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Communicating nutrition information at the point of purchase: An eye-tracking study of shoppers at two grocery stores in the United States

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Abstract

Providing nutrition information at the point of purchase is one approach that can be used to help consumers adopt and maintain a healthy diet. Previous research has examined consumer self-reported notice and use of the information as well as how the design of the information affects its attention and use in a laboratory environment using eye-tracking methodology. This study advances the literature by applying eye-tracking methodology to explore consumer visual and choice behavior in a real shopping environment, and by recognizing that nutrition information competes with other visual stimuli in the store and consumers are vulnerable to a “limited attention span” for nutrition information in a shopping setting. Data came from a cross-sectional survey conducted in two grocery stores in the United States in July 2014 with a convenience sample of 60 grocery shoppers while they were selecting and buying items from one of three product categories (ready-to-eat cereal, snacks, and soup). The study finds that point-of-purchase nutrition information faced strong competition for participants’ attention from other visual elements in a real shopping environment and the attention is dominated by nonnutrition elements, particularly brand/product name, product imagery, and product pricing. Nutrition-related information, on the other hand, received much less attention, with claims and front-of-package nutrition symbols seen by more participants than the Nutrition Facts label. The study suggests that to more effectively enable nutrition information to “catch the eyes” of shoppers at the point of purchase, increasing consumer exposure to the information and enhancing shopper education may merit further investigation.

KEYWORDS

dietary choices, eye tracking, nutrition information, point of purchase

1 | INTRODUCTION

With the high prevalence of obesity and diet-related chronic diseases (e.g., cardiovascular disease, diabetes) in the United States and in many parts of the world, helping consumers adopt and maintain a healthy diet is an important yet challenging public health issue. Many intervention strategies at the environmental level are available, implemented, or both. One such strategy is to provide nutrition

information at the point of purchase or on product packages so interested consumers can use the information to make informed choices. In the United States, most packaged food products are required by the Nutrition Labeling and Education Act (NLEA) of 1990 to declare the amounts of nutrients, e.g., calories and sodium, on the standardized Nutrition Facts label. In addition, many food manufacturers and retailers voluntarily put on product packages or in the store nutrition statements, e.g., Low Fat, or symbols that highlight nutritional

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characteristics of their products (Wartella, Lichtenstein, & Boon, 2010). These statements, according to the NLEA, must be truthful, not misleading, and meet certain requirements (FDA, 2016a).

Attention to (or, notice of) information is one of the precursors as well as hurdles (e.g., exposure, attention, comprehension, retention) for nutrition information or similar information disclosure such as warnings to achieve its desired behavioral effects (Jacoby, Chestnut, & Silberman, 1977; Mazis & Staelin, 1982; McGuire, 1976) No information can affect behavior unless, among other things, it is seen by its intended audience. Nevertheless, consumers face massive amounts of information in the marketplace and therefore attend to only a selective set of information. It is important for communicators to understand the information environment faced by the consumers to allow nutrition information, particularly information mandated by the NLEA, to have its intended effects (Jacoby, Chestnut, & Silberman, 1977; Mazis & Staelin, 1982).

The current study explored eye-tracking (ET) and related data from 60 US grocery shoppers to enrich understanding of consumer notice and use of nutrition information during grocery shopping. The ET technique is a behavioral research methodology frequently employed in studies of perception, reasoning, and decision-making (Radach, Hyona, & Deubel, 2003; Rayner, 1998). At the point of purchase, ET records shoppers' eye movements as indicators of information acquisition and subconscious information-processing behavior, such as the timing, location, and duration of eyes' attention on a piece of information, and informs what information shoppers notice. Although notice of a given piece of information does not guarantee understanding or use of the information, notice is considered a precursor of understanding and use of information (Becker, Bello, & Sundar, 2015).

By examining the totality of visual behaviors that comprises "shopping" in a particular section of products, ET can help (1) determine which attributes are viewed or attracted more attention during an authentic shopping experience, (2) inform the full visual shopping experience rather than just the behaviors that are later recalled by the shopper, and (3) verify that the self-reported information provided by the participant is consistent with the recorded visual behavior data. ET thus has the capacity to provide better insight into how shoppers make their product selections, particularly in the real world, than self-reported behavioral and cognitive data or data collected in a controlled environment.

We are not aware of any published ET studies that explored attention competition between nutrition and other visual stimuli at point of purchase, focused on American consumers, and were conducted in the store while shoppers were making purchase decisions. Most of the existing research on prevalence and reasons of use of nutrition information comes from self-reports by consumers or shoppers in quantitative (e.g., surveys) or qualitative (e.g., focus groups) studies. Yet, self-reports are difficult to verify and self-reports are usually not collected during food shopping. More importantly, to better understand use of nutrition information at the point of purchase, we must examine what consumers do in an environment where nutrition information competes with a

plethora of other visual stimuli for shoppers' interest and attention. Studies in various countries have used the ET methodology to examine consumer notice and use of nutrition information (Bialkova & van Trijp, 2011; Bix, Sundar, & Bello, 2015; Enright, Good, & Williams, 2010; Goldberg & Probart, 1999; Graham & Jeffery, 2011; Grebitus & Davis, 2017; Koenigstorfer, Wąsowicz-Kiryto, & Styśko-Kunkowska, 2014; Rawson, Janes, & Jordan, 2008; Vyth, Steenhuis, & Vlot, 2010). The studies were conducted in an experimental context instead of an authentic store and focused on information design (e.g., layout, content, location) instead of how the nutrition information competes with other point-of-purchase information.

2 | METHODS

The study was conducted in July, 2014, with a convenience sample of 30 shoppers at a Food Lion® store in Maryland and 30 shoppers at a Hannaford® store in Massachusetts. Shoppers were intercepted upon entering the store and were asked if they would be willing to participate in a brief research study. Prospective participants, however, were not told what the research was about. Each willing shopper then answered a series of screening questions to determine eligibility—(1) did not wear glasses or contacts or report significant visual impairments, (2) was responsible for at least half of the shopping for the household, (3) was not working for or related to someone who was working for an agency associated with marketing or grocery distribution, manufacture, or sale, (4) was 25–74 years old, (5) had not participated in a market research study in the past 3 months, (6) had shopped at the particular store at least once every 2–3 weeks, and (7) was planning to shop for at least one of three target product categories (cereal, snacks, and soup) and another nontargeted category on a predetermined list of 12 categories.

The recruited sample consisted of 38% male and 62% female shoppers. Most participants (62%) were between the ages of 35 and 54. No other demographic characteristics were collected.

Tobii Pro Glasses were used to collect visual behavior data. An experienced interviewer assisted the participant in putting the Glasses on and confirmed that the fit was comfortable and that visibility was unobstructed. Then the interviewer completed a calibration of the Glasses to ensure that the equipment worked properly.

Each participant was assigned to shop in two different aisles. The first aisle (a nontargeted product category from the list of 12 categories) was a practice session and the second aisle (one of the three randomly selected and targeted categories—cereal, snacks, and soup) was the session for analysis. After completing the first assigned aisle and showing the interviewer her or his selection, the participant was escorted to the second assigned product aisle where the shopping task was completed again. In this session, the participant was permitted to select as many products as desired to mimic the true shopping experience as closely as possible.

The second shopping task was followed by a face-to-face interviewer-administered paper-and-pencil debriefing. The debriefing asked about the products selected in the second shopping task,

TABLE 1 Preselected visual stimuli for eye-tracking data coding and analysis

Visual stimulus	Definition
Signage element	
Promotional Signage	Signs or tags promoting specific products, events, or product attributes
Navigational Signage	Signs that provide aisle content or store directional information
Nutrition Signage	Signs or tags designed to communicate nutrition information (e.g. the <i>Guiding Stars</i> [®] nutrition symbol on shelf tags or on packages)
Pricing Signage	Price tags and sale information
Packaging element	
Product/Brand	Text, symbols, and characters identifying the brand, product, form, and type
Product Imagery	Pictures, graphics, and food shots of the product itself
Nutrition Label	The Nutrition Facts label and the ingredient list on a product's side or back panel (the label is required for most prepackaged foods by the Nutrition Labeling and Education Act of 1990)
Nutrition Symbol	The Facts Up Front [®] icon some food manufacturers voluntarily provided on the front of some of their products (GMA, 2016)

whether the purchase was planned or unplanned, reasons of purchase (routine purchase, new product, price, promotion, need), any items considered but not purchased and why, factors influencing product selection, viewing of and opinions toward the Nutrition Facts label and front-of-package (FOP) nutrition information, and occasions when the label or FOP information was viewed or not (i.e., when buying a new product versus when buying a routine product). Upon completion of the debriefing, each participant was compensated with a \$50.00 store gift card and was thanked and dismissed. The U.S. Food and Drug Administration's Institutional Review Board approved the protocol.

Two measures were taken to make the shopping task as realistic as possible. First, participants were told to "shop (insert product category) as you normally would" and to "shop for a product that you would actually buy for yourself or your household, assuming you were spending your own money." Second, the interviewer remained in another area of the store, away from the participant to minimize any pressure to shop quickly or purchase particular products. Videos showed no signs that participants hastened their shopping or that they attracted any attention from other shoppers.

Analyzed portions of the second session included browsing or considering items of purchase, picking up items for close examination, selecting an item (putting an item in a shopping basket or cart) and later putting it back on the shelf, and selecting an item that was ultimately chosen for purchase. Periods of quick visual scanning and navigation (e.g., walking up and down the aisle while not viewing products) were not analyzed.

A team of analysts reviewed video from each participant's session frame-by-frame and coded instances of visual attention to preselected visual stimuli (i.e., elements of interest) that could be present in an aisle or on packages (Table 1). Signage elements were defined as any in-aisle signs or stickers on or near the shelf that were not part of a package. Packaging elements were defined as visual components of the products packages. All coded eye-tracking data were reviewed by a separate analyst to check for errors and resolve

conflicts. Analysis of elements focused on those that could be reliably identified from the video and organized by category. Elements that were ambiguous or did not fit the common categories listed in Table 1 were not examined.

An instance of visual "attention" was recorded each time the eye data position indicator was directly overlaid on one of the elements of interest in a video frame. A participant was considered to have "viewed" a given element if the eye data landed upon the element one or more times over the course of the shopping task. The total length of time, in seconds, that a participant's point-of-gaze in the eye tracking video falls upon a given element, including revisits of a given element, was defined as the duration of viewing that element. First fixation was determined by the point when the first fixation that a participant's point-of-gaze falls upon a given element. It is important to note that all eye-tracking data includes some degree of error resulting from inconsistency in calibration as well as the physiological limitation of specifying the exact location of foveal vision (estimated at 1–2 degrees of the visual angle).

We report medians rather than means of duration (in seconds) because, for most measures of time length, there were wide distributions and many outliers. When sample sizes and distributions allowed, we applied Chi-square homogeneity tests to frequency data and Kruskal–Wallis one-way Analysis of Variance tests to continuous data such as durations. None of the packaging elements, except the Nutrition Facts label, appeared on all product packages. Therefore, applicable statistical tests focused on the Nutrition Facts label only.

3 | RESULTS

The number of participants who visited each of the three product aisles was about evenly distributed: 19 visited the cereal aisle, 21 snacks, and 20 soup, respectively. They spent a median of 1.4 minutes shopping in the targeted grocery aisles. Neither food category nor store location

differences were statistically significant ($p = 0.38$ for food category and $p = 0.91$ for location, respectively). Most participants selected one or two products in a given product category. Shopping time, however, did not appear to be correlated with the number of products selected. Of the 120 products selected, 56% were planned.

Participants were asked to identify one or more reasons from a list of five reasons that typically drive the selections they made. Across all product categories, the most frequently identified reason was "I routinely buy this item" (53%). Other reasons were identified less often—"I realized I needed it when I saw it" (28%), "on sale" (15%), "it's a good price" (11%), and "new product I want to try" (9%).

Participants were asked which one or more of 10 listed approaches they used to locate their selections. Among these approaches, brand name was selected most often (28% of all selections). Other more frequently selected approaches included looking at the price or "On sale" sign (24%) and familiarity with the physical location of a product (23%). None of the remaining approaches received larger than a 15% share each. Notably, nutrition contents on the package only constituted 6% of the self-reported approaches, and the use of this approach did not appear to be related to whether a participant bought a product for the first time or not. Participants also were probed about which one of the 10 approaches was most influential on their product selections. Brand name again accounted for the largest share (24%).

Participants were asked if they had looked at the "nutritional contents label on any of the products you considered buying today in the soup/cereal/snack aisle." Only 25% of the participants answered affirmatively. Those who reported having ever looked at the label also were asked what information on the label they typically looked at. Among the 11 items shown to participants, calories, sodium, and sugars received most interest (approximately 16% each), total fat (12%) next, and all other nutrients (e.g., saturated fat, fiber, and protein) received less interest. More participants identified calories, saturated fat, sugars, and sodium as the most important items on the label when selecting a product.

Thirty-six of the 60 participants said the information on the Nutrition Facts label was "extremely" or "very" important (on a 5-point scale from "extremely" important to "not at all important") when shopping the target product categories. Among these 36 participants, however, only 12 of them revealed that they looked at the label when selecting products in this study. Seventy-two percent of all participants felt the importance of the label was different when buying a brand new versus when buying a routine product, mainly because they wanted to know nutritional contents of a new product or how the new and the routine products compare nutritionally.

The study also asked participants about nutrition information on the front of product packages. Forty-two percent of all participants (25) said that the information was "extremely" or "very" important when shopping the target product categories. Among the 25 participants, 13 also felt that the Nutrition Facts label was "extremely" or "very" important, and only 5 said they looked at the Nutrition Facts label when selecting products in this study. Sixty-two percent of participants felt that the front-package information had different degrees of importance when buying a brand new versus when buying a routine product. When asked an open-ended question regarding the reason for differing degrees of information importance, sensory appeals (e.g., taste and look) and nutritional characteristics (e.g., amount of calories and ingredients) of new products were mentioned most often.

Table 2 includes viewing statistics for visual elements of the shelf. All but one participant viewed product/brand, product imagery, or pricing at least once. In contrast, about a third of the participants viewed any of the nutrition information elements at least once. The largest share of viewing duration was spent on two packaging elements, *Product/Brand* information (text, symbols, and characters identifying the brand, product, form, and type) and *Product Imagery* (pictures, graphics, and food shots of the product itself) (Figure 1). Nutrition information, including the Nutrition Facts label, the ingredient list, claims on package fronts, the Facts Up Front[®] symbol, and nutrition signage (in the store or on shelves) accounted for only 8% of the viewing duration.

TABLE 2 Viewing statistics for on-shelf visual elements

Visual element	Share of participants who viewed an element at least once (%)	Median time spent viewing an element (interquartile range) (s)	Share of total viewing time (duration) spent on an element ^a (%)
Nonnutrition			
Product/brand	100	7.67 (3.19–16.08)	45
Imagery	98	4.74 (2.03–9.68)	27
Pricing	100	3.94 (2.06–6.17)	18
Promotion	48	0.45 (0.24–0.86)	2
Navigation	28	0.55 (0.21–1.20)	1
Nutrition			
Claims	35	0.55 (0.27–1.48)	1
Signage	38	0.24 (0.09–.045)	1
Nutrition Facts label	28	0.69 (0.34–3.16)	5
Facts Up Front [®]	25	0.28 (0.22–0.72)	1

^aThe numbers in the column do not sum to 100 due to rounding.

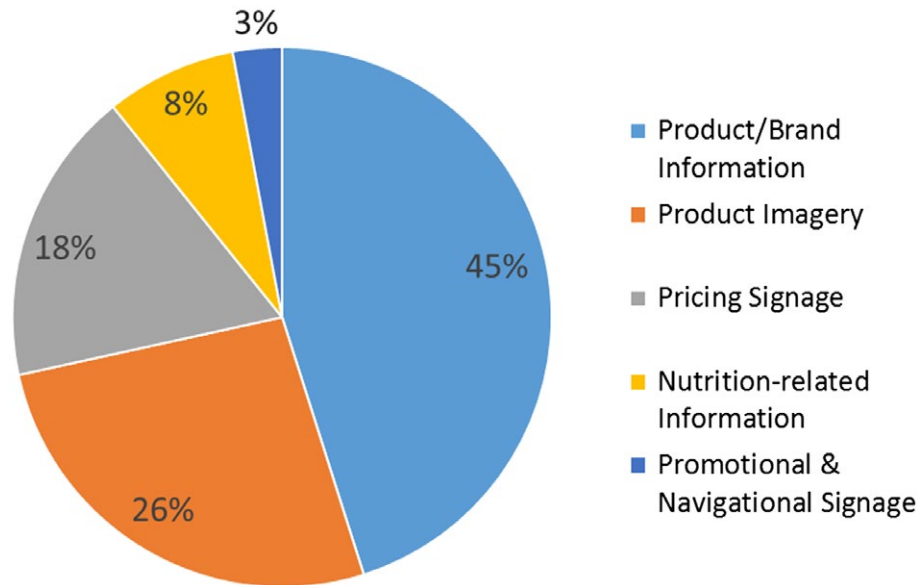


FIGURE 1 Percentage of viewing duration allocated to visual elements

Twenty-eight percent of participants viewed the Nutrition Facts label (Table 2). A larger proportion of participants who visited the cereal aisle did so compared to others who visited the soup aisle or the snack aisle. Among the 25% of participants who said they had viewed “nutritional contents label” on any of the products they considered buying, only 4 of them viewed the Nutrition Facts label. Others among the 25% of participants looked at claims or nutrition signage, and 4 did not look at any nutrition information at all. Furthermore, only 3 out of the 11 participants who reported selecting a new product looked at the label, regardless of whether they said the importance of the label differed when selecting a new versus a routine product. Across all three product categories, the time spent on the Nutrition Facts label was less than 0.7 seconds (Table 2), with 5 participants spending more than 3 seconds viewing it. Among all participants, only two looked at the ingredient list.

Nutrition-related information on the front of the package included the Facts Up Front[®] symbol and nutrition-related claims. More participants viewed claims or signage than the Facts Up Front[®] or the Nutrition Facts label (Table 2). Among those who looked at any of the three pieces of nutrition information, the first notice of the Facts Up Front[®] and Health Claims occurred earlier than that of the label.

In addition to the nutrition-related information on individual packages, all aisles included nutrition signage. The most common type of nutrition signage in the two stores was the Guiding Stars[®] (GS) symbol. Overall, three in four participants saw the symbol on stand-alone tags or price tags.

To explore attention to nutrition information as it pertained to the actual purchase decision, we examined attention to a particular product that occurred whenever the product appeared to attract some visual interest (e.g., when the product was picked up and then either put back to the shelf or put into the basket). Of the participants, 42% viewed one or more of the Nutrition Facts label, claims, Facts Up Front[®], and nutrition signage immediately before

the selection of a product for purchase. This included 22% of participants who viewed claims, 17% the label, 10% the Facts Up Front[®], and 13% nutrition-related signage (most often, GS[®]).

How was self-reported importance of the Nutrition Facts label related to actual viewing of the label? Most participants (60%) indicated that the label was “extremely important” or “very important” rather than “somewhat,” “slightly,” or “not at all important” during the shopping task. Nevertheless, the incidence of actually viewing the label was not statistically different between the two groups of participants (Figure 2, $\chi^2_1 = 0.22$, $p = 0.64$).

4 | DISCUSSION

This study was aimed at exploring eye-tracking and debriefing data from 60 US grocery shoppers to enrich our understanding of consumer notice and use of nutrition information during grocery shopping. Unlike previous eye-tracking research, this study focused on competition between nutrition information and other visual information at the point of purchase. Nevertheless, this study suggests many of the findings from previous research also apply to nutrition information as a visual element at the point of purchase.

The totality of results illustrates that point-of-purchase nutrition information faces strong competition for attention from other visual elements in a real shopping environment and shoppers' attention is dominated by nonnutrition elements. Participants' visual experience was heavily focused on brand/product name, product imagery, and product pricing. Nutrition-related information, on the other hand, received much less attention, with claims, the Facts Up Front[®] symbol, and the Guiding Stars symbol seen by more participants than the Nutrition Facts label.

The observed visual behavior appears reasonable and a practical necessity because simple heuristics such as brands and prices, rather than detailed information processing, are more likely used in choices

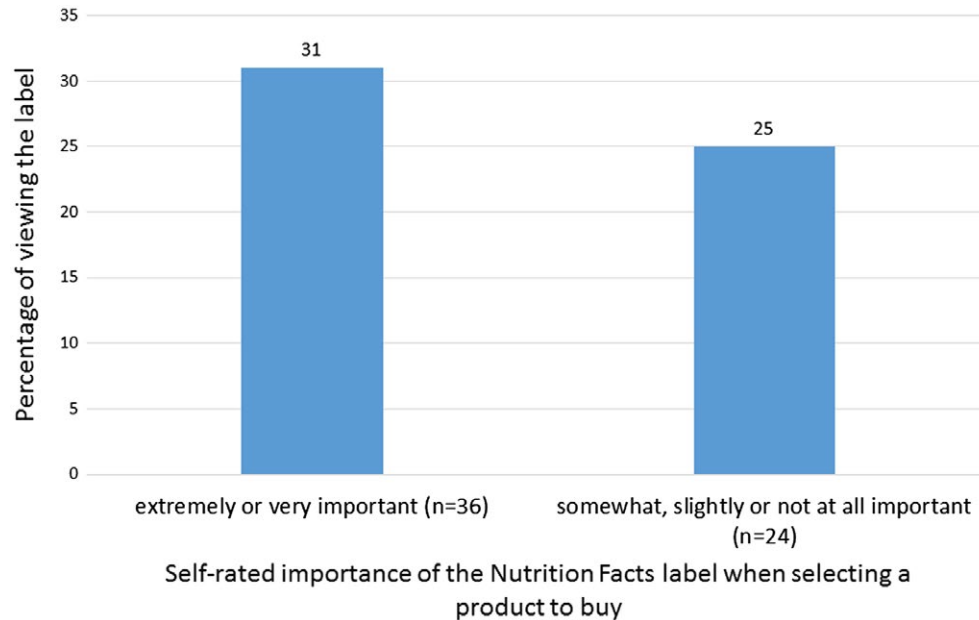


FIGURE 2 Self-rated importance of the Nutrition Facts label when selecting a (cereal/soup/snack) to buy and viewing the label during the shopping task

(Dodds, 2002; Schulte-Mecklenbeck et al., 2013; Vidal, Barreiro, & Gómez, 2013; Zeithaml, 1988) due to lack the time, capacity, or willingness to consider and evaluate the entire array of information and choices (Clement, 2007; Graham & Jeffery, 2011), or both. In selecting products that individually are not important or relevant to a shopper (i.e., low involvement products (Greenwald & Leavitt, 1984), such as a box of cereal, a snack, and a can of soup, the shopper may prefer to shop using simple rules (heuristics) based on clues such as brands, prices, and package design rather than processing all available product information such as nutrition information and other clues in the grocery stores (Leathwood et al., 2007). Additionally, a shopper may not view the nutrition information if s/he is already familiar with a product from experience. The visual behavior also appears to make intuitive sense if one thinks of the shopper experience as a continual process of first identifying a product (viewing the brand/product name), then evaluating its appeal (viewing imagery on the package and, when needed, nutrition information), and finally determining if it falls within budget parameters (viewing pricing).

Furthermore, brands, imageries, and price information are ubiquitous and prominently displayed and conducive to quick processing during product choices. The same could also explain why, in this study, claims and nutrition symbols were noticed more often and earlier than the Nutrition Facts label. The Nutrition Facts label is located on the back or side of a package. Notice of the label cannot occur without a shopper's motivation to look at the information and effort to turn over a package to read the information.

The above discussion appears to be consistent with the concept that attention to different visual elements at the point of purchase is influenced by both memory-based factors, which are voluntary and under the control of the viewer, and attention-based factors, which are involuntary and determine visual salience of the stimuli (Bojko, 2013; Chandon et al., 2006). The shopping decision criteria, which reflect

shoppers' prior familiarity with brands and product characteristics, including nutrition profiles, are the memory-based viewer factors that partly influence which visual elements to focus on more (e.g., brand) or less (e.g., nutrition). At the same time, the design and placement of elements such as brand name and imagery are attention-based factors that also affect the amount of attention toward them. It may not be easy to quantify which of memory-based factors and design-based factors are more influential on attention paid to nutrition information. Yet, it is noted that many food choices are probably made before the point of purchase and preshopping factors, such as budget, habit, personal and family preferences, and convenience, advertising. Therefore, preshopping factors can have an influential role in deciding attention.

The study findings also suggest the existence of a "limited attention span" for nutrition information (Graham & Jeffery, 2011). Many participants overlooked nutrition information entirely, and others paid it only fleeting attention. Most participants ignored the Nutrition Facts label or other nutrition information (claims, symbol, and signage). The time spent viewing any of the nutrition information was much shorter than the time spent viewing product/brand, imagery, or pricing.

There were discrepancies between the eye-tracking data and the debriefing data in terms of the attention on the Nutrition Facts label. Only some of the participants who said they had looked at the label during product selections were found to do so based on the eye-tracking data. Only 3 out of the 11 participants who reported selecting a new product looked at the label, regardless of whether they thought the label's importance was different when buying a new or a familiar product. One possible reason for the observed discrepancies is that some participants had had the intent to consult the label but failed to do so while selecting the products. This omission could also be related to, among other things, time pressure, prior knowledge of or experience with a brand or a product category, or perceived importance of the selection. Another possible reason is "social desirability bias" (Maccoby & Maccoby, 1954)—some

participants felt saying they had looked at the label was the “correct” answer because they thought that was the expected answer and wanted to avoid embarrassment in front of the interviewer.

Though nutrition elements were not viewed by most participants in this study, this does not necessarily mean that this was uniformly the case for all nutrition elements. Differences in attention to nutrition elements across product categories and types of nutrition elements may provide insight into how nutrition elements could capture the eye of the shopper more effectively.

The best example of such an insight can be found with cereal. More of the participants who shopped for cereals viewed the Nutrition Facts label than others who shopped for soups or snacks. Those who viewed any nutrition elements spent more time on such elements on cereals than on the other two product types. Cereal packages are usually “busier” and contain relatively more attention-capturing visual elements (e.g., pictures, colors, contrasts) than packages of soup or snacks. This should have reduced the attention to nutrition information on cereals compared to that on soups or snacks, but it did not. This observation appears to corroborate the finding from a national survey in the United States, which showed that Americans reported looking for nutrition information more frequently on breakfast cereals than on snacks (FDA, 2016b). We would hypothesize two potential contributing factors to this increase in attention to nutrition information related to cereal.

1. **Increased Exposure to information:** There are simply more nutrition elements in the Cereal aisle, including the Guiding Stars® and the Facts Up Front®, than the other two aisles. Assuming everything else is constant, this means that the probability that a nutrition element is noticed is higher on cereal products than on the other two product types. Adding more viewing opportunities, when sensible, appropriate, and feasible, could be one approach to increasing overall visual attention to nutrition information. This is consistent with the review of the relationship between number of product facings and attention (Chandon et al., 2009) as well as empirical findings (Gidlöf et al., 2017)
2. **Perceived Relevance of Nutrition:** The Nutrition Facts label was present on all products. Thus, increased attention to this element in the Cereal aisle cannot be explained by increased exposure. Instead, it is possible that the relatively high level of attention to the label in this aisle is a result of some shoppers' perceptions that nutrition is more important or more relevant in choosing cereal, one of the more popular grocery categories with widely varying dietary quality (Golub & Binkley, 2005), than soup or snacks. In addition, cereal is one of the most promoted product categories and promotional materials often distinguish products based on their nutritional or health-related characteristics (e.g., whole grain, antioxidants, or cholesterol level). More broadly, people intentionally choose to pay attention to information that they consider relevant for a given goal, based on their existing knowledge, expectations, perceptions, shopping plans, and previous product and store experiences. Both consumption pattern and perceived product characteristics could have helped develop predisposition or motivation toward more attention to the label on cereals (i.e. top-down visual attention). In addition, however, promoting knowledge or perception of the importance or relevance of

nutritional attributes may be another approach that can “prepare the eyes” to notice nutrition information, which in turn may help increase attention paid to nutrition information during product choices.

This eye-tracking study explored shopper attention to various types of nutrition information at the point of purchase in a real shopping environment, and from the perspective that nutrition and non-nutrition visual elements coexist and compete for shopper attention. The current research is an observational study in a real shopping environment. The study approach has the advantage of illustrating how grocery shoppers may react to visual elements in real life rather than in controlled and experimental settings, and the crowding-out effects of nonnutrition information on attention to nutrition information on food packages. The results have a much higher degree of ecological validity than findings from previous studies that use a controlled and/or simulated experimental approach. The gain in ecological validity, however, is obtained at the expense of the study's limited ability for a systematic examination of the influences of specific visual elements or their design on the shopping experience. In addition, there could have been some unknown or unmeasured factors, such as shoppers' demographic, cognitive, or attitudinal background, number of displayed products and shelf configuration for each food category, that influenced visual attention in the current study. The sample size of 60 participants and the number of product types were relatively small. Therefore, the study was not intended and cannot be used to make generalizable conclusions for the population or the entire shopping environment. The small sample size also makes comparison across age, gender, and other demographic groups as well as between nutritional elements of interest (claims, signage, the Nutrition Facts label, and the Facts Up Front® symbol) impossible.

We also acknowledge that—while the results of this research provide a powerful insight into the attention of shoppers—visual attention is a useful but not a perfect data source for measuring shopper perception or processing of visual stimuli. Not all visual information that falls within the shopper's line of sight is cognitively processed, and so eye-tracking data necessarily overestimate the level of mental engagement with visual elements. Additionally, we acknowledge that the depth of eye-tracking data analysis is relatively limited compared to other studies conducted in a controlled and simulated context. That context offers a much better control of the visual stimuli, tasks, and participant characteristics, which in turn renders more opportunities for deeper analysis of visual data such as time to first fixation, fixation count, and fixation duration. The naturalistic context in this study, however, limits its capability to perform deeper analysis. Despite the limitations, eye tracking in authentic environments remains the most appropriate tool for unobtrusively assessing visual experience across a range of contexts, including shopping.

5 | CONCLUSIONS

The challenges of communicating nutrition information to grocery shoppers are well-documented. The findings of the current study suggest that the visual process of locating and selecting products

relies more on heuristics (e.g., brands and imageries) than on a reasoned accounting of nutrition characteristics. More importantly, the present study illustrates that some consumers notice nutrition information at point of purchase and that various pieces of information (e.g., the Nutrition Facts label, labeling claims, nutrition symbols) coexist and vie for attention on packages or in store. This, in and of itself, may not be a shocking revelation, but the highly exclusionary pattern of attention on nonnutrition visual elements and the consistency of the results across product types and types of information elements is notable. So how might nutrition information more effectively “catch the eye” of the shopper? Research suggests that attention to information is a precursor to its effectiveness. The results presented here suggest that increased exposure and shopper education may be among potential approaches that merit further investigation. The number of nutrition elements and the type of nutrition information on product packages or in the store might be increased, including point-of-purchase signage and textual elements that convey prominent and easy-to-understand information. In addition to the mandatory Nutrition Facts label, research has suggested that front-of-package nutrition icons could help consumers identify food products with more nutritious profiles (IOM, 2011; Rahkovsky, Lin, Lin, & Lee, 2013). Future research may explore whether more numerous and more prominent icons on the front of packages improve attention and whether any improvement leads to healthier dietary choices. It may also be useful for future research to explore effective approaches to stimulating or enhancing top-down attention (i.e. preplanned product selection) by motivating search for and use of nutrition elements through consumer education. After all, consumer education can be helpful in empowering consumers with the importance, utility, and knowledge of nutrition information, which in turn can help strengthen predisposition toward noticing nutrition information as consumers navigate the food and shopping environments to make healthy choices. Such approaches may focus on areas such as helping consumers better understand the importance and relevance of point-of-purchase nutrition information and develop better skills of applying nutrition information to product choices.

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