairly good amount of calcium, but how many milligrams of calcium does this represent? How does this consumption choice contribute to reaching her doctor-prescribed goal of 1200–1500 milligrams per day? We invite readers to refer to Figure 1 and to try to perform this calculation before reading further.

This scenario represents an underresearched area in consumer decision making: How do consumers make food consumption decisions when product information falls short of providing the nutritional knowledge needed for personal health consumption goals? Our research explores how consumers interpret the percent daily value (%DV) information on the Nutrition Facts panel of food labels to determine their calcium consumption. One reason we chose to explore calcium in this research is the prevalence of osteoporosis in the United States. According to the National Osteoporosis Foundation, ten million Americans, both male and female, have osteoporosis, and an estimated 34 million more have low bone density. The National Osteoporosis Foundation estimates that one in two women and one in four men over the age of 50 will have an osteoporosis-related fracture, at a cost of approximately $50 million per day (see http://www.nof.org/osteoporosis/stats.htm).

Importantly, according to the Food and Drug Administration (FDA), despite the availability of nutrition information

Figure 1. Nutrition Facts Panel: Typical Eight-Ounce Container of Yogurt

Nutrition Facts Service Size 1 Container	
Amount Per Serving	
Calories 160	
	%DV*
Total Fat 0g	0%
Cholesterol 0 mg	0%
Sodium 135 mg	6%
Total Carbohydrate 30g	10%
Fiber 0g	0%
Sugars 29g	
Protein 9g	18%
Vitamin A 0% • Vitamin C 4%	
Calcium 45% • Iron 2%	
Not a significant source of calories from fat or saturated fat	
*Percent Daily Values (DV) are based on a 2,000 calorie diet.	

Lauren G. Block is Professor of Marketing, Zicklin School of Business, Baruch College, City University of New York (e-mail: Lauren_Block@baruch.cuny.edu). *Laura A. Peracchio* is Roger L. Fitzsimmonds Scholar and Professor of Marketing, University of Wisconsin–Milwaukee (e-mail: Lperacch@uwm.edu).

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on the Nutrition Facts panel in %DV format, experts, such as physicians, often provide the recommended daily intake of calcium to consumers in milligrams (http://www.cfsan.fda.gov/~dms/foodlab.html). Thus, using the nutrition label to determine compliance with the doctor-recommended calcium intake requires computation and transformation, for which consumers typically perform poorly (Levy, Fein, and Schucker 1996).

Although we focus on calcium in this study, the challenge of using the Nutrition Facts panel to make adequate food consumption decisions is similar for other nutrients that consumers often do not consume enough of, such as dietary fiber, vitamin A, vitamin C, and iron (FDA 2004). Nutrients listed in the Nutrition Facts panel are separated into two categories: "limit these nutrients" (e.g., fat, cholesterol, sodium) and "get enough of these nutrients" (e.g., fiber, iron, vitamins A and C). Much more attention and educational efforts have been paid to the former than to the latter (Tussing and Chapman-Novakofski 2004). However, deficiencies in nutrients in the latter category (e.g., iron) can result in short-term and long-term consequences (e.g., iron depletion and iron deficiency anemia). Many groups of people who may need extra iron to prevent deficiency (e.g., pregnant women; patients with celiac disease, Crohn's disease, or renal failure) are advised by their physicians to consume as much as 30 milligrams of iron per day. As with calcium, iron is listed in %DV on the Nutrition Facts panel. One hundred percent represents 18 milligrams of iron per day, which is inadequate for at-risk groups (Iannelli 2005). Again, as in the calcium scenario we described previously, at-risk people would need to perform a transformation to satisfy their required daily intake of iron through food sources.

Brief Overview of Food-Labeling Regulation

The history of food-labeling regulation can be characterized as contentious and ever-evolving (Derby and Levy 2001). For manufacturers, the food label, as part of the product's package, is a crucial communication device that can help differentiate products from competitors. For consumers, food labels are expected to provide accurate ingredient lists and health claims so that they can make informed food choices. In 1990, a report prepared by the Committee on the Nutrition Components of Food Labeling (Porter and Earl 1990) determined that consumer packaged goods companies provided incomplete nutrition information and misleading nutrient claims on food labels. In addition, information on vitamins and minerals that are not typically deficient in Americans' diets were listed on food labels, whereas other nutrients of public health concern (e.g., cholesterol) were omitted (Derby and Levy 2001).

To address these issues, Congress passed the Nutrition Labeling and Education Act (NLEA; 21 U.S.C. 301) to establish standards for food labeling and health claims. Three years later in 1993, the FDA published comprehensive regulations governing food labeling that defined the nutrition label format (i.e., the Nutrition Facts panel) that manufacturers were required to use. The NLEA had several goals, including protecting consumers from inaccurate, deceptive, and misleading nutritional claims on food labels and encouraging manufacturers to improve the nutritional content of their products by making the information easily available to consumers. The NLEA was also designed to eliminate the inconsistent and poorly defined terms being used to describe the nutritional content of foods. Another goal of the NLEA was to help consumers make healthful food choices by providing nutritional information that was more easily available, presented in an easy-to-understand format, and meaningful in the context of a total daily diet. A label-based formatting change to help consumers accomplish this was the substitution of nutrient reference values (%DVs) for the pre-NLEA gram or milligram amounts. This was expected to minimize consumers' need to transform quantitative information into a usable form (Levy, Fein, and Schucker 1996).

It has been a more than a decade since the NLEA went into effect in 1994. The NLEA has increased public access to nutrition information. Over these years, many researchers have explored the effects of the NLEA labeling requirements on consumers' ability to compare food products and make healthier food choices (e.g., consistency of the Nutrition Facts panel and on-package claims [Garretson and Burton 2000; Keller et al. 1997], comparison with alternative reference information [Barone et al. 1996], a conceptual model of the use of nutrition labels [Szykman, Bloom, and Levy 1997], comparison of %DV with summary information on labels [Viswanathan and Hastak 2002]). Many of these studies point to the successes of the NLEA in meeting its goal of helping consumers make better nutritional choices.

Post-NLEA research has also focused on evaluating how consumers use nutritional information and the NLEA labeling format (Burton, Garretson, and Velliquette 1999). Moorman (1996) finds that the Nutrition Facts panel increases consumers' acquisition and comprehension of nutritional information. In a series of studies examining how consumers use nutritional information, Balasubramanian and Cole (2002) find that post-NLEA consumers increase their attention to negative nutritional information (e.g., fat, sodium) and decrease their attention to positive nutritional information (e.g., calcium). Other research has examined how the format of the food label affects consumers' comprehension and acceptance of nutritional information (Levy and Fein 1998; Levy, Fein, and Schucker 1996).

Over the past few years, research on the Nutrition Facts panel has waned, because it is now assumed that consumers are well aware of the Nutrition Facts panel and comfortable using the nutrition information it provides to infer the health benefits of products. However, two important omissions are evident in the decade of research on NLEA labels. First, how do consumers cope with instances when the easily available information from the Nutrition Facts panel is insufficient to pursue personal health objectives? Second, how do consumers who differ from the average requirements interpret %DV? For example, what is the impact of food labels on nutritional consumption for segments of consumers who either have higher nutrition requirements than the average consumer (e.g., older people require more calcium on a daily basis) or require a different level of overall food consumption (i.e., people whose diet should be under or over the 2000 calorie requirement)?

Calcium consumption provides an excellent context for studying these two omitted research questions because the

required daily intake of calcium (1) is presented as %DV on the Nutrition Facts panel, though consumers are given advice regarding calcium consumption in milligrams, and (2) may differ from that listed on the label, depending on a person's age, gender, and genetic history of osteoporosis. Across three studies, we document the difficulty consumers have in using %DV to determine their daily calcium intake, and we explore how this difficulty results in systematic bias in consumption of this nutrient. Our expectation is that regardless of nutrition knowledge or at-risk status, consumers cannot interpret %DV calcium on the Nutrition Facts panel to meet their calcium requirements.

In a pilot study, we explored the average consumer's interpretation of %DV for calcium. The FDA has set 2000 calories as the reference amount for calculating %DV, so we queried average respondents in the pilot study (i.e., those requiring 2000-calorie diets who are at low-risk for osteoporosis) about their understanding of calcium information on the Nutrition Facts panel. Respondents were shown the Nutrition Facts panel in Figure 1 and asked to compute the number of milligrams of calcium in the yogurt. Only 2 of 58 respondents offered correct responses; all other respondents offered a range of responses that were significantly different from the correct response. The results of this pilot study demonstrate the difficulty consumers face in using the calcium information available on a Nutrition Facts panel. If average consumers are challenged by this calculation, how do people who have higher-than-average calcium needs and who cannot rely on 100% DV use calcium information?

In Study 1, we survey consumers who are at risk for osteoporosis. Consumers age 55 and over usually receive calcium information from their physicians; they require higher-than-average daily calcium intake (1500 milligrams per day) and typically require a 1600-calorie-per-day diet. In Study 2, we survey a group of physicians who regularly dispense nutrition advice and are presumably highly knowledgeable about health and nutrition. In this study, we confirm that calcium nutrition advice is indeed provided in milligrams without further guidance on the appropriate transformation from %DV. These physicians provide a third, independent sample, confirming our initial finding; most of these doctors cannot interpret the %DV on the Nutrition Facts panel and are unable to transform %DV into milligrams. In Study 3, we show that providing pregnant or lactating women with easy-to-use information about how to interpret the %DV from the Nutrition Facts panel increases their actual calcium consumption to within the suggested daily recommended range.

Before presenting Study 1, we answer the question, How many milligrams of calcium are in the container of yogurt? To answer this question, the daily required intake of calcium for the average individual must be known; an adult of average body size and weight and moderate activity level should consume 1000 milligrams of calcium per day. Therefore, 45% of 1000 milligrams is 450 milligrams calcium. Not many people, knowledgeable or otherwise, know this.

Study 1

Method

Respondents were recruited with a promotional flyer placed in their mailboxes. A total of 37 respondents age 55 and over volunteered to participate in the study. All respondents were Florida residents; approximately one-third (30%) of respondents were male; and 16% percent of respondents were ages 56–64, 51% were ages 65–74, and 15% were age 75 and over. At a prearranged appointment time, residents met the survey administrator for a one-on-one administration of the survey. Each respondent received three Florida lottery tickets as compensation for their participation. Thirty-one percent of the respondents had physician-diagnosed osteoporosis and took prescription medication to maintain bone density.

The questionnaire began by introducing respondents to the terminology used on the Nutrition Facts panel. Respondents were told that DVs are dietary reference guidelines displayed on food labels to provide guidelines for planning a healthful diet. They were advised that nutrition guidelines exist for dietary intake of vitamins, minerals, fat, carbohydrates, protein, cholesterol, and fiber. Then, respondents indicated their daily recommended intake on a blank line for a list of nine vitamins and minerals (e.g., protein, sodium, iron) in which calcium was embedded. For each nutrient, respondents were provided with a reference: either number of grams per day (e.g., protein) or number of milligrams per day (e.g., calcium). Respondents were instructed to guess if they did not know the answers to these nutrition questions.

Next, respondents used the same Nutrition Facts panel presented in Figure 1 to respond to the following: (1) How many milligrams of calcium are in the container of yogurt? and (2) Explain how you arrived at this number. Then, we asked respondents to list, as specifically as possible, the type and quantity of foods they consume on an average day to satisfy their calcium requirements. Respondents then repeated this for calcium supplements ("List the type and quantity of calcium supplements you consume on an average day").

The last pages of the questionnaire included Moorman's (1996) general nutrition knowledge scale and several demographic questions. We used a median split on the general nutrition knowledge scale to separate the respondents into two groups with lower and higher levels of nutrition knowledge.

Results

Daily Recommended Intake of Calories and Calcium

Respondents were knowledgeable about their daily recommended caloric intake (Mdn = 1600, M = 1614.40), with the mean response not significantly different from the recommended 1600-calorie-per-day test statistic ($t < 1$). Respondents did not have accurate knowledge about their daily recommended intake of calcium (Mdn = 1000, M = 898.44 versus recommended intake = 1200; $t(1, 35) = -3.09$, $p < .01$). The acceptable range for calcium consumption for this group of respondents is 1200–1500 milligrams of calcium daily (www.nof.org/osteoporosis/stats.htm).[1]

[1]The current National Institutes of Health guidelines suggest 1200 milligrams of calcium per day for an adult age 50 or over; however, some osteoporosis organizations recommend 1500 milligrams per day. Physicians routinely recommend 1200–1500 milligrams per day.

How Many Milligrams of Calcium in the Yogurt?

The results demonstrate that consumers have difficulty translating %DV into milligrams. Given the Nutrition Facts panel (Figure 1), respondents indicated that the yogurt contained an average of 309.26 milligrams of calcium (Mdn = 300 milligrams; for percentile distribution of values, see Table 1). This represents a significant difference from the test statistic of 450 ($t(1, 30) = -2.89$, $p < .01$). Two respondents correctly stated 450 milligrams and knew that 45% corresponds to 1000 milligrams recommended.

Respondents demonstrated the difficulty in performing this task when asked to describe how they arrived at their answer. The open-ended responses were categorized into strategies used for calculating the number of milligrams in the yogurt container. Seven respondents intentionally left this blank. All remaining respondents used one of four strategies. A strategy, which we call "45," was used by 24% of the respondents. In this strategy, respondents simply noted that there was 45% DV in the container of yogurt and co-opted this number (e.g., "make the 45% into a whole number out of 100"). A strategy used by 8% of respondents was to try to compare the calcium with one of the nutrients that lists milligrams on the label. For example, some respondents noticed that the yogurt contains 135 milligrams sodium and tried, however randomly, to extrapolate from there. Nineteen percent of respondents simply guessed without attempting to use any additional product label information, and the remaining 30% attempted to compute and answer on the basis of available information (e.g., "calcium is 45% of the 2000 calorie diet; therefore, 45% of 2000 = 900).

How Much Calcium Do Respondents Consume?

The results of the open-ended measure that asked respondents to list their calcium consumption indicate that these at-risk respondents are underconsuming calcium. The recommended calcium intake for adults age 50 and over is a minimum of 1200 milligrams per day (range: 1200–1500 milligrams). To analyze the open-ended list of foods, each listed item was first converted into milligrams by multiplying the reported number of servings by the average milligrams for that food type, as indicated on the "Calcium Checklist" provided by Virginia Cooperative Extension (a joint program of Virginia Tech, Virginia State University, the U.S. Department of Agriculture, and state and local governments; see Hertzler 2000). For calcium supplements, we researched each brand listed and multiplied the dose by the number of tablets consumed per day.

The results reveal an average consumption of 1067.05 calcium milligrams per day for the combined total of food and calcium supplements and an average of 628.24 milligrams for food only. Total food and supplement consumption is significantly less than the minimum recommended intake of 1200 milligrams ($t(1, 36) = -1.753$, $p < .05$), as is consumption of calcium through food only ($t(1, 36) = -10.41$, $p < .001$). Alarmingly, 24% of respondents consume fewer than 700 milligrams of calcium per day, and an additional 16% consume between 700 and 900 milligrams calcium per day. This level of calcium consumption places them in the "danger zone" and "alert zone" for adult intake, respectively (Hertzler 2000 [this information was contained in the original 2000 report and is not available in the revised 2003 version]).

Moderating Factors: Knowledge and Osteoporosis

There were no significant differences between respondents with lower nutrition knowledge and those with higher nutrition knowledge on any of the dependent measures ($Fs < 1$). However, we found some differences when we compared respondents who reported being diagnosed with osteoporosis with those who did not report this diagnosis. Notably, respondents with osteoporosis consumed an equivalent amount of calcium through food as those without osteoporosis (M = 549.09 versus M = 644.16; $F < 1$) but significantly more calcium through supplements (M = 709.09 versus M = 287.56; $F(1, 27) = 5.46$, $p < .05$). Finally, respondents with osteoporosis stated their daily required calcium level to be marginally higher (M = 1090.91) than

Table 1. Study 1: Older Consumers' Interpretation of %DV and Self-Reported Calcium Consumption

	Minimum	Maximum	M	Percentile (25, 50, 75)	High Versus Low Knowledge	Diagnosed with Osteoporosis
Conversion and Interpretation of %DV						
How many milligrams calcium in container of yogurt?	10	900	309.26**	45, 300, 500	$p > .10$	$F < 1$
Self-Reported Calcium Consumption						
Milligrams (food and supplement) consumed daily	320	1890	1067.05*	683, 965, 1467.5	$F < 1$	$p < .10$
Milligrams (food only) consumed daily	0	1465	628.24***	375, 600, 900	$F < 1$	$F < 1$

*$p < .05$.
**$p < .01$.
***$p < .001$.

those without osteoporosis (M = 732; $F(1, 27) = 3.47$, $p < .10$; for information about these moderating factors, see Table 1).

Discussion

These results illustrate the difficulties that at-risk consumers with higher-than-average calcium requirements face in understanding the calcium information on a Nutrition Facts panel and in making appropriate calcium-related choices. These at-risk consumers cannot correctly interpret the %DV calcium on the Nutrition Facts panel to meet their calcium requirements. Consistent with the National Osteoporosis Foundation's claims, respondents' self-reports of calcium consumption indicate that they are underconsuming calcium (see http://www.nof.org/osteoporosis/stats.htm).

At-risk consumers also consume 37% of their daily calcium in the form of supplements. This practice is contrary to the advice of nutritional experts, who agree that it is preferable to consume calcium from food rather than from supplemental pills to maximize calcium absorption (Ivry 2003). To explore the reasons consumers use calcium supplements, we asked these at-risk respondents to indicate their level of agreement (seven-point scales) with a series of questions beginning with "I consume calcium supplements because...." The highest-rated reason for using calcium supplements was "because that way I know exactly how much calcium I am getting" (M = 5.73). The second highest-rated reason was "because a physician recommended I do so" (M = 5.38). Thus, at-risk consumers were choosing calcium supplements primarily because (1) they provided a known and certain amount of calcium and (2) their physicians were recommending supplements. In Study 2, we explore these issues further by investigating physicians' calcium recommendations to their patients and physicians' own understanding of the %DV calcium on the Nutrition Facts panel.

Study 2

Method

A total of 20 physicians participated in Study 2, 7 of whom specialized in obstetrics/gynecology and 13 of whom were general practitioners. The doctors were in practice an average of 16 years (range: 2–40). Half were men, and half were women. The survey booklet included a cover page that identified the researchers and provided a brief description of the study. Physicians were asked two basic categories of questions: (1) How do they provide calcium advice to their patients? and (2) How many milligrams of calcium are in the yogurt container represented by the Nutritional Facts panel? (see Figure 1).

Results

How Do Physicians Advise Patients?

Of the physicians, 50% indicated that they offer advice about calcium consumption routinely with every visit and/or with every annual exam, and the remaining 50% offer such advice when a patient is in a risk category. When asked to list their calcium recommendations per gender and age category, all physicians advised their patients consistently within the range established by the FDA (average milligrams per day for men ages 19–50: M = 1028.57; for men age 51 and over: M = 1028.57; for women ages 19–50: M = 1100; for women age 51 and over: M = 1347.37; for a pregnant patient: M = 1317.65; for a lactating patient: M = 1313.33). As we expected, all physicians dispensed calcium advice in milligrams per day, leaving the translation to %DV for their patients.

When asked to rate their confidence regarding their calcium recommendations, physicians were fairly confident overall (M = 5.50 on a seven-point scale [1 = "not at all confident," 7 = "extremely confident"]; only one physician indicated a value below the midpoint). However, they were significantly less confident that their patients could make adequate calcium choices on their own (M = 3.80 on a seven-point scale [1 = "not at all confident," 7 = "extremely confident"]; 3.80 versus 5.50; $t(1, 19) = 5.23$, $p < .001$). Yet despite their lack of confidence in their patients' ability to consume an adequate amount of calcium, 56% of the physicians never provided a nutritional information sheet containing food and calcium content to their patients (M = 2.95 [1 = "never," 7 = "always"]). All the physicians (100%) reported that they suggest that their patients satisfy their calcium requirements through both food and calcium supplements.

How Many Milligrams of Calcium in the Yogurt?

Even these expert respondents could not easily translate %DV into milligrams. Physicians indicated that an average of 375.59 milligrams (range: 45–540) of calcium was represented by the Nutrition Facts panel in Figure 1. Again, this confirms our hypothesis and represents a significant difference from the test value of 450 ($t(1, 16) = –2.08$, $p < .05$).

Of the 20 physicians, 6 (30%) correctly calculated 450 milligrams on the basis of 45% of 1000 milligrams of recommended daily intake, and 3 of the physicians intentionally left this question blank, indicating that this calculation was indeterminable given the information provided. Responses of the 11 remaining physicians who calculated incorrectly were as follows:

- 45: "I have no idea. I made it up";
- 75: "160 × .45";
- 225: "RDA [recommended daily allowance] ~ 500 milligrams or less";
- 300: "I think it is 300. I think the RDA is around 600, which is why lady vitamins aren't enough";
- 300: "Knowledge of calcium in food";
- 360: "45% of 800 milligrams RDA" (2 physicians indicated this);
- 400: "This is 45% of a person's average dietary intake, but without knowing what an 'average' person weighs or their age or sex"; and
- 540: "1200 milligrams/day (RDA) × .45" (3 physicians indicated this).

Although these experts experienced the same difficulties as the respondents in Study 1 in calculating the amount of calcium in the yogurt, the majority (70%) tried to use their knowledge of the RDA as a guide. Only a minority (30%) demonstrated the strategies that the respondents used in the pilot study and in Study 1, such as trying to calculate the amount of calcium on the basis of 160 calories per container or simply saying it is indeterminate.

In summary, although these experts performed better than both the average and the at-risk respondents in the previous studies, only 30% of physicians were able to interpret the %DV calcium on the Nutrition Facts panel correctly. All physicians indicated that they offered calcium recommendations to patients in milligrams, despite their own inability to transform %DV calcium to milligrams and their lack of confidence that patients could follow their calcium recommendations.

In Studies 1 and 2, we provide initial evidence that a gap may exist between a person's dietary goal (e.g., to consume at least 1200 milligrams calcium per day) and his or her ability to achieve that goal given limited information. We conclude with a study that addresses whether a consumer with additional, easy-to-use information (i.e., the ability to transform %DV to milligrams) can achieve these goals. Study 3 investigates whether consumers who know their recommended calcium intake goal and understand the transformation from %DV to milligrams will consume sufficient calcium. If consumers know their quantitative goal for calcium consumption and can perform the transformation from %DV, will they consume sufficient calcium? This research includes another group of respondents with higher-than-average calcium requirements, namely, pregnant and breast-feeding women. The recommended calcium intake for pregnant and nursing women is a minimum of 1200 milligrams per day, with the optimal intake between 1200 and 1500 milligrams per day. In Study 3, we demonstrate that a simple instructional sheet that teaches consumers how to interpret the %DV calcium from the Nutrition Facts panel can increase calcium consumption.

Study 3

Method

Pregnant or breast-feeding women were recruited to participate in a study in exchange for a $15 Barnes & Noble gift certificate and the chance to win $300 in a lottery drawing. In total, 41 women ranging in age from 20 to 41 years (mean age = 32 years) agreed to participate. Twenty-five percent of the women were breast-feeding, and the others were pregnant.

Participants were given a two-part survey. Part 1 was identical for all participants; they were queried on their knowledge about their calcium requirements and asked to list the type and quantity of foods and supplements they consume on an average day. Part 2 of the survey required participants to keep a calcium diary for three consecutive days. Women were instructed to write down everything they consumed (brand name and quantity included), even if they were not sure whether the food or supplement item contained calcium. All open-ended consumption measures were coded using the procedure we described in Study 1. Half of the participants were randomly assigned to a condition in which, before they completed their calcium diaries, we provided them with a one-page fact sheet that described how to interpret the Nutrition Facts panel using an example of a whole milk container ("intervention" condition). This fact sheet explained how to convert %DV to milligrams (see Figure 2). After completing the diary for the third day, respondents noted (on seven-point scales) how confident they were in their ability to understand %DV on a food label.

Figure 2. Calcium Fact Sheet

Please read the following information. It describes how to understand the %DV calcium on a food label. The Nutrition Label used below is from a container of Whole Milk.

Nutrition Facts	
Service Size 1 cup (240 mL)	
Servings Per Container 1	
Amount Per Serving	
Calories 150	Calories from Fat 70
	%DV*
Total Fat 8g	12%
Saturated Fat 5 g	25%
Cholesterol 35 mg	11%
Sodium 130 mg	5%
Total Carbohydrate 12g	4%
Fiber 0g	0%
Sugars 12g	
Protein 8g	16%
Vitamin A 6% • Vitamin C 2%	
Calcium 30% • Iron 0% • Vitamin D 25%	
*Percent Daily Values (DV) are based on a 2,000 calorie diet.	

The Nutrition Facts Panel lists the amount of calcium in the serving size listed on the label. Add a "0" to the Percent Daily Value to convert to milligrams. For example, 30% DV equals 300 mg of calcium.

If your OB/GYN recommended you consume 1500 mg calcium per day, you would need 150% DV.

Results

Daily Recommended Intake of Calcium

Participants were knowledgeable about their daily calcium requirements. Respondents mean and median responses for their daily recommended intake of calcium during pregnancy or while they were lactating (Mdn = 1200, M = 1104.04 versus 1200; $t < 1$) were not significantly different from the target values. A reason these women may have been more knowledgeable than the respondents in Study 1 is that one-third of the women in Study 3 reported that their obstetricians told them to consume 1200 milligrams calcium, and an additional 20% reported that they read it on their own in a pregnancy guide (e.g., *What to Expect When You're Expecting*). In general, all respondents believed that they consumed the recommended daily intake of calcium every day, as indicated by a mean score of 5.15 on a seven-point scale.

Preintervention: How Much Calcium Do Respondents Consume?

Before administration of the experimental intervention, knowledge of recommended calcium consumption did not translate into adequate actual calcium consumption. As we expected, respondents in both conditions were underconsuming calcium, as indicated by their self-reported calcium consumption on a typical day. As Table 2 shows, average calcium consumption (Mdn = 950, M = 1007.68) is significantly lower than the recommended minimum level of 1200 milligrams per day ($t = 2.94$, $p < .01$). There was no difference in the self-reported typical consumption across the intervention and control conditions ($F < 1$; for respondents' self-reported calcium consumption, see Table 2).

Postintervention: Does the Intervention Increase Calcium Intake?

Actual calcium consumption increased for the intervention condition after a one-page calcium fact sheet was introduced. Women who were educated about how to interpret %DV calcium consumed significantly more average daily calcium (M = 1429.78) than women who were not given the fact sheet (M = 988.24; $F(1, 40) = 16.30$, $p < .001$). In addition, women in the intervention condition consumed significantly more calcium postintervention (M = 1429.78) than preintervention (M = 1010.25; $t = 3.48$, $p < .001$). Consumption of calcium did not increase for women who were not in the intervention condition (M = 1005.24 versus M = 988.24; $t < 1$). That calcium consumption did not increase despite specific instructions to keep a calcium diary gives us confidence that women in both conditions accurately reported their calcium consumption. An examination of the increase in calcium consumption for women in the intervention condition reveals that they were consuming larger quantities of the same products they were consuming preintervention (e.g., two glasses of milk instead of one). These between-subjects (intervention versus control) and within-subjects (typical consumption versus diary consumption) patterns hold for each individual day as well (for DVs, see Table 2). As we anticipated, respondents in the intervention condition were significantly more confident in their ability to understand the calcium information on a food label (M = 5.30) than those who were not in the intervention condition (M = 4.00; $F(1, 40) = 3.71$, $p < .05$).

Follow-Up Study

We conducted a follow-up study with a different sample of respondents to determine whether the increase in calcium consumption in the intervention condition was due to the educational benefit of the calcium fact sheet teaching respondents to convert %DV to milligrams or to the mere salience of calcium in the intervention condition. Forty-four respondents ages 23–35 were divided into three equivalent groups: an intervention group, which received the same calcium fact sheet as in Study 3; a salience group, in which the importance of calcium was emphasized but respondents were not taught the conversion algorithm; and a control group, which received no treatment. After exposure to the treatment information, all respondents viewed three Nutrition Facts panels for energy bars that were purportedly on the market; these were simply labeled "Brand A," "Brand B," and "Brand C." The three labels were deliberately designed to represent energy bars with varying calcium content and some variation in fat and calories with otherwise equivalent nutritional content. For example, Brand A was lowest in calcium content (35%) but also lowest in calories (200) and calories from fat (50), Brand B was highest in calcium content (55%) but had more calories (225) and fat (60), and Brand C was dominated by Brand B (45% calcium, 225 calories, 60 calories from fat).

Without any other qualifying instructions, respondents were simply asked to select their most preferred brand on the basis of the Nutrition Facts panels presented. The majority of respondents in the calcium intervention condition chose the brand that was highest in calcium content (Brand B); only three respondents in the calcium salience condition and no respondents in the control condition chose this product ($F(1, 42) = 5.93$, $p < .01$; contrasts revealed no significant differences between the salience and the control conditions). Almost all respondents in the salience (82%) and control (100%) conditions chose Brand A as their most preferred. Because respondents in the salience condition made

Table 2. Study 3: Pregnant and Lactating Women's Self-Reported Calcium Consumption

				Percentile		
	M	Minimum	Maximum	25th	Mdn	75th
Recommended daily intake (before pregnancy)	885.22	10	1600	500	1000	1200
Recommended daily intake (current)	1104.04	30	2200	1000	1200	1500
Typical calcium consumption	1007.68	0	1950	750	950	1280

	No Intervention (a)		Intervention (b)		Significance
	M	Mdn	M	Mdn	(a Versus b)
Typical calcium consumption	1005.24	900.00	1010.25	975.00	$F < 1$
Diary: averaged over three days	988.24	900.00	1429.78	1476.67	$p < .001$
Diary: Day 1	958.52	967.00	1611.65	1537.50	$p < .001$
Diary: Day 2	1082.90	1030.00	1275.10	1275.00	$p < .10$
Diary: Day 3	923.29	850.00	1402.60	1410.00	$p < .01$
n	21		20		

similar product choices to respondents in the control condition, we can rule out the salience of calcium as an alternative explanation for respondents' increase in calcium consumption.

General Discussion

Together, the results of the experiments indicate that consumers cannot interpret %DV on the Nutrition Facts panel to determine their calcium intake from a food product, and they cannot transform %DV to milligrams, a calculation that is required to determine expert-recommended calcium consumption. Average consumers (those whose nutritional needs represent 100% DV), at-risk consumers age 55 and over, and physicians who dispense calcium recommendations were unable to use the %DV on the Nutrition Facts panel to determine calcium content accurately. These findings reveal that consumers are unlikely to discern and spontaneously use calcium information from the Nutrition Facts panel to assist them in consuming an adequate amount of calcium. Thus, it appears that despite the changes in food labeling brought about by the NLEA, because of the nature of expert recommendations for calcium intake, consumers are experiencing difficulty in using the %DV nutritional information available on the Nutrition Facts panel.

The results of Study 2 add a critical insight into our understanding of the dynamics of calcium consumption. Consistent with information from the FDA, the results reveal that physicians are dispensing calcium recommendations in milligrams, forcing consumers who wish to consume adequate calcium to transform %DV from the Nutrition Facts panel on food labels into milligrams. Study 3 demonstrates that providing people with a simple educational tool—a one-page fact sheet that teaches the transformation—facilitates a meaningful consumption change. Thus, explicitly providing such easy-to-use information is a feasible way to increase healthful eating behaviors and reduce the risk of long-term consequences, such as osteoporosis. Alternatively, a public service campaign targeting physicians could make doctors aware that 100% DV is equivalent to 1000 milligrams of calcium. Physicians could then advise patients whose calcium needs are average to consume 100% DV of calcium, and they could advise at-risk patients with higher-than-average calcium requirements to consume 120% DV to 150% DV calcium. This strategy is consistent with the FDA's Center for Food Safety and Applied Nutrition guidelines on how to understand the Nutrition Facts panel, in which it is suggested that the daily target for teenage girls, for example, should be 130% DV (http://www.cfsan.fda.gov/~dms/foodlab.html). Such physician and nutrition expert recommendations would facilitate patients' understanding of calcium and presumably increase calcium consumption.

A review of theoretical research in consumer behavior indicates that though consumer behavior is dynamic, most research focuses on one-shot events (Johar, Maheshwaran, and Peracchio 2006). This review challenges consumer researchers to examine dynamic environments, for example, consumers' nutrition decisions. Consumers form, shape, and reshape their nutrition-related thoughts and decisions in response to numerous types of input, such as advice from doctors, articles they read in newspapers or magazines, advice from friends, and information from food labels. Examining how these multiple inputs affect consumer information processing is an important direction for future nutrition research.

Future nutrition research should also move in the direction of studying how consumers update attitudes and decisions. New nutrition information may be consistent or inconsistent with other available nutrition information. Studying the conditions under which nutritional attitudes are open or resistant to change is an important area of research. Although the literature on belief updating suggests that person and self beliefs are persistent under certain conditions (Fabrigar and Petty 1999; Lord and Lepper 1999), further research should examine how and when nutrition thoughts and beliefs may or may not be subject to change.

At the same time, the preceding insights draw attention to some challenges and limitations that arise in our work and in the study of such issues. For example, achieving a nutritional objective, such as eating a balanced diet, is a complex enterprise on a day-to-day basis. Consumers face many obstacles in attaining a daily nutrition goal. In addition to the difficulty of transforming milligram amounts to %DV, consumers must estimate portion size and determine the nutritional content of unlabeled foods, foods consumed in complex mixtures, and foods eaten at restaurants. If consumers are concerned about their consumption of multiple nutrients, this task can become overwhelming. Understanding how consumers self-monitor to achieve their nutrition goals and work to balance nutrition across their day presents important areas for future investigation.

Another challenge is that most consumers spend little time, if any, reading the Nutrition Facts panel on food products. The average consumer spends only seven seconds making grocery purchase decisions in the supermarket, an automatic process that would seem to allow only enough time to read the name and look at the pictures on the label (Hoyer 1984). Thus, consumers must be motivated, through personal health goals or physician recommendations, to examine the Nutrition Facts panel on food products. Nutrition research into these issues would benefit from a thoughtful examination of how conscious and cognitive processes versus automatic and nonconscious processes operate (Johar, Maheshwaran, and Peracchio 2006). Further research needs to examine how consumers activate and combine both conscious and automatic processing in the nutrition arena.

Still another challenge that must be grappled with is educating consumers about the nutritional efficacy of calcium supplements versus food. Although there is evidence that calcium consumed through food is better absorbed by the body, many consumers continue to believe that supplements offer superior nutritional efficacy (Ivry 2003). Thus, research is needed to identify methods that will alleviate these sorts of challenges.

Finally, the notion that consumers have difficulty using the information on the Nutrition Facts panel suggests several fruitful avenues for further research. How do people reconcile the potential conflicts that arise when a Nutrition Facts panel offers a seemingly high level of %DV calcium while also listing a perceived high level of %DV fat or cho-

lesterol? Furthermore, although we observed that average and at-risk consumers experienced difficulty in using the calcium information from the Nutrition Facts panel, are there exceptions in which certain groups of consumers, perhaps those with high nutritional knowledge or those with certain measurable individual difference traits, are able to perform these calcium transformations? How might the knowledge of these informed consumers be conveyed (e.g., word of mouth, viral marketing) to a broader group of consumers? We hope that further research will pursue these and other questions.

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