

CONSUMERS' USE OF NUTRITIONAL LABELS: A REVIEW OF RESEARCH STUDIES AND ISSUES

Andreas C. Drichoutis

Agricultural University of Athens

Panagiotis Lazaridis

Agricultural University of Athens

Rodolfo M. Nayga, Jr.

Texas A&M University

Andreas C. Drichoutis is a PhD candidate at the Department of Agricultural Economics and Rural Development in Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece, telephone +30 210 5294726, adrihout@aua.gr. Panagiotis Lazaridis is an Associate Professor at the Department of Agricultural Economics and Rural Development in Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece, telephone +30 210 5294720, t.lazaridis@aua.gr. Rodolfo M. Nayga, Jr. is a Professor at the Department of Agricultural Economics in Texas A&M University, College Station, TX 77843-2124, USA, mayga@tamu.edu. The authors are grateful to the Editor and three anonymous reviewers for their valuable and constructive comments and suggestions.

EXECUTIVE SUMMARY

Introduction

Diet-related health problems have increased dramatically over the last few years. Consequently, nutritional labeling has emerged as an important aspect of consumers' food purchase decisions. Nutritional content in food products is considered to be a credence attribute. However, if trustworthy nutritional labels are available, nutritional labels could function as a search characteristic. The regulatory environment in some countries (e.g. USA, Australia etc.) has long recognized the potential of standardized on-pack nutrition information and has mandated the presence of nutritional labels on all processed food products. Others, like the EU, are contemplating similar mandatory nutritional labeling regulations. The nutritional labeling literature has grown significantly in recent years. Our paper reviews this increasingly important literature and addresses some specific issues regarding the determinants of label use, the debate on mandatory labeling, the label formats preferred by consumers, and the effect of nutrition label use on purchase and dietary behavior.

Determinants of nutritional label use

There has been no consistency in the results of studies conducted regarding the determinants of label use. For example, there has been no consensus on the effect of age, income, or working status on nutritional label use. However, education and gender (i.e., being female) have been found to positively affect label use. In addition, people with more available time for grocery shopping have been found to be more likely to be classified as label users. It also appears that consumers who are more concerned about nutrition and health are more likely to use nutritional labels. Consequently, consumers on a special diet, organic buyers, and those aware of the diet-disease relation are more likely to search for on-pack nutrition information than others.

Type of household also has an effect on label use. Specifically, smaller households and households with young children are more likely to engage in nutrition information search behaviors. In addition, households in non-city or rural areas are more likely to use nutritional labels. Grocery shoppers but not meal planners are also more likely to engage in nutrition information search.

Our review of the literature also suggests that consumers who attach importance to price usually are less likely to use labels but those who attach importance to nutrition are, as expected, more likely to search for nutritional information. Finally many studies have found that nutrition knowledge has a significant impact on nutritional label use.

Mandatory vs. voluntary labeling

From a firm's point of view, provision of nutritional information on food packages is desirable if it can generate more revenues. In the context of effective private quality signalling, government regulation would be unnecessary if higher quality products had nutritional information on their packages and those with lower quality did not. However, if sellers cannot signal quality effectively, the market may disappear completely or only the lowest quality products may be sold. Mandatory labeling is called to fill the void of information provision mainly by correcting asymmetric information or by correcting externality problems. However, prescriptions such as "more information is always better" may not be an optimal policy for nutrition labeling. One cannot therefore unambiguously state that the benefits of new nutrition labeling rules will be greater than the costs, although there is some reason to believe that benefits may be greater than the costs.

The U.S.' Nutritional Labeling and Educational Act (NLEA) that went into effect in 1994 can serve as a good reference point for mandatory labeling. Some authors have found no significant change in the average nutritional quality of food products offered for sale by manufacturers and retailers after the implementation of the NLEA, thus suggesting that the benefits from information provision might be more limited than previously thought. Other studies did not also detect any change in behavior of consumers with regard to nutritional information search both before and after the implementation of the NLEA. More recently, due to rising obesity rates, there has been debate on whether to require nutritional labeling in the Food Away From Home (FAFH) sector. However, some studies have found that provision of nutrition information has no effect on overall energy and fat intake from restaurants.

Label formats: which is preferred?

Nutritional labels come in different formats. The format that consistently produces the most positive dietary benefits is the percentage declaration of the various nutrient amounts based on the daily values for each nutrient. Consumers tend to perform poorly with manipulation of quantitative nutrient information. Furthermore, the use of bold text, colored nutrition panels, and whole numbers instead of decimals and calories instead of joules (in a typical EU nutritional label, energy has to be expressed both in terms of calories and joules where 1 kcal=4,18 kjoules) are preferred by the majority of consumers.

Does nutritional label use affect purchasing behavior?

In general, it has been found that nutritional label use affects purchasing behavior mainly because consumers want to avoid the negative nutrients in food products. The effects can be even greater if labeling is combined with an information campaign to educate consumers. It appears that nutritional information affects purchasing behavior because it influences valuations and perceptions of the product. In that context, several surveys have studied the effect that claims create on personal evaluations. Health claims in the front of the package have been found to create favourable judgements about a product. For example, when a product features a health or nutrient content claim, consumers tend to view the product as healthier and are then more likely to purchase it, independent of their information search behavior. Other studies, however, have found that health claims have a weak effect on disease risk perceptions. Most importantly, one has to keep in mind that in the food choice process, there will always be a taste-nutrition trade off. Consumers may prefer the immediate gratification offered by a tasteful product rather than the

long run benefits of a nutritious product. Dietary indulgence is often cited as consumer's self-control problem.

Can use of nutritional information lead to dietary changes?

Some researchers have argued that provision of health related information does not always lead to healthier consumption. Most empirical research, however, suggests that provision and use of information can significantly change dietary patterns. Several studies have found that nutritional label use contributes to a better dietary intake or to reduced consumption of 'unhealthy' foods. Nutritional label use is also associated with diets high in vitamin C, low in cholesterol, and lower percentage of calories from fat. Other studies have found nutritional label use to increase dietary quality of consumers, with higher improvements detected when health claim information was used. Finally, some studies have also found that consumers who use the Nutrition Facts panel that was mandated by the NLEA have higher fiber, iron, and protein intakes than non-label users.

Conclusion

This study synthesizes the results of empirical research related to nutritional label use that spans almost two decades. The summary of results presented in this study provides valuable information for directions for future research and development of theoretical and empirical studies. Among others, we find that provision of information has a positive effect on the consumption of beneficial nutrient components and a negative effect on the consumption of harmful components such as fat and cholesterol.

No large-scale, longitudinal research has yet been conducted on the determinants of nutritional label use and the effect of nutritional label use on purchase and consumption behavior. Longitudinal analysis would assess the temporal stability of the conclusions derived from the extant literature. Finally, research on nutritional label use can be characterized as applied research and an area of future research that needs some attention is the development and empirical testing of theoretical models related to nutritional label use.

Keywords: Nutritional labels, Nutritional Information, Health, Labeling formats, Mandatory labeling, Dietary behavior, Purchase behavior.

CONSUMERS' USE OF NUTRITIONAL LABELS: A REVIEW OF RESEARCH STUDIES AND ISSUES

More than 40 years have passed since Lancaster (1966) published his now famous product characteristics theory. In this model, consumers derive utility from attributes of the goods when some transformation is performed, instead of deriving utility directly from the goods. However, Silberberg and Suen (2001, p. 343) acknowledged that, "...it still remains that empirical implementation of the Lancaster model in a truly observable manner is not straightforward. Identification and measurement of 'attributes' may be more difficult than measurements and predictions of market goods." The big change that occurred with Lancaster's model was that marketing economists started looking at products such as foods (and other commodities) not just as consumption commodities, but as a bundle of attributes (see for example, Lazaridis and Drichoutis, 2005). Empirical applications of this model have been more successful when applied to goods whose attributes are additive and non-conflicting (Drichoutis and Lazaridis, 2006; Leung and Miklius, 1997; Silberberg, 1985).

Nelson (1970; 1974) distinguished the concepts of search and experience attributes for products but it is Darby and Karni (1973) that added the concept of the credence attribute. Credence attributes cannot be evaluated even when the product is in use or after consumption (e.g. the nutrient value of foods). However, Caswell and Moduszka (1996) argued that the credence attribute of nutritional content can be transformed into a search attribute when a nutritional label is present. The regulatory environment in some countries (e.g., USA), by mandating the presence of nutrition information on food products, has long recognized the possibility that the transformation of the credence attribute of nutrition to a search attribute through nutritional labels may help consumers make healthier food choices and, therefore, help reduce diet-related diseases. In EU countries, the debate has been launched only recently when, in January 2003, the Commission launched a consultation among Member States and stakeholders related to the revision of the current regulation (90/496 EOC) and the preparation of a proposal amending, among others, the voluntary provision of nutritional information to become mandatory.

Globally, diet-related health problems have increased dramatically over the last few years. Consequently, nutritional labeling has emerged as an important aspect of the food purchasing decision both for the scientific and the non-scientific literature. Most empirical applications with respect to label use have been based on Stigler's (1961) approach (cost-benefit), although others have attempted to develop and provide theoretical frameworks (Drichoutis, Lazaridis, and Nayga, 2006; Sexton, 1979; Zarkin and Anderson, 1992)

In this paper, we attempt to synthesize the findings of nutritional label use studies that spans almost two decades. The other literature review attempts that have been done in the past (Baltas, 2001b; Cowburn and Stockley, 2003), although insightful and rich, have generally been selective. It is highly likely that the persistent exploratory nature of new empirical research in this area is due to the lack of an organized synthesis of past research. Our paper addresses more specific questions related to use of nutrition information such as: (a) What are the determinants of label use? (b) Is there a consistent finding about the profile of consumers more likely to use nutritional labels? (c) Is mandatory labeling the profound answer in increasing consumers' ability to make healthier food choices? (d) What is the label format consumers' best comprehend or prefer? (e) Does labeling affect purchase behavior? and, (f) Does the use of labels lead to dietary changes? The following sections discuss and synthesize the findings of several studies that have addressed these questions. The last section concludes and provides discussion about future areas of research.

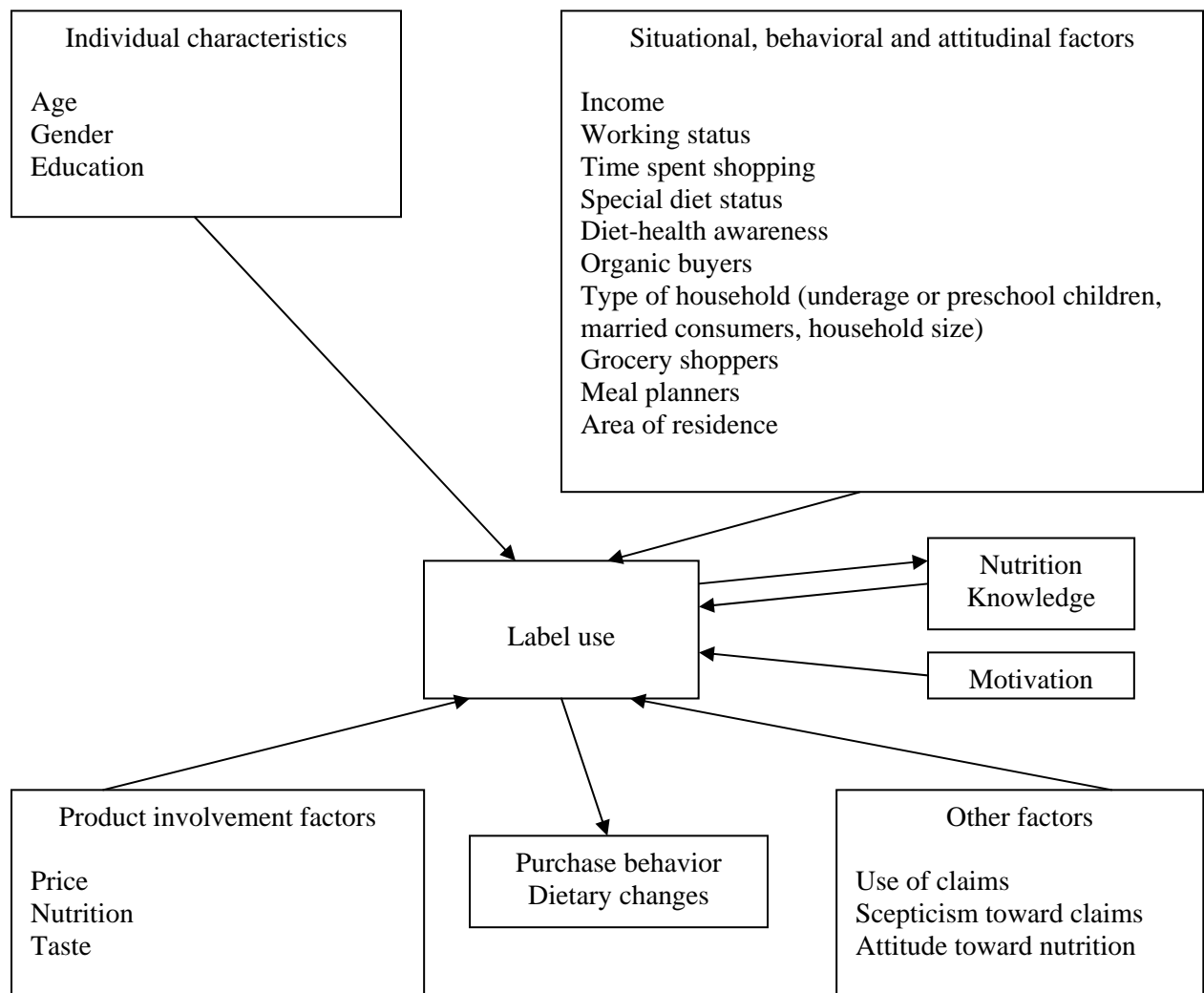
DETERMINANTS OF NUTRITIONAL LABEL USE

There is considerable empirical research on the determinants of nutritional label use. These studies primarily deal with identifying the profile of consumers who use nutritional food labels using Stigler's (1961) cost-benefit ap-

proach, i.e., consumers will search for nutrition-related information as long as the costs (mainly viewed as time spent reading labels) do not outweigh the benefits (healthful food choices). Many of these studies have focused on exploring the determinants of nutritional labels in general, while only a few made a distinction between ingredient lists and nutrition panels (Bender and Derby, 1992), or explored the use of specific nutrient information (Drichoutis, Lazaridis, and Nayga, 2005; Nayga, 1996). One study has assessed the determinants of perceptions and/or beliefs of label usage (Nayga, 1999).

Following Drichoutis, Lazaridis, and Nayga (2005) and Nayga (1999), we develop a conceptual framework by grouping the factors affecting the use of on-pack nutrition information into the following categories (see Figure 1): (a) individual characteristics; (b) situational, attitudinal, and behavioral; (c) product class involvement; (d) knowledge; (e) motivation factors; and (f) other factors. Figure 1 presents the consequences of label use on purchase behavior and diet as well as the antecedents of label use.

FIGURE 1
Antecedents and Consequences of Label Use Based on Literature Review



Individual characteristics

Table 1 summarizes the findings from key studies in the literature. It is well known that individual characteristics affect information search behavior (Ippolito and Mathios, 1990). One very common characteristic that has been

used in several studies is age, which has been found to affect use of nutritional labels in different ways. For example, Burton and Andrews (1996) found that older people perceive the labels as less understandable. This may explain why Bender and Derby (1992) found that older people tend to read only the ingredient list, while younger people tend to read both the nutritional labels and ingredient lists, or just the nutritional labels. In accordance, Kim, Nayga, and Capps (2001a; 2001b) and Cole and Balasubramanian (1993) showed that as age increases, the probability of using nutritional labels decreases while others have found the exact opposite (Coulson, 2000; Drichoutis, Lazaridis, and Nayga, 2005; Govindasamy and Italia, 1999). Specifically, as age increases so is the likelihood of using the information about fat content (Lin and Lee, 2003; Nayga, 1996), cholesterol content (Drichoutis, Lazaridis, and Nayga, 2005; Nayga, 1996), and health benefits (Nayga, 1996).

Past studies have also found that more education leads to higher levels of information search (Katona and Mueller, 1955; Schultz, 1975). This does not necessarily mean that the less educated do not engage in information search behaviors at all, but rather they focus only on nutrition labels whereas the better educated individuals look at both nutritional labels and ingredient lists (Bender and Derby, 1992). Even though the higher educated individuals are less likely to perceive that reading labels makes it easier to choose foods (Nayga, 1999), several studies have confirmed the hypothesis that higher educated individuals are more likely to use nutritional labels (Drichoutis, Lazaridis, and Nayga, 2005; Feick, Herrmann, and Warland, 1986; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; McLean-Meyinsse, 2001; Nayga, Lipinski, and Savur, 1998; Wang, Fletcher, and Carley, 1995). Specifically, higher educated consumers were found to be more likely to use the sugar and ingredient information in one study (Drichoutis, Lazaridis, and Nayga, 2005) and all nine types of nutrient information used in another study (Nayga, 1996).

Most of the studies have also found that females are, in general, more likely than men to use nutritional labels (Govindasamy and Italia, 1999; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; 2001b; McLean-Meyinsse, 2001). This may be attributed to the fact that many males do not agree that nutritional information is useful, that the information can help in food choice, or that health is a matter of importance to them (Nayga, 1999). Moreover, research has found that males are less likely to use all nine types of nutrient information (Nayga, 1996), males tend to focus on ingredient lists (Bender and Derby, 1992), and that they are more likely to use the ingredient lists (Drichoutis, Lazaridis, and Nayga, 2005). In contrast, females pay attention to information about calories, vitamins, and minerals (Drichoutis, Lazaridis, and Nayga, 2005) and they tend to use both nutrition labels and ingredient lists (Bender and Derby, 1992).

TABLE 1
Literature Summary for the Effect of Individual Characteristics on Nutrition Information Search

Key variable	Effect on nutrition information search	Sample Studies
Age	Negative	Bender and Derby, 1992; Burton and Andrews, 1996; Cole and Balasubramanian, 1993; Kim, Nayga, and Capps, 2001a, 2001b
	Positive	Coulson, 2000; Drichoutis, Lazaridis, and Nayga, 2005; Govindasamy and Italia, 1999; Lin and Lee, 2003; Nayga, 1996
Education	Positive	Drichoutis, Lazaridis, and Nayga, 2005; Feick, Herrmann, and Warland, 1986; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; McLean-Meyinsse, 2001; Nayga, 1996; Nayga, Lipinski, and Savur, 1998; Wang, Fletcher, and Carley, 1995
Being female vs. being male	Positive	Govindasamy and Italia, 1999; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; 2001b; McLean-Meyinsse, 2001

Situational, behavioral and attitudinal factors

In Table 2, we present a summary of the findings from our literature review with respect to the corresponding factors of this section as depicted in Figure 1. Time pressure has been found to limit individuals' search of nutrition information (Beatty and Smith, 1987; Feick, Herrmann, and Warland, 1986; Katona and Mueller, 1955; Park, Iyer, and Smith, 1989). In most of the studies, working status, income, and time spent grocery shopping have been

used as proxies of time pressure in information search behavior (Figure 1). Table 2 shows that there are contradictory results in the literature (e.g., with regards to income). For instance, higher income consumers were more likely to agree with statements a) on the usefulness of nutrition information, b) on the ease of choosing foods based on the nutritional information, c) that it is better to rely on the nutritional label information than on one's own knowledge, and d) on the fact that nutritional labels can be a motive to try a new food product (Nayga, 1999). When it comes to the use of specific nutrient information, however, higher income respondents are more likely to use calories, sodium, fiber and fat information (Nayga, 1996), while the effect of income on cholesterol information use remains ambiguous due to contrasting results (Drichoutis, Lazaridis, and Nayga, 2005; Nayga, 1996).

No conclusion can be drawn about label use pertaining to work status since unemployed consumers (Nayga, 2000; Nayga, Lipinski, and Savur, 1998) or retired household heads (Schupp, Gillespie, and Reed, 1998) are more likely to use nutritional labels, whereas Drichoutis, Lazaridis, and Nayga (2005) found that it is working people who are more likely to use the nutrient information. Furthermore, in Drichoutis, Lazaridis, and Nayga (2005), even though working respondents were found more likely to use ingredients and vitamins/minerals information, the same respondents were also less likely to use cholesterol information. Nayga (1996) found a negative relation between employment and use of sodium information.

In addition, people with low levels of time pressure, as approximated by high levels of time spent in grocery shopping, are more likely to use nutritional labels (Nayga, Lipinski, and Savur, 1998). More specifically, low levels of time pressure are positively correlated with the use of cholesterol information and negatively with the use of vitamins/minerals information (Drichoutis, Lazaridis, and Nayga, 2005). Time pressure effects on label use are also apparent in Kim, Nayga, and Capps (2001a) and Lin and Lee (2003), where respondents that agreed with the statement "reading labels takes more time than I can spend," were less likely to use nutritional labels and information on fat content, respectively.

Furthermore, studies show a positive effect of current diet status on search for nutrition information. It appears that consumers with a special interest in diet, use nutritional labeling as a means to an end (see Table 2). Consumers who follow a special diet may not necessarily do it because of a special medical situation, but because of their general diet-health awareness. Therefore, in close relation with these results, consumers aware of the diet-health/diet-disease relation or consumers who perceive diet as important to their lifestyle, are more likely to use on-pack nutrition information and/or health claims (Derby and Fein, 1994; Feick, Herrmann, and Warland, 1986; Kim, Nayga, and Capps, 2001a; Nayga, 2000; Shine, O'Reilly, and O'Sullivan, 1997a; Szykman, Bloom, and Levy, 1997; Wang, Fletcher, and Carley, 1995). Awareness of the diet-disease relation may also positively affect the likelihood of consumers paying attention to the caloric content of foods (Drichoutis, Lazaridis, and Nayga, 2005). These results are amplified when one considers the fact that consumers buying organic products are more likely to use nutrition information (Govindasamy and Italia, 1999) and that placing importance on following dietary guidelines or healthy dietary practices positively affects nutritional label use (Guthrie et al., 1995; Nayga, 2000; Nayga, Lipinski, and Savur, 1998) or specifically, the use of fat and sugar content information (Drichoutis, Lazaridis, and Nayga, 2005; Lin and Lee, 2003).

The type of the household also has an effect on label usage. For example, households with preschool children and married consumers are more likely to search for nutrition information (Feick, Herrmann, and Warland, 1986; McLean-Meyinsse, 2001). On the other hand, household size is negatively related to label use (Drichoutis, Lazaridis, and Nayga, 2005; Govindasamy and Italia, 1999; Guthrie et al., 1995). However, other studies found that larger households are more likely to use nutritional labels in general (Wang, Fletcher, and Carley, 1995) and vitamins/minerals and sugar content information (Nayga, 1996).

Major grocery shoppers were found more likely to use nutritional labels (Drichoutis, Lazaridis, and Nayga, 2005; Kim, Nayga, and Capps, 2001a), but meal planners were found less likely to use calories and/or cholesterol information (Drichoutis, Lazaridis, and Nayga, 2005) perhaps because they assign greater value to taste (Drichoutis, Lazaridis, and Nayga, 2007).

Furthermore, the geographic location of the household has been shown to have an impact on use of nutrition information. All of the studies reviewed have found that those who live in non-city or rural areas are more likely to use on-pack nutrition information (Govindasamy and Italia, 1999; Piedra, Schupp, and Montgomery, 1996; Wang, Fletcher, and Carley, 1995) or specifically, fat content information (Lin and Lee, 2003).

TABLE 2
Literature Summary for the Effect of Situational, Behavioral and Attitudinal Factors on Nutrition Information Search

Key variable	Effect on nutrition information search	Sample Studies
Income	Positive	Kim, Nayga, and Capps, 2001a; McLean-Meyinsse, 2001; Piedra, Schupp, and Montgomery, 1996; Wang, Fletcher, and Carley, 1995
	Negative	Drichoutis, Lazaridis, and Nayga, 2005; Schupp, Gillespie, and Reed, 1998
Employment	Positive	Drichoutis, Lazaridis, and Nayga, 2005
	Negative	Nayga, 2000; Nayga, Lipinski, and Savur, 1998
Time spent grocery shopping	Positive	Nayga, Lipinski, and Savur, 1998
Special diet	Positive	Bender and Derby, 1992; Drichoutis, Lazaridis, and Nayga, 2005; Kim, Nayga, and Capps, 2001a; Nayga, Lipinski, and Savur, 1998; Schupp, Gillespie, and Reed, 1998
Diet-health awareness or diet importance	Positive	Derby and Fein, 1994; Feick, Herrmann, and Warland, 1986; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; Nayga, 2000; Nayga, Lipinski, and Savur, 1998; Shine, O'Reilly, and O'Sullivan, 1997a; Szykman, Bloom, and Levy, 1997; Wang, Fletcher, and Carley, 1995
Household size	Positive	Nayga, 1996; Wang, Fletcher, and Carley, 1995
	Negative	Drichoutis, Lazaridis, and Nayga, 2005; Govindasamy and Italia, 1999; Guthrie et al., 1995
Being the major grocery shopper	Positive	Drichoutis, Lazaridis, and Nayga, 2005; Kim, Nayga, and Capps, 2001a
Being the major meal planner	Negative	Drichoutis, Lazaridis, and Nayga, 2005
Residing in rural and non-city areas	Positive	Govindasamy and Italia, 1999; Lin and Lee, 2003; Piedra, Schupp, and Montgomery, 1996; Wang, Fletcher, and Carley, 1995

Product involvement factors

The importance consumers place on certain food attributes has been widely hypothesized to affect nutritional label use because of the importance of these factors in food purchase decisions (Rose, 1994; Thayer, 1997). Consumers placing importance on price are less likely to use nutritional labels in general (Drichoutis, Lazaridis, and Nayga, 2005; Nayga, Lipinski, and Savur, 1998) and specifically, information on fat and cholesterol (Drichoutis, Lazaridis, and Nayga, 2005) (see also Figure 1). This can be explained by the fact that consumers who place high importance on the price attribute are actively looking for price information, which may then inhibit them from examining nutritional labels to either avoid information overload or simply because of lack of available time to do so. Not surprisingly, people placing high importance on nutrition are more likely to use nutritional labels (Nayga, 2000; Nayga, Lipinski, and Savur, 1998) or to use specific nutrient information (Drichoutis, Lazaridis, and Nayga, 2005; Lin and Lee, 2003; Nayga, 1996, 1999). In contrast, the effect of importance of taste on nutritional label use

Academy of Marketing Science Review

volume 2006 no. 9 Available: <http://www.amsreview.org/articles/drichoutis09-2006.pdf>

Copyright © 2006 – Academy of Marketing Science.

is not clear since different studies have found contradicting results (Drichoutis, Lazaridis, and Nayga, 2005; Nayga, 1996, 1999, 2000; Nayga, Lipinski, and Savur, 1998).

Nutrition knowledge

Nutrition knowledge may facilitate label use by increasing its perceived benefits and by increasing the efficiency of label use, thereby decreasing the cost of using labels. Early studies of label use found a relationship between nutrition knowledge or self perception of knowledge and the use of specific nutrients (Bender and Derby, 1992) (see Figure 1). Moorman and Matulich (1993) showed that higher levels of health knowledge have a positive effect on information acquisition from media sources (including nutrition label reading). Later, Guthrie et al. (1995), Szykman, Bloom, and Levy (1997), and Kim, Nayga, and Capps (2001b) found evidence supporting a positive relationship between label use and knowledge, even though Nayga (2000) found no evidence supporting this relationship. Moorman (1998) also found that consumers with more knowledge were less skeptical toward nutritional information. In addition, Levy and Fein (1998) revealed the positive effect of knowledge on consumer's ability to perform nutrition label use tasks.

Although it is reasonable to expect that nutrition knowledge can affect nutritional label use, it is also possible that label use can affect nutrition knowledge. For example, consumers can gain more knowledge as they read more nutritional labels from the products they purchase. In fact, Drichoutis, Lazaridis, and Nayga (2005) found that label use in general and use of vitamins/minerals and ingredients information improve consumer's nutrition knowledge.

Motivation

The motivation to process information has been shown to be one of the moderators of the effect of nutrition information panels (Figure 1). Moorman (1990), investigating the effect of enduring motivation on the use of nutritional information, found that this factor influenced not only the information processing and decision quality but also that this relationship was stronger in the post-NLEA period (Moorman, 1996). Enduring motivation has also been shown to moderate the effects of product nutrition value on consumer evaluations even though claims' effects were not influenced by the level of motivation (Keller et al., 1997).

A note should be made at this point on the measurement of motivation just to indicate the different interpretations between studies. Moorman (1990; 1996) and Keller et al. (1997) define motivation with questions relating to how often someone uses nutritional labels in general and when grocery shopping. They also depicted motivation based on one's interest in reading nutrition and health related information. For most of the studies cited in the previous paragraphs (e.g. Drichoutis, Lazaridis, and Nayga, 2005; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001a; Nayga, 2000; Wang, Fletcher, and Carley, 1995), label use was measured with questions similar to what Moorman (1990; 1996) and Keller et al. (1997) have used as a motivation variable. Therefore, caution is needed when comparing results between studies.

Other factors

Search for nutrition information has also been correlated with other informational search behaviors (see Figure 1). Szykman, Bloom, and Levy (1997) explored health claim use and nutrient claim use as a moderating factor in nutritional content use. They found that the use of nutrient claims has a negative effect on the use of health claims, but a positive effect on the frequency of nutrient content use. Furthermore, being skeptical toward claims has a negative effect on use of health claims and a positive effect on nutritional label use.

Ford et al. (1996), Garretson and Burton (2000), Keller et al. (1997), and Mitra et al. (1999) found that when nutrition panels are available, health and nutrient claims have little impact on product evaluations since consumers tend to rely on the panels. Although these studies are very useful, caution is needed since they were not conducted in store environments where consumers face time constraints. This may be the reason why Roe, Levy, and Derby (1999) in a mall intercept study found that the presence of health and nutrient content claims on food packages leads to truncated information search, i.e. respondents tend to rely only on the front panel of packages. However, the studies revealed that consumers are in general capable of using the nutrition information panels in construct-

ing product evaluations in these out-of-store settings. In addition, label use is affected by the attitude consumers have toward nutritional content, i.e., the perceived usefulness of nutritional information (Feick, Herrmann, and Warland, 1986; Shine, O'Reilly, and O'Sullivan, 1997a).

MANDATORY VS. VOLUNTARY LABELING

Search goods are those for which consumers are able to examine product characteristics, such as size, shape, and color, before purchasing. Experience goods are those for which consumers evaluate attributes after purchasing the product. Darby and Karni (1973) added the concept of the credence attribute to the concepts of search and experience attributes distinguished by Nelson (1970; 1974). Credence attributes are those that consumers cannot evaluate before purchase or even after consumption. Nutritional content is considered to be a credence attribute. However, if trustworthy nutritional information is available, nutrition labels could function as a search characteristic (Caswell and Mojduszka, 1996). Labeling policies, with the aim to circumvent market inefficiencies by making available to the consumer the information initially held by the firm, are least likely to be justifiable for search attributes (Teisl and Roe, 1998) given the costs associated with such a policy intervention.

From the firm's point of view, more information on food packages would only be optimal if the information would generate more revenue. Labels may help improve the credibility of firms' privately sponsored communications since the existence of labeling allows consumers to verify claims made by advertisers and may hold back some firms from overstating product qualifications (Teisl and Roe, 1998).

According to Grossman's model (1981), provision of voluntary information on the nutritional quality of processed foods would have been effective if higher quality products had nutritional information panels on their packages and those with lower quality did not. In this case, consumers would be able to distinguish the nutritional quality of food products at the point of purchase. With effective private quality signaling, government regulation of nutrition labeling would be unnecessary. However, Grossman's model is based on assumptions of totally effective, truthful, and costless quality signaling and verification of claims. In Akerlof's (1970) market for "lemons" model, where sellers cannot signal quality effectively, the market may disappear completely or only the lowest quality products may be sold. In general, incentives for voluntary disclosure of nutritional content by food processing companies did not generally result in reliable and consistent quality signals to consumers in the US (Mojduszka and Caswell, 2000). In addition, studies found little support to the unfolding process (Caswell, 1992).

Mandatory labeling is called to fill the void of information provision mainly by correcting asymmetric information or by correcting externality problems. When the food consumption choices of consumers affect the welfare of others, and these welfare effects are not priced, then consumers may consume more or less than is socially optimal. The producers, manufacturers, and retailers of Energy-Dense, Nutrient-Poor foods (EDNP) (Kant, 2000) are just as socially powerful as the tobacco industry (Lambert, Dibsdall, and Frewer, 2002) and their lobbying capability is substantial (Padberg, 1999). In this context, the so called "fat tax" has gained ground in discussions (Marshall, 2000; O'Rourke et al., 2000; Schenker, 2000). Economic theory also suggests that other methods like Pigouvian taxes, bans, quotas, etc., may be more useful than mandatory labeling (Golan et al., 2000). Others have argued that if the government has the choice of banning a risky product or activity, and providing information about the risks involved, it should choose the informational provision (Magat and Viscusi, 1992). Either way, prescriptions such as "more information is always better" may not characterize an optimal policy solution for nutrition labeling (Teisl, Bockstael, and Levy, 1997). Additional information need not result in better purchasing decisions by consumers, but it could result in worse decisions (Sexton, 1979). We therefore cannot unambiguously state that the benefits of new nutrition labeling rules will be greater than the costs, but there is some reason to believe that benefits may be greater than the costs (Crutchfield, Kuchler, and Variyam, 2001).

The benefits arising from mandatory labeling can be product reformulation, product innovation, and changed consumer behavior. Mandatory labeling could improve food products if producers reformulate their products to avoid

having to make unfavorable disclosures (Aldrich, 1999), thus moving the benefits from label users to consumers who do not use labels for their purchasing decision (Caswell and Padberg, 1992). However, "...studies have shown that producers behave strategically in such situations—for example, by reducing the price of less healthful foods—adding to the uncertainty about the eventual effect of reformulation on consumer diets" (Variyam, 2005). The largest benefit can accrue if consumers who are overweight and who have poor diets, change their behavior and start choosing foods based on nutritional information. However, in order to be successful, nutrition programs, besides making more nutritional information available, may also need to instruct the consumer on how to use the information (Cole, Balasubramanian, and Castellano, 1992).

The costs can be seen as government costs and industry costs. The costs, expectedly, are to be paid by the consumer, mainly because an official agency will have to manage the labeling program. While in other cases, a lump-sum tax should be used "...there can be very good reasons why a general lump-sum tax may not be optimal, even though it is non-distorting" (Crespi and Marette, 2003). The latter costs will probably pass to consumers since they can be substantial [see European Advisory Services (2004) for an assessment of label change costs in European industries]. The problem arising is that some consumers may pay more than they would choose to pay otherwise, leading to a 'reverse Robin Hood effect' (Mazis, 1980). This calls for the conduct of willingness to pay (WTP) studies about nutritional labeling (e.g., Prathiraja and Ariyawardana, 2003). One recent study (Loureiro, Gracia, and Nayga, 2006) using a Spanish sample, estimated an average WTP of 10.62% over the regular price of a box of cookies but also ranged from 12.9% for consumers with diet-related health problems to 8.99% for consumers with no diet-related health problems. More WTP studies are needed, however, that will use a variety of elicitation methodologies and a diversity of food products to test whether nutrition information is valued differently for different food products in different countries.

As Golan et al. (2000) noted, mandatory labeling can be an appropriate policy tool when consumer preferences differ, information is clear and concise, information on product use enhances safety, costs and benefits of consumption are borne by the consumer, and when no political consensus on regulation exists.

The NLEA case

Whatever method someone would follow in order to assess the impact of mandatory nutritional labeling on food packages, it is unlikely to lead to accurate estimates of the true impact of this change. In at least three countries, USA, Australia, and Canada, cost benefit analyses have been conducted as part of the process of developing regulations. The dramatic rise of several chronic diseases, strongly related with obesity, has partly resulted in the legislation of the Nutrition Labeling and Education Act (NLEA) in 1990 in USA. The NLEA went into effect in 1994 and required disclosure of the nutritional content of foods on a standardized label and strictly regulated the presence of health and nutrient claims. The regulation also required a new format for the nutrition information panel and standardized serving sizes. Prior to implementation of the NLEA, food manufacturers provided nutritional information on a voluntary basis. Table 3 summarizes the literature with respect to NLEA and mandatory provision of nutritional information.

However, even though nutritional labeling is theorized to allow consumers to make healthier food choices, obesity rates in USA are still rising and some attribute part of the rise to the rise of fast food consumption (McCann, 2004). Fast food consumption may not be the only one to blame. Nutritional labeling can also be seen as a disclosure remedy, that has the aim to correct market failure related to the inadequate provision of information (Seiders and Petty, 2004). Ironically, remedy messages boomerang on the people they are intended to help most (Bolton, Cohen, and Bloom, 2006) because some consumers appear less risk averse when remedies are available. In an experiment, Bolton, Cohen, and Bloom (2006) found that a remedy message for a fat-fighting pill undermined food fat content perceptions and increased high-fat eating intentions as problem status (concerns about body image) increased.

Therefore, it is extremely hard to infer *a priori* the impact of a transition to a mandatory labeling system. This issue is timely in Europe considering the fact that the EU Commission launched a consultative meeting in January 2003 to discuss nutritional food labeling and one of the key issues raised during the consultation meeting was

whether to introduce mandatory nutritional labeling similar to the Nutritional Labeling and Educational Act (NLEA) that went into effect in 1994 in the United States. In November 2004, the EU Commission published a study which assessed the potential impact of mandatory provision of nutritional information on food products in the EU (European Advisory Services, 2004). In this study, 203 food companies in Europe were surveyed about the impact a mandatory labeling policy would have on the prices of food products. The direct costs of a label change were calculated to be in the range of €2,000 - €4,000 per product (\$ 2,400 - \$ 4,800). If a label would require redesigning, the additional costs could be in the range of €7,000 - €9,000 per product (\$ 8,400 - \$ 10,800). Based on their sample, the study estimated the total cost of mandatory nutritional labeling to be in excess of €560 million (\$ 670 million). In this study, it is also recognized that the true cost of mandatory labeling is underestimated since many other factors can influence the calculated figures.

NLEA had as an objective to reduce consumers' entanglement with respect to nutrition information by creating a standardized label and specifying which claims could be used and under which conditions (Pappalardo, 1996; Petruccioli, 1996; Silverglade, 1996). Preliminary studies indicated that the additional nutritional information as required by the NLEA could affect nutrition attitudes, perceptions, and product purchase likelihood (Burton and Biswas, 1993). Several authors have tried to draw conclusions on the impact of NLEA starting with Mojdzuska et al. (1999), which found that no significant change occurred in the average nutritional quality of food products offered for sale by manufacturers after the implementation of the NLEA, thus suggesting that the benefits from information provision might be more limited than previously thought (Caswell and Padberg, 1992). In addition, Mojdzuska (2001) showed that consumer preferences and purchasing patterns within the prepared frozen meals category did not change significantly after the implementation of mandatory nutrition labeling.

In accordance with the above, Balasubramanian and Cole (2002) did not detect any changes in consumers' search for nutritional information or their recall of this information in the pre- and post- NLEA period, even though private quality signaling was not reliably at work in food markets prior to implementation of the NLEA (Mojdzuska and Caswell, 2000). The authors did find, however, that consumers' attention changed for negative nutrition attributes more than it changed for positive attributes. In support of this, studies have found that the NLEA label formats may be more helpful in accurately assessing products lower in nutritional value than products higher in nutritional value (Burton and Andrews, 1996). Others argued that markets for nutritional quality were already changing significantly prior to implementation of NLEA (Caswell and Mojdzuska, 1996) or that the NLEA has generally been seen as a successful food-labeling program (Crespi and Marette, 2003). Finke (2000) saw NLEA as successful and pinpointed that a key reason for that was that it placed emphasis on educating the consumers. Another reason was that the NLEA aimed to eliminate 'hollow' health claims e.g., health claims made by one brand when the claim is inherent to the product category but has not been featured previously (Burke, Milberg, and Moe, 1997), which may mislead consumers. An example of a hollow claim would be if a specific plant oil brand would use a "no cholesterol" claim, even though all plant oils do not contain cholesterol. Consumers may then infer that only this brand contains no cholesterol, which is misleading.

The results of labeling interventions, such as the NLEA, with respect to purchase behavior and dietary behavior are more likely to be larger on the more motivated (Keller et al., 1997; Moorman, 1990, 1996) and those with higher nutrition knowledge (Drichoutis, Lazaridis, and Nayga, 2005; Guthrie et al., 1995; Kim, Nayga, and Capps, 2001b; Szykman, Bloom, and Levy, 1997). Increasing the segments of the market with motivated and knowledgeable consumers will increase the chances of success of nutrition labeling programs.

Some consumers, after a labeling intervention, may notice the change in labels immediately, but for others, it may take time before they notice (Teisl and Levy, 1997). Label users are more likely to notice a change, since they are already reading labels, and this may be the reason why the effect of the NLEA may have been more profound among them. Finke (2000) showed that consumers who often used the 1995 food labels were more likely to eat a low-fat diet than consumers who often used the food labels in 1989, whereas there appeared to be little difference in the probability of eating a low-fat diet among respondents who rarely, never, or sometimes used food labels. Mathios (1998) found evidence which suggested that elimination of health claims for cooking oils in the post-

NLEA period may have stifled the flow of useful information to consumers, especially to the less-educated consumers.

Even if this flow of useful information benefits the minority, Beales, Craswell, and Salop (1981) argue that this is sufficient to influence product changes. They suggest that manufacturers will increase their market shares by reformulating their products (i.e., improving the nutritional content) and thus swaying this minority. In welfare terms, if the expected damage is relatively large, liability rules are not efficient for regulating the market due to insolvency of firms and therefore mandatory labeling is sufficient and essential for welfare maximization and reducing consumption (Coestier, Gozlan, and Marette, 2005). However, concerns about the ineffectiveness of labeling have emerged recently (McCann, 2005). In general, consumers' response to label changes will depend on how much they under- or over- estimate the content of a food in a particular nutrient and if that nutrient is healthful or not (Zarkin and Anderson, 1992).

TABLE 3
Literature Summary for Findings Related to NLEA or Mandatory Labeling in General

Sample Studies	Findings or suggestions
McCann, 2004	Obesity rise is caused by increased fast food consumption.
Bolton, Cohen, and Bloom, 2006	Remedy messages (e.g. nutritional labeling) may boomerang on people they are intended to help the most because some consumers may appear less risk averse when remedies are available.
European Advisory Services, 2004	Total cost of mandatory labeling in Europe to be in excess of €560 million (\$670 million).
Burton and Biswas, 1993	Additional nutritional information as required by the NLEA could affect nutrition attitudes, perceptions and product purchase likelihood.
Mojduszka et al., 1999	No significant change occurred in the average nutritional quality of food products offered for sale by manufacturers after the implementation of the NLEA.
Mojduszka, 2001	Consumer preferences and purchasing patterns within the prepared frozen meals category did not change significantly after the implementation of NLEA.
Balasubramanian and Cole, 2002	No changes in consumers' search for nutritional information or their recall of this information in the pre- and post- NLEA period. Consumers' attention changed for negative nutrition attributes more than it changed for positive attributes
Crespi and Marette, 2003; Finke, 2000	NLEA was seen as a successful labeling program
Burke, Milberg, and Moe, 1997	Success of NLEA was that it eliminated 'hollow' health claims
Finke, 2000	Consumers who often used the 1995 food labels were more likely to eat a low-fat diet than consumers who often used the food labels in 1989. Little difference in probability of eating a low-fat diet among respondents who rarely, never, or sometimes used food labels
Mathios, 1998	Elimination of health claims for cooking oils in the post-NLEA period may have stifled the flow of useful information to consumers

The FAFH case

Even though the NLEA went into effect more than 10 years ago, obesity rates are still rising in the US. Food Away From Home (FAFH) and fast food have been blamed for overlapping the benefits associated with label use, since consumers are now increasingly substituting the at-home consumption, which the NLEA was targeting, with away from home consumption. Therefore, a new debate that has emerged is whether restaurants should provide nutritional information on a mandatory basis. Our purpose is not to completely analyze the aforementioned debate

since this has been addressed by recent studies (The Keystone Center, 2006; Variyam, 2005) but rather to complete the picture on nutritional labeling, which the previous sections have described in the context of at-home consumption.

The big question is whether nutritional information, if mandated on restaurant settings, will have an effect on consumers' diets and whether consumers would demand this kind of information when they eat away from home. The usefulness of such information can be substantial since most consumers underestimate the nutrient content of restaurant foods (Burton et al., 2006) which can be as much as twice of what consumers expected (Burton and Creyer, 2004). Even though some studies showed that provision of nutrition information has an effect on product attitude and purchase intention (Burton and Creyer, 2004; Burton et al., 2006; Kozup, Creyer, and Burton, 2003), other studies found that providing information about energy density or other nutritional information had no effect on overall energy and fat intake (Kral, Roe, and Rolls, 2002; Stubenitsky et al., 2000). On the other hand, providing information voluntarily may not be successful since this will probably be part of a wider scope of the company's marketing strategy dealing with sales increases. For example, five fast food companies in New York in 1985 voluntarily agreed to supply nutritional brochures at their chains, but this agreement failed because the companies either over-powered their brochures with distracting, promotional material, or they simply did not offer them at all (McCann, 2005). McCann (2004) has also suggested the revision of the NLEA in order "...to require the divulgence of nutritional information for all fast food items marketed for childhood consumption. In this narrowly tailored setting, the food decision-making process appears both uniquely optimistic and capable of correction, as parents often dictate or significantly influence the food consumption of their children, and in that particular decision-making process, they internalize an anomalously high value in nutrition and diminished tolerance of risk". One of his arguments in favor of labeling is that fast food, if anything, is remarkable for offering the same product no matter the location, season, or chef (McCann, 2005).

Padberg (1999) pointed out that food companies have little awareness of nutrition issues since their offerings are driven by efficiency, cost savings, food appearance, taste, aroma, etc. If awareness of nutrition is raised (through labeling), then this can be a basis for competition. Padberg also suggested that a policy of nutritional labeling for Food-Away-From-Home should be oriented to the larger firms. Similarly, a report by the Center for Science in the Public Interest proposes that food-service chains with ten or more units be required to list the calorie, saturated and trans fat, and sodium contents of standard menu items on their menus (Center for Science in the Public Interest, 2003).

LABEL FORMATS: WHICH IS PREFERRED?

Having argued about the need for mandating nutritional information on food products, the next question to be answered is: What information should be provided to consumers? Should this information be detailed? What kind of health claims should be used? In what follows, we attempt to provide a general picture of research findings regarding label formats. Table 4 provides a summary of the research findings regarding label formats based on our literature review.

Many people say that they want and would use the largest amount of information offered, but often the preferred amount of information leads to poorer performance (Levy, Fein, and Schucker, 1996), possibly because too much information may lead to "information overload" (Golan et al., 2000). Burton, Biswas, and Netemeyer (1994) found that label formats and reference value information have an effect on consumer perceptions and evaluations. However, there was no evidence that any of the formats used in the study outperformed all others across relevant dimensions.

In contrast, others found that the format that consistently produces the most positive benefits for dietary management tasks is the percentage declaration of the various nutrient amounts based on the daily values for each nutrient (Levy, Fein, and Schucker, 1996). Daily percentage value information in this study helped consumers to better

judge how high or low a specific nutrient was in the food, than when this information was not present. However, Barone et al. (1996) comparing daily values with average-brand reference points found that the latter better facilitate consumers' judgment between healthy and less healthy products. In addition, Viswanathan (1994) found that summary information and verbal presentations of nutrition information facilitate the usage of such information and Viswanathan and Hastak (2002) found that summary information outperforms percent daily values in helping consumers judge the nutritional content of a brand compared with other offerings in that category.

Overall, it appears that consumers do not perform well when they have to do math calculations or handle quantitative information (Eves et al., 1994; Hawkes, 2004; Levy and Fein, 1998). Therefore, formats that avoid quantitative tasks to derive information should be preferred. In another study, women were found to be more capable of locating and manipulating information on labels than men (Byrd-Bredbenner, Wong, and Cottee, 2000). In the same study, women were significantly more able to assess nutrient content claims using the Nutrition Facts label than the current typical EU nutritional label format. Even though consumers showed a preference for the "per 100 grams" (EU label) over the "per serving" (US label) format (Higginson et al., 2002), they had difficulties assessing the amount of nutrients consumed from products like butter and margarine due to the small portion of consumption sizes. The use of simplifying tools such as the percent Daily Value may help translate consumer enthusiasm for the new label into improved food selection (Guthrie, Derby, and Levy, 1999). Furthermore, the use of bold text, colored nutrition panels, whole numbers instead of decimals and calories instead of joules (in a typical EU nutritional label, energy has to be expressed both in terms of calories and joules where 1 kcal=4.18 kJoules) are preferred by the majority of consumers (Co-operative Wholesale Society, 2002).

These difficulties in consumer understanding gave rise to approaches like the "traffic light" labeling. The idea of the "traffic light" labeling is to place colors next to each nutrient of a product, similar to traffic lights, which will indicate low, medium and high assessments of the nutrient. Foods will be labeled with a panel of colored spots relating, possibly, to the amount of salt, sugar, fat and saturated fat. Many health lobbyists are pushing the adoption of some form of traffic light labeling. Even though many professionals find it an "over-simplification" and food companies oppose its possible implementation, traffic light labeling seems to be preferred by consumers. Ninety percent of the consumers in a survey found the use of high, medium, and low assessments next to each nutrition item useful (Co-operative Wholesale Society, 2002). One should keep in mind that if this format was to be adopted, it could make it hard for some "fat" products to sell even though they might be beneficial as part of the whole diet (Hawkes, 2004). Another argument opposing its implementation is that this form of labeling would just indicate the lack of 'bad' components rather than the presence of 'good' components. For example components that might increase good cholesterol are not indicated by this labeling format. However, a number of consumer focus groups have shown a clear preference toward this form of labeling.

To further illustrate the discussion above, in a survey conducted in the United Kingdom, 55.5% of consumers said they want to be given more detailed information, 44.8% want labels to use simpler words, 35.3% want them to have less numerical information, and 23.5% want to see symbols and pictures on the labels (Abbott, 1997). In addition, consumers preferred the nutrition label that displays all nutrient values using a bar graph format (Geiger et al., 1991).

The most looked at components of a label were found to be energy and fat, but consumer experts tend to look for other information like saturated fat (Higginson et al., 2002). However, the term "energy" and the expressions given in the international energy units, joules, are less widely understood (Eves et al., 1994). This may be a signal that consumers tend not to understand complicated terms and therefore truncate their search. This also calls for the conduct of education campaigns in order to increase nutrition knowledge of consumers since increased consumer knowledge of nutrition information may reduce consumer misperceptions (Mazis and Raymond, 1997). Consumers also tend to look at information about the "negative" nutrients (Worsley, 1996). Furthermore, consumers are having difficulties distinguishing between sugar and carbohydrates and sodium and salt (Co-operative Wholesale Society, 2002). The label information, seen as the most useful, is that related to public health problems (e.g. calories, sodium, proteins) (Heimbach and Stokes, 1982). Researchers have also suggested that a problem with the

various label formats is that these do not highlight information related to obesity but rather provide nutritional information that is relatively unrelated to weight-relevant concerns and outcomes (Seiders and Petty, 2004).

Several studies have also explored the role of health claims as a moderating factor in the search for nutritional information. Label claims are distinguished between two types: nutrient content claims and health benefit claims, but consumers find this distinction confusing (Derby and Levy, 2001). Overall, consumers value more products with claims than products with no claims at all and these claims induce consumers to pay more attention to the nutrition panel (Teratanavat et al., 2004). These authors concluded that consumers tend to rely more on the nutritional panel than claims. It may be that consumers see claims as a form of promotion and this is why claims have little impact on product evaluations (Ford et al., 1996; Garretson and Burton, 2000; Keller et al., 1997; Mitra et al., 1999). On the other hand, Roe, Levy, and Derby (1999) found that the presence of health and nutrient claims on food packages induces respondents to truncate information search to the front panel of packages. Furthermore, the presence of a claim was associated with a halo effect (rating the product higher on other health attributes not mentioned in the claim) and a magic-bullet effect (attributing inappropriate health benefits to the product). It is also interesting that lower educated consumers were more likely to rely only on the front panel. Burke, Milberg, and Moe (1997) found that broader claims (i.e., claims that communicate information for the whole product category) help low-knowledge consumers, but are not likely to be used by marketers since these benefit the whole product category. Consumers may also over-generalize (i.e., mis-interpret) and be affected by advertising of nutrient content claims (Andrews, Netemeyer, and Burton, 1998). Mazis and Raymond (1997) found that consumers tended to have lower beliefs about the nutritional value of food products with both nutrition information and the health claim as opposed to food products with only the health claim. Furthermore, using two sides of the package for claims (short claim on front; long on back) increases the believability of health claims (Wansink, 2003; Wansink, Sonka, and Hasler, 2004). These shorter health claims also led to more favorable beliefs about the product and to a more positive image of the product.

TABLE 4
Literature Summary for Labeling Formats

Sample Studies	Findings or suggestions
Levy, Fein, and Schucker, 1996	The percentage declaration of the various nutrient amounts based on the daily values for each nutrient is the format producing the most benefits for dietary management tasks.
Barone et al., 1996; Viswanathan, 1994; Viswanathan and Hastak, 2002	Comparing to daily values, average-brand reference points facilitate consumers' judgment between healthy and less healthy products.
Eves et al., 1994; Hawkes, 2004; Levy and Fein, 1998	Consumers do not perform well when they have to do math calculations or handle quantitative information.
Byrd-Bredbenner, Wong, and Cottee, 2000	Women were significantly more able to assess nutrient content claims using the Nutrition Facts label than the current typical EU nutritional label format.
Higginson et al., 2002	Consumers showed a preference for the "per 100 grams" (EU label) over the "per serving" (US label) format.
Co-operative Wholesale Society, 2002	Use of bold text, colored nutrition panels, whole numbers instead of decimals and calories instead of joules are preferred by the majority of consumers Ninety percent of the consumers in a survey found the use of high, medium and low assessments next to each nutrition item useful Consumers are having difficulties distinguishing between sugar and carbohydrates and sodium and salt.
Eves et al., 1994	The term "energy" and the expressions given in the international energy units, joules, are less widely understood.
Heimbach and Stokes, 1982	The label information, seen as the most useful, is that related to public health problems (e.g. calories, sodium, proteins).
Derby and Levy, 2001	Consumers find the distinction between nutrient and health claims

	confusing.
Teratanavat et al., 2004	Consumers value more products with claims than products with no claims at all.
Roe, Levy, and Derby, 1999	The presence of health and nutrient claims on food packages induces respondents to truncate information search to the front panel of packages.
Burke, Milberg, and Moe, 1997	Broader claims (i.e., claims that communicate information for the whole product category) help low-knowledge consumers.
Wansink, 2003; Wansink, Sonka, and Hasler, 2004	Using two sides of the package for claims (short claim on front; long on back) increases the believability of health claims.

DOES NUTRITIONAL LABEL USE AFFECT PURCHASING BEHAVIOR?

Another important issue related to use of nutrition information is whether reading nutritional labels, with all the advantages and disadvantages of the different formats, affects purchasing behavior or do other factors (e.g., taste) dominate the decision process.

Derby and Levy (2001) report that, in the 1990 Diet and Health Survey, one-third of consumers said they had changed their decision to buy a product because of the information on the nutrition label. The same authors report that in another survey in 1995, almost 48% of consumers reported that they changed their purchasing behavior due to nutritional labels. Furthermore, they cite a 1996 survey where one-third of those interviewed said that they stopped buying a product that they had regularly purchased and used because they read the nutrition label, and one in four started to buy or use a product not used before based on the nutrition label, with fat being the main information that influenced their decision.

In accordance with the previously reported results, Abbott (1997), Hawkes (2004), and Shine, O'Reilly, and O'Sullivan (1997b) found that nutrient information does affect food choice. The most common reason cited for use of this information was the avoidance of negative nutrients (Shine, O'Reilly, and O'Sullivan, 1997b). Furthermore, Baltas (2001a) found that nutritional information affected brand choice. In other studies, results suggest that labeling of food products, with respect to their nutritional characteristics along with an information campaign to educate consumers, can significantly affect consumer behavior (Teisl, Bockstael, and Levy, 2001; Teisl and Levy, 1997). Kreuter et al. (1997) conducted a survey in a clinical setting and results revealed that patients eating diets lower in fat were much more likely than patients whose diets were higher in fat, to report that nutritional labels influenced their food purchasing decisions.

Overall, it appears that nutritional label use affects purchasing behavior because it influences valuations and perceptions of the product. In that context, several surveys have studied the effect that claims create on personal evaluations. Derby and Levy (2001) report that in the 1990 FMI (Food Marketing Institute) Trends Survey, 73% of the sample said that health claims influenced their purchase decisions, even though only 8% considered health claims very believable. Health claims in the front of the package also create more favorable judgments about the product (Levy and Fein, 1998) because these claims also lead to truncated information search (Roe, Levy, and Derby, 1999). When a product features a health or content claim, respondents view the product as healthier and state that they are more likely to purchase it, independent of their information search behavior (Roe, Levy, and Derby, 1999). Ippolito and Mathios (1991) found that consumers increased their fiber cereal consumption once cereals' producers were allowed to advertise the associated health benefits. In contrast to the above, claims do not affect product evaluations or purchase intentions, and there is a weak effect of inclusion of a health claim on disease risk perceptions (Garretson and Burton, 2000).

One needs to also keep in mind that consumers have to choose between myriads of food to consume everyday. These foods carry complex combinations of nutritional and taste characteristics. Often foods that taste better are

considered to be least nutritious. However, consumers may continue to choose tasteful but nutritionally poor foods, because taste offers immediate gratification while the benefits of a proper nutrition can be realized only in the long run. In fact, dietary indulgence is often cited as evidence of the consumer's more general problem of "self-control" (Smith, 2004).

CAN USE OF NUTRITIONAL INFORMATION LEAD TO DIETARY CHANGES?

The NLEA was seen as a major breakthrough and the number of discounted life years that could be gained was estimated to be as high as 1.2 million life years during the next 20 years (Zarkin et al., 1993). On the other hand, Teisl, Bockstael, and Levy (2001) argued that providing health-related information does not always lead consumers to switch their consumption away from "unhealthy" products. This may mean that consumers need to be educated about the beneficial impact of making healthful food choices first (Golodner, 1993). Most empirical research, however, indicates that provision and use of nutritional information can significantly change dietary patterns.

Variyam, Blaylock, and Smallwood (1995; 1997) assessed the effect of information (as expressed by knowledge) on dietary intake. This study found that general knowledge reduced the intake of total fat, saturated fat, and cholesterol. Brown and Schrader (1990) found that increased information about cholesterol decreased egg consumption per capita. Similarly, Yen, Jensen, and Wang (1996) found that nutritional information changed demand for fats and oils. Chern, Loehman, and Yen (1995) found that cholesterol information reduced consumption of butter and lard.

Survey results are more specific when it comes to the use of nutritional information. In general, label use has been found to affect diet (Hawkes, 2004), and increased use of food labels has been associated with healthier patterns of dietary behavior as well as food choice motivations (Coulson, 2000). Other studies associated label use with diets high in vitamin C and low in cholesterol (Guthrie et al., 1995) and with a lower percentage of calories from fat (Lin and Lee, 2003). In addition, disclosure of cereal brands' sugar content ("negative" information) caused consumers to switch to low-sugar cereals (Russo et al., 1986), while Variyam, Blaylock, and Smallwood (1996) confirmed the influence of nutritional information on fiber intake.

Furthermore, consumers' label use was found to increase the average Healthy Eating Index (HEI) by a range between 3.5 and 6.1 points, with higher improvements in diet quality detected when health claim information was used (Kim, Nayga, and Capps, 2001a). Variyam (2004) found that the Nutrition Facts panel that was mandated by the NLEA, increased the fiber, iron, and protein intakes of consumers who used labels compared with non users. Neuhouser, Kristal, and Patterson (1999) found that label use was associated with lower fat intake, explaining 6% of the variance in fat intake. Kim, Nayga, and Capps (2000) found that label users generally had healthier diets than non users, i.e., lower percentage of calories from fat and saturated fat, lower cholesterol and sodium intake, and higher fiber intake.

CONCLUSIONS AND FUTURE AREAS OF RESEARCH

This paper synthesized the results of empirical research related to nutritional label use. The summary of results presented in this paper provides valuable information for directions for future research and development of theoretical and empirical studies.

Our review indicates that several factors affect the use of nutrition information, but a number of these factors have conflicting effects due to differences and diversity in methodology, data, timing, location, and scope of the studies. In addition, although there is some consistency as to which general factors are considered by researchers, the

range of factors included in the individual studies varied considerably. There also seems to be a need to broaden research in specific directions in order to increase the generalizability of the findings.

There appears to be an overrepresentation of studies conducted in the United States in the empirical literature. There is, therefore, a need for replication of research, particularly in Europe where new nutritional labeling regulations are being proposed and debated. Any differences or similarities in terms of the determinants of nutritional label use can only be understood if research is replicated in these areas. No studies have examined inter-country differences yet and, hence, there is a need for future research in this direction.

It appears from the analysis that mandating nutritional labels on processed foods may help consumers improve their food or dietary choices (see section on nutritional information and dietary changes). In general, studies cited in the previous section show that the effect of information is positive on several beneficial nutrient components (e.g. fiber) and negative on harmful components such as fat, cholesterol etc. However, nutritional labels are currently mandated for the food at home market and not in the FAFH market. FAFH now constitutes a big part of consumers' diets and has, consequently, raised the debate on whether to mandate nutritional labeling regulations in the FAFH sector in the United States. The reason on why obesity rates in US are still rising, even though the NLEA went into effect more than 10 years ago, may as well be the significant increase of the FAFH market and of the proportion of people eating away from home, substituting in-home consumption. More research on nutritional label use in the FAFH market is indeed warranted.

As far as the formats are concerned, studies show that consumers prefer labels to be graphic and colored, rather than the currently used quantitatively-oriented labels. Further work on this area is also needed to definitively assess the best formats that consumers will use and comprehend.

Beyond these, a key question that has not been answered by our literature review, and therefore requires further research, is whether consumers demand nutritional information when eating out and, if they do, under what conditions. For example, many consumers dine out not only to satisfy hunger, but also for the atmosphere and for other social reasons beyond nutritional considerations. Consumers may also regard eating out as an opportunity to eat more and restaurants are judged negatively if they serve too small portions. Furthermore, requiring restaurants to provide nutritional information for their menus will incur costs similar to the costs incurred with packaged food products (see also the assessment of the EU Commission on the provision of nutrition information in EU countries; European Advisory Services, 2004). These costs will be passed on to the consumers, and it is a matter of further investigation if consumers are willing to pay these costs for the sake of a healthier diet.

We also presented evidence from a few studies that suggest that nutritional labeling positively influences purchasing behavior and that it can promote healthier consumption. These studies, however, have used cross-sectional data. No large-scale, longitudinal research has yet been conducted on the determinants of nutritional label use and the effect of nutritional label use on purchase and consumption behavior. Longitudinal analysis would assess the temporal stability of the conclusions derived from the extant literature. Finally, research on nutritional label use can be characterized as applied research and an area of future research that needs some attention is development and testing of theoretical models related to nutritional label use. Future review studies should also make use of meta-analytic techniques. The empirical studies included in this review, however, used a wide variety of methodologies, measures, and objectives. Hence, due to the incompatible and inconsistent nature of the reported results, these studies could not be subjected to a formal meta-analysis.

REFERENCES

Abbott, R. (1997). Food and nutrition information: a study of sources, uses, and understanding. *British Food Journal*, 99(2), 43-49.

- Akerlof, G. A. (1970). The market for 'Lemons': Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488-500.
- Aldrich, L. (1999). Consumer use of information: Implications for food policy. *Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Handbook No. 715.*
- Andrews, J. C., Netemeyer, R., and Burton, S. (1998). Consumer generalization of nutrient content claims in advertising. *Journal of Marketing*, 62(October), 62-75.
- Center for Science in the Public Interest. (2003). Anyone's guess, The need for nutrition labeling at fast-food and other chain restaurants. Washington DC, USA: Center for Science in the Public Interest.
- Balasubramanian, S. K., and Cole, C. A. (2002). Consumers' search and use of nutrition information: The challenge and promise of the Nutrition Labeling and Education Act. *Journal of Marketing*, 66(July), 112-127.
- Baltas, G. (2001a). The effects of nutrition information on consumer choice. *Journal of Advertising Research*, March/April, 57-63.
- Baltas, G. (2001b). Nutrition labelling: issues and policies. *European Journal of Marketing*, 35(5/6), 708-721.
- Barone, M. J., Rose, R. L., Manning, K. C., and Miniard, P. W. (1996). Another look at the impact of reference information on consumer impressions of nutrition information. *Journal of Public Policy & Marketing*, 15(1), 55-62.
- Beales, H. J., Craswell, R., and Salop, S. (1981). The efficient regulation of consumer information. *Journal of Law and Economics*, 24(December), 491-539.
- Beatty, S. E., and Smith, S. M. (1987). External search effort: An investigation across several product categories. *Journal of Consumer Research*, 14(1), 83-95.
- Bender, M. M., and Derby, B. M. (1992). Prevalence of reading nutrition and ingredient information on food labels among adult Americans: 1982-1988. *Journal of Nutrition Education*, 24, 292-297.
- Bolton, L. E., Cohen, J. B., and Bloom, P. N. (2006). Does marketing products as remedies create "Get out of jail free cards"? *Journal of Consumer Research*, 33(June), 71-81.
- Brown, D. J., and Schrader, L. F. (1990). Cholesterol information and shell egg consumption. *American Journal of Agricultural Economics*, 72(3), 548-555.
- Burke, S. J., Milberg, S. J., and Moe, W. W. (1997). Displaying common but previously neglected health claims on product labels: Understanding competitive advantages, deception, and education. *Journal of Public Policy & Marketing*, 16(2), 242-255.
- Burton, S., and Andrews, J. C. (1996). Age, product nutrition, and label format effects on consumer perceptions and product evaluations. *The Journal of Consumer Affairs*, 30(1), 68-89.
- Burton, S., and Biswas, A. (1993). Preliminary assessment of changes in labels required by the Nutrition Labeling and Education Act of 1990. *The Journal of Consumer Affairs*, 27(1), 127-144.
- Burton, S., Biswas, A., and Netemeyer, R. (1994). Effects of alternative nutrition label formats and nutrition reference information on consumer perceptions, comprehension, and product evaluations. *Journal of Public Policy & Marketing*, 13(1), 36-47.
- Burton, S., and Creyer, E. H. (2004). What consumers don't know can hurt them: Consumer evaluations and disease risk perceptions of restaurant menu items. *The Journal of Consumer Affairs*, 38(1), 121-145.
- Burton, S., Creyer, E. H., Kees, J., and Huggins, K. (2006). Attacking the obesity epidemic: The potential health benefits of providing nutrition information in restaurants. *American Journal of Public Health*, 196(9), 1669-1675.
- Byrd-Bredbenner, C., Wong, A., and Cottee, P. (2000). Consumer understanding of US and EU nutrition labels. *British Food Journal*, 102(8), 615-629.
- Caswell, J. A. (1992). Current information levels on food labels. *American Journal of Agricultural Economics*, 74(5), 1196-1201.
- Caswell, J. A., and Mojduszka, E. M. (1996). Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics*, 78(5), 1248-1253.
- Caswell, J. A., and Padberg, D. I. (1992). Toward a more comprehensive theory of food labels. *American Journal of Agricultural Economics*, 74(2), 460-468.
- Chern, W. S., Loehman, E. T., and Yen, S. T. (1995). Information, health risk beliefs and the demand for fats and oils. *Review of Economics and Statistics*, 77, 555-564.

- Coestier, B., Gozlan, E., and Marette, S. (2005). On food companies liability for obesity. *American Journal of Agricultural Economics*, 87(1), 1-14.
- Cole, C. A., and Balasubramanian, S. K. (1993). Age differences in consumers' search for information: Public policy implications. *The Journal of consumer Research*, 20(1), 157-169.
- Cole, C. A., Balasubramanian, S. K., and Castellano, N. M. (1992). Individual differences in consumers' willingness to use nutritional information. In J. F. Sherry, Jr. and B. Sternthal (Eds.), in *Advances in Consumer Research* (Vol. 19, pp. 489-490). Provo, UT, USA: Association for Consumer Research.
- Coulson, N. S. (2000). An application of the stages of change model to consumer use of food labels. *British Food Journal*, 102(9), 661-668.
- Cowburn, G., and Stockley, L. (2003). *A systematic review of the research on consumer understanding of nutrition labelling*. Brussels: European Heart Network.
- Co-operative Wholesale Society Ltd., UK. (2002). *Lie of the label II: Why dishonest labelling is past its sell-by date*: Co-operative Wholesale Society Ltd., UK.
- Crespi, J. M., and Marette, S. (2003). Some economic implications of public labeling. *Journal of Food Distribution Research*, 34(3), 83-94.
- Crutchfield, S., Kuchler, F., and Variyam, J. N. (2001). The economic benefits of nutrition labeling: A case study for fresh meat and poultry products. *Journal of Consumer Policy*, 24, 185-207.
- Darby, M. R., and Karni, E. (1973). Free competition and the optimal amount of fraud. *Journal of Law and Economics*, 16(1), 67-88.
- Derby, B. M., and Fein, S. B. (1994). Meeting the NLEA Challenge: A Consumer Research Perspective. In R. Shapiro (Ed.), *Nutrition Labeling Handbook* (pp. 315-353). New York: Marcel Dekker.
- Derby, B. M., and Levy, A. S. (2001). Do food labels work? Gauging the effectiveness of food labels pre- and post-NLEA. In P. N. Bloom and G. T. Gundlach (Eds.), *Handbook of marketing and society* (pp. 372-398): Sage, Thousand Oaks, CA.
- Drichoutis, A. C., and Lazaridis, P. (2006). What influences tastes? An analysis of the determinants of consumers' demand for tastes in food: Agricultural University of Athens.
- Drichoutis, A. C., Lazaridis, P., and Nayga, R. M., Jr. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics*, 32(1), 93-118.
- Drichoutis, A. C., Lazaridis, P., and Nayga, R. M., Jr. (2006). The economics of nutrition information search: Agricultural University of Athens.
- Drichoutis, A. C., Lazaridis, P., and Nayga, R. M., Jr. (2007). An assessment of product class involvement in food purchasing behaviour. *European Journal of Marketing*, 40(forthcoming).
- Eves, A., Gibson, S., Kilcast, D., and Rose, D. (1994). Influence of nutrition information on the attitudes and knowledge of dieters. *Nutrition & Food Science*, 5(September/October), 17-21.
- European Advisory Services. (2004). *The introduction of mandatory labelling in the European Union*. Brussels: European Advisory Services.
- Feick, L. F., Herrmann, R. O., and Warland, R. H. (1986). Search for nutrition information: A probit analysis of the use of different information sources. *The Journal of Consumer Affairs*, 20(2), 173-192.
- Finke, M. S. (2000). *Did the Nutrition Labeling and Education Act affect food choice in the United States?*, The American Consumer and the Changing Structure of the Food System Conference. Arlington, VA: Economic Research Service USDA.
- Ford, G. T., Hastak, M., Mitra, A., and Ringold, D. J. (1996). Can consumers interpret nutrition information in the presence of a health claim? A laboratory investigation. *Journal of Public Policy & Marketing*, 15(1), 16-27.
- Garretson, J. A., and Burton, S. (2000). Effects of nutrition facts panel values, nutrition claims, and health claims on consumer attitudes, perceptions of disease-related risks, and trust. *Journal of Public Policy & Marketing*, 19(2), 213-227.
- Geiger, C. J., Wyse, B. W., Parent, C. R., and Hansen, R. G. (1991). Nutrition labels in bar graph format deemed most suitable for consumer purchase decisions using adaptive conjoint analysis. *Journal of the American Dietetic Association*, 91(7), 800-807.
- Golan, E., Kuchler, F., Mitchell, L., Greene, C., and Jessup, A. (2000). Economics of food labelling. *USDA Research Service, Agricultural Economic Report No. 793*.

- Golodner, L. F. (1993). Healthy confusion for consumers. *Journal of Public Policy & Marketing*, 12(1), 130-134.
- Govindasamy, R., and Italia, J. (1999). The influence of consumer demographic characteristics on nutritional label usage. *Journal of Food Products Marketing*, 5(4), 55-68.
- Grossman, S. J. (1981). The informational role of warranties and private disclosure about product quality. *Journal of Law and Economics*, 24(December), 461-483.
- Guthrie, J. F., Derby, B. M., and Levy, A. S. (1999). What people know and do not know about nutrition. In E. Frazao (Ed.), *America's eating habits: Changes and consequences* (pp. 243-280): US Department of Agriculture, Economic Research Service, Agriculture Information Bulletin No. (AIB750).
- Guthrie, J. F., Fox, J. J., Cleveland, L. E., and Welsh, S. (1995). Who uses nutritional labeling, and what effects does label use have on diet quality? *Journal of Nutrition Education*, 27(4), 163-172.
- Hawkes, C. (2004). Nutrition labels and health claims: the global regulatory environment. *World Health Organization, Geneva*.
- Heimbach, J. T., and Stokes, R. C. (1982). Nutrition labeling and public health: survey of American Institute of Nutrition members, food industry, and consumers. *The American Journal of Clinical Nutrition*, 36(October), 700-708.
- Higginson, C. S., Rayner, M. F., Draper, S. W., and Kirk, T. R. (2002). The nutrition label - which information is looked at? *Nutrition and Food Science*, 32(3), 92-99.
- Ippolito, P. M., and Mathios, A. D. (1990). Information, advertising and health choices: A study of the cereal market. *The RAND Journal of Economics*, 21(3), 459-480.
- Ippolito, P. M., and Mathios, A. D. (1991). Health claims in food marketing: Evidence on knowledge and behavior in the cereal market. *Journal of Public Policy & Marketing*, 10(1), 15-32.
- Kant, A. K. (2000). Consumption of energy-dense, nutrient-poor foods by adult Americans: nutritional and health implications. The third National Health and Nutrition Examination Survey, 1988-1994. *American Journal of Clinical Nutrition*, 72, 929-936.
- Katona, G. C., and Mueller, E. (1955). A study of purchase decisions. In L. H. Clark (Ed.), *Consumer behavior: The dynamics of consumer reactions* (pp. 30-87). New York: New York University Press.
- Keller, S. B., Landry, M., Olson, J., Velliquette, A. M., Burton, S., and Andrews, J. C. (1997). The effects of nutrition package claims, nutrition facts panels, and motivation to process nutrition information on consumer product evaluations. *Journal of Public Policy & Marketing*, 16(2), 256-269.
- Kim, S.-Y., Nayga, R. M., Jr., and Capps, O., Jr. (2000). The effect of food label use on nutrient intakes: An endogenous switching regression analysis. *Journal of Agricultural and Resource Economics*, 25(1), 215-231.
- Kim, S.-Y., Nayga, R. M., Jr., and Capps, O., Jr. (2001a). Food label use, self-selectivity, and diet quality. *The Journal of Consumer Affairs*, 35(2), 346-363.
- Kim, S.-Y., Nayga, R. M., Jr., and Capps, O., Jr. (2001b). Health knowledge and consumer use of nutritional labels: The issue revisited. *Agricultural and Resource Economics Review*, 30(1), 10-19.
- Kozup, J. C., Creyer, E. H., and Burton, S. (2003). Making healthful food choices: The influence of health claims and nutrition information on consumers' evaluations of packaged food products and restaurant menu items. *Journal of Marketing*, 67(April), 19-34.
- Kral, T. V. E., Roe, L. S., and Rolls, B. J. (2002). Does nutrition information about the energy density of meals affect food intake in normal-weight women? *Appetite*, 39(October), 137-145.
- Kreuter, M. W., Brennan, L. K., Shriff, D. P., and Lukwago, S. N. (1997). Do nutrition label readers eat healthier diets? Behavioral correlates of adults' use of food labels. *American Journal of Preventive Medicine*, 13, 277-283.
- Lambert, N., Dibsdall, L. A., and Frewer, L. J. (2002). Poor diet and smoking: the big killers. Comparing health education in two hazard domains. *British Food Journal*, 104(1), 63-75.
- Lancaster, K. (1966). A new approach to consumer theory. *The Journal of Political Economy*, 74(2), 132-157.
- Leung, P., and Miklius, W. (1997). Demand for nutrition vs. demand for tastes. *Applied Economics Letters*, 4, 291-295.
- Levy, A. S., and Fein, S. B. (1998). Consumers' ability to perform tasks using nutrition labels. *Journal of Nutrition Education*, 30(4), 210-217.

- Levy, A. S., Fein, S. B., and Schucker, R. E. (1996). Performance characteristics of seven nutrition label formats. *Journal of Public Policy & Marketing*, 15(1), 1-15.
- Lin, C.-T. J., and Lee, J.-Y. (2003). Dietary fat intake and search for fat information on food labels: New evidence. *Consumer Interests Annual*, 49.
- Loureiro, M. L., Gracia, A., and Nayga, R. M., Jr. (2006). Do consumers value nutritional labels? *European Review of Agricultural Economics*, 33(2), 249-268.
- Magat, W. A., and Viscusi, W. K. (1992). *Informational approaches to regulation*. Cambridge MA: MIT Press.
- Marshall, T. (2000). Exploring a fiscal food policy: the case of diet and ischaemic heart disease. *British Medical Journal*, 320(7230), 301-305.
- Mathios, A. D. (1998). The importance of nutrition labeling and health claim regulation on product choice: An analysis of the cooking oils market. *Agricultural and Resource Economics Review*, 27(2), 159-168.
- Mazis, M. B. (1980). An overview of product labeling and health risks. In L. A. Morris, M. B. Mazis, and I. Barofsky (Eds.), *Product labeling and health risks*. New York: Cold Spring Harbor Laboratory.
- Mazis, M. B., and Raymond, M. A. (1997). Consumer perceptions of health claims in advertisements and on food labels. *The Journal of Consumer Affairs*, 31(1), 10-26.
- McCann, M. A. (2004). Economic efficiency and consumer choice theory in nutritional labeling. *Winsconsin Law Review*, 1161.
- McCann, M. A. (2005). Comparing legal, economic, and legislative approaches to nutritional labeling of fast food items. *Update*(Jan/Febr), 4-8.
- McLean-Meyinsse, P. E. (2001). An analysis of nutritional label use in the Southern United States. *Journal of Food Distribution Research*, 32(1), 110-114.
- Mitra, A., Hastak, M., Ford, G. T., and Ringold, D. J. (1999). Can the educationally disadvantaged interpret the FDA-mandated nutrition facts panel in the presence of an implied health claim? *Journal of Public Policy & Marketing*, 18(1), 106-117.
- Mojduszka, E. M. (2001). Integration of a product choice model and a latent variable model of nutrition information, AAEA conference. Chicago, Illinois.
- Mojduszka, E. M., and Caswell, J. A. (2000). A test of nutritional quality signaling in food markets prior to implementation of mandatory labeling. *American Journal of Agricultural Economics*, 82, 298-309.
- Mojduszka, E. M., Caswell, J. A., West, D. B., and Harris, J. M. (1999). Changes in nutritional quality of food product offerings and purchases, A case study in the mid-1990's. *Economic Research Service Report, Technical Bulletin 1880, USDA, Washington DC*.
- Moorman, C. (1990). The effects of stimulus and consumer characteristics on the utilization of nutrition information. *The Journal of consumer Research*, 17(3), 362-374.
- Moorman, C. (1996). A quasi-experiment to assess the consumer and informational determinants of nutrition information processing activities : The case of the Nutrition Labeling and Education Act. *Journal of Public Policy & Marketing*, 15(1), 28-44.
- Moorman, C. (1998). Market level effects of information: Competitive responses and consumer dynamics. *Journal of Marketing Research*, 35(February), 82-98.
- Moorman, C., and Matulich, E. (1993). A model of consumers' preventive health behaviors: the role of health motivation and health ability. *Journal of Consumer Research*, 20(September), 208-228.
- Nayga, R. M., Jr. (1996). Determinants of consumers' use of nutritional information on food packages. *Journal of Agricultural and Applied Economics*, 28(2), 303-312.
- Nayga, R. M., Jr. (1999). Toward an understanding of consumers' perceptions of food labels. *International Food and Agribusiness Management Review*, 2(1), 29-45.
- Nayga, R. M., Jr. (2000). Nutrition knowledge, gender, and food label use. *The Journal of Consumer Affairs*, 34(1), 97-112.
- Nayga, R. M., Jr., Lipinski, D., and Savur, N. (1998). Consumers' use of nutritional labels while food shopping and at home. *The Journal of Consumer Affairs*, 32(1), 106-120.
- Nelson, P. (1970). Information and consumer behavior. *The Journal of Political Economy*, 78(2), 311-329.
- Nelson, P. (1974). Advertising as information. *The Journal of Political Economy*, 82(4), 729-754.
- Neuhouser, M. L., Kristal, A. R., and Patterson, R. E. (1999). Use of food nutrition labels is associated with lower fat intake. *Journal of the American Dietetic Association*, 99, 45-53.

- O'Rourke, A., Stanley, J. C., Ravnskov, U., and Marshall, T. (2000). VAT and fat. *British Medical Journal*, 320(7247), 1469-1476.
- Padberg, D. (1999). Nutritional labeling for Food-Away-From-Home, New Economic Approaches to Consumer Welfare and Nutrition. Alexandria, VA, USA.
- Pappalardo, J. K. (1996). Evaluating the NLEA: Where's the beef? *Journal of Public Policy & Marketing*, 15(1), 153-156.
- Park, W. C., Iyer, E. S., and Smith, D. C. (1989). The effects of situational factors on in-store grocery shopping behavior: The role of store environment and time available for shopping. *The Journal of consumer Research*, 15(4), 422-433.
- Petrucelli, P. J. (1996). Consumer and marketing implications of information provision: The case of the Nutrition Labeling and Education Act of 1990. *Journal of Public Policy & Marketing*, 15(1), 150-153.
- Piedra, M. A., Schupp, A. R., and Montgomery, D. E. (1996). Consumer use of nutrition labels on packaged meats. *Journal of Food Distribution Research*, 27(2), 42-47.
- Prathiraja, P. H. K., and Ariyawardana, A. (2003). Impact of nutritional labeling on consumer buying behavior. *Sri Lankan Journal of Agricultural Economics*, 5(1), 35-46.
- Roe, B., Levy, A. S., and Derby, B. M. (1999). The impact of health claims on consumer search and product evaluation outcomes: Results from FDA experimental data. *Journal of Public Policy & Marketing*, 18(1), 89-105.
- Rose, D. (1994). Attitudes and behaviors related to weight status. *Food Review*, 17, 30-35.
- Russo, J. E., Staelin, R., Nolan, C. A., Rusell, G. J., and Metcalf, B. L. (1986). Nutrition information in the supermarket. *Journal of Consumer Research*, 13(1), 48-70.
- Schenker, S. (2000). VAT on fatty foods. *Nutrition Bulletin*, 25, 101-102.
- Schultz, T. W. (1975). The value of the ability to deal with disequilibria. *Journal of Economic Literature*, 13(3), 827-846.
- Schupp, A., Gillespie, J., and Reed, D. (1998). Consumer awareness and use of nutrition labels on packaged fresh meats: A pilot study. *Journal of Food Distribution Research*, 29(2), 24-30.
- Seiders, K., and Petty, R. D. (2004). Obesity and the role of food marketing: A policy analysis of issues and remedies. *Journal of Public Policy & Marketing*, 23(2), 153-169.
- Sexton, R. J. (1979). A theory on information and its application to the effect of labeling on food products. *Staff paper P79-35, Department of Agricultural and Applied Economics, University of Minnesota*, October.
- Shine, A., O'Reilly, S., and O'Sullivan, K. (1997a). Consumer attitudes to nutrition labelling. *British Food Journal*, 99(8), 283-289.
- Shine, A., O'Reilly, S., and O'Sullivan, K. (1997b). Consumer use of nutrition labels. *British Food Journal*, 99(8), 290-296.
- Silberberg, E. (1985). Nutrition and the demand for tastes. *The Journal of Political Economy*, 93(5), 881-900.
- Silberberg, E., and Suen, W. (2001). *The structure of economics, A mathematical approach* (3rd ed.). New York: McGraw-Hill.
- Silverglade, B. A. (1996). The Nutrition Labeling and Education Act-Progress to date and challenges for the future. *Journal of Public Policy & Marketing*, 15(1), 148-156.
- Smith, T. G. (2004). The McDonald's equilibrium, Advertising, empty calories, and the endogenous determination of dietary preferences. *Social Choice and Welfare*, 23, 383-413.
- Stigler, G. J. (1961). The economics of information. *The Journal of Political Economy*, 69(3), 213-225.
- Stubenitsky, K., Aaron, J. I., Catt, S. L., and Mela, D. J. (2000). The influence of recipe modification and nutritional information on restaurant food acceptance and macronutrient intakes *Public Health Nutrition*, 3(2), 201-209.
- Szykman, L. R., Bloom, P. N., and Levy, A. S. (1997). A proposed model of the use of package claims and nutrition labels. *Journal of Public Policy and Marketing*, 16(2), 228-241.
- Teisl, M. F., Bockstael, N. E., and Levy, A. S. (1997). Preferences for food labels: A discrete choice approach. In J. A. Caswell and R. W. Cotterill (Eds.), *Strategy and policy in the food system: Emerging issues* (pp. 171-194). Washington, D.C.
- Teisl, M. F., Bockstael, N. E., and Levy, A. S. (2001). Measuring the welfare effects of nutrition information. *American Journal of Agricultural Economics*, 83(1), 133-149.

- Teisl, M. F., and Levy, A. S. (1997). Does nutrition labeling lead to healthier eating? *Journal of Food Distribution Research*, 28(3), 18-27.
- Teisl, M. F., and Roe, B. (1998). The economics of labeling: An overview of issues for health and environmental disclosure. *Agricultural and Resource Economics Review*, 27(2), 140-150.
- Teratanavat, R. P., Hooker, N. H., Haugtvedt, C. P., and Rucker, D. D. (2004). Consumer understanding and use of health information on product labels: Marketing implications for functional food, AAEA conference. Denver, Colorado.
- Thayer, W. (1997). Retailers select 10 best new products of the year. *Frozen Food Age*, 46(1), 1-96.
- The Keystone center. (2006). The Keystone forum on Away-From-Home food: Opportunities for preventing weight gain and obesity. Washington DC, USA: The Keystone center.
- Variyam, J. N. (2004). Evaluating the effect of nutrition labels: a quasi-experimental approach, Creating and Using Evidence in Public Policy Analysis and Management. Atlanta, GA, USA: Twenty-Sixth Annual AP-PAM Research Conference.
- Variyam, J. N. (2005). *Nutrition labeling in the Food-Away-From-Home sector: An economic assessment*: United States Department of Agriculture, Economic Research Service Report No 4.
- Variyam, J. N., Blaylock, J., and Smallwood, D. (1995). Modeling nutrient intake: The role of dietary information. *Economic Research Service, US Department of Agriculture, TB-1842*.
- Variyam, J. N., Blaylock, J., and Smallwood, D. (1996). A probit latent variable model of nutrition information and dietary fiber intake. *American Journal of Agricultural Economics*, 78, 628-639.
- Variyam, J. N., Blaylock, J., and Smallwood, D. (1997). Diet-health information and nutrition: The intake of dietary fats and cholesterol. *Economic Research Service, US Department of Agriculture, TB-1855*.
- Viswanathan, M. (1994). The influence of summary information on the usage of nutrition information. *Journal of Public Policy & Marketing*, 13(1), 48-60.
- Viswanathan, M., and Hastak, M. (2002). The role of summary information in facilitating consumers' comprehension of nutrition information. *Journal of Public Policy & Marketing*, 21(2), 305-318.
- Wang, G., Fletcher, S. M., and Carley, D. H. (1995). Consumer utilization of food labeling as a source of nutrition information. *The Journal of Consumer Affairs*, 29(2), 368-380.
- Wansink, B. (2003). How do front and back package labels influence beliefs about health claims. *The Journal of Consumer Affairs*, 37(2), 305-316.
- Wansink, B., Sonka, S. T., and Hasler, C. M. (2004). Front-label health claims: when less is more. *Food Policy*, 29, 659-667.
- Worsley, A. (1996). Which nutrition information do shoppers want on food labels? *Asia Pacific journal of Clinical Nutrition*, 5, 70-78.
- Yen, S. T., Jensen, H. H., and Wang, O. (1996). Cholesterol information and egg consumption in the US: a non-normal and heteroskedastic double-hurdle model. *European Review of Agricultural Economics*, 23(3), 343-356.
- Zarkin, G. A., and Anderson, D. W. (1992). Consumer and producer responses to nutrition label changes. *American Journal of Agricultural Economics*, 74(5), 1202-1207.
- Zarkin, G. A., Dean, N., Mauskopf, J. A., and Williams, R. (1993). Potential health benefits of nutrition label changes. *American Journal of Public Health*, 83(5), 717-724.